Test Method: TESTM:01

SAP 2012 TEST METHOD FOR CENTRALISED MECHANICAL SUPPLY AND EXTRACT VENTILATION SYSTEM PACKAGES WITH HEAT RECOVERY USED IN A SINGLE DWELLING

Issue 1.0

DOCUMENT REVISIONS

Documents will be revised by issue of updated editions or amendments. Revised documents will be posted on the website at www.ncm-pcdb.org.uk/sap.

Technical or other changes which affect product recognition requirements (for example) will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

Users of this document should ensure that they possess the latest issue.

DOCUMENT REVISION LOG

DATE	VERSION NO.	AMENDMENT DETAILS	APPROVED BY
31.03.15	1.0	First issue	MS

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1. INTRODUCTION

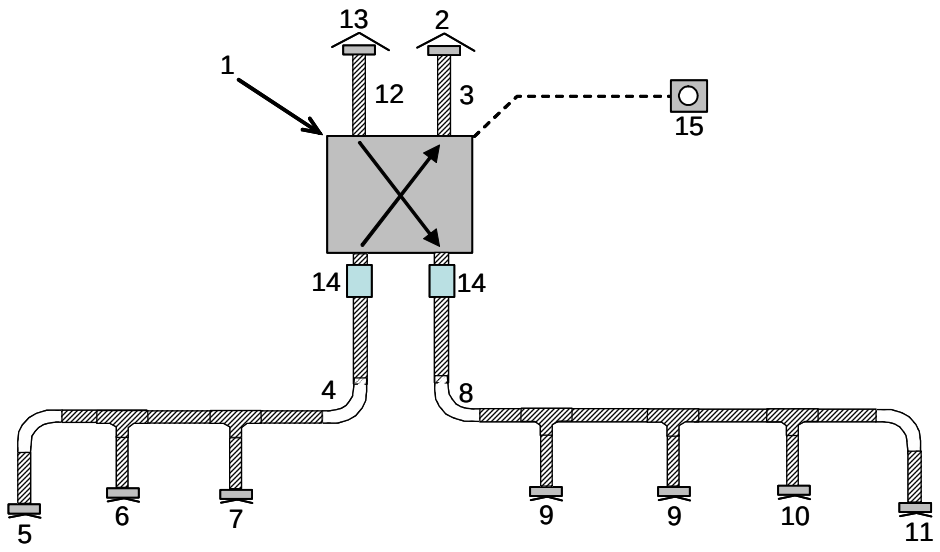
This test method is based on the European Standard BS EN 13141-6:2004, to define the duct configurations, and EN13141-7:2010, covering the testing of heat recovery ventilation devices, and must be read in conjunction with these standards.

The National Calculation Methodology for energy rating of dwellings (SAP) defines “Centralised mechanical supply and extract ventilation system packages with heat recovery” as a “Mechanical Ventilation and Heat Recovery” (MVHR) system. Performance data from such systems can be input within SAP 2012 calculations via testing in accordance with this document and entry of such data into the Product Characteristics Database (PCDB).

2. SCOPE

This test method specifies laboratory methods for measuring the aerodynamic and thermal performance of assembled supply and extract ventilation packages with heat recovery used for a single dwelling.

The test method objective is to assess the ability of a ventilation package to provide the continuous supply and extract (trickle) air flow rates required by the Building Regulations Approved Document F Ventilation (2010 Edition). The method also determines the effective fan power input at each operating point flow rate when the system is installed in accordance with the manufacturer’s instructions.



1	Heat recovery and fan unit	9	Bedroom supply valve device
2	Roof / wall exhaust terminal	10	Living room supply valve device
3	Duct from fan to exhaust terminal	11	Kitchen diner supply valve device
4	Extract duct	12	Duct from fan to supply terminal
5	Kitchen extract valve device	13	Roof / wall fresh air terminal
6	Bathroom extract valve device	14	Sound attenuators
7	Toilet extract valve device	15	System controller
8	Supply duct		

Figure 1 - Typical components that may form part of a mechanical supply and extract ventilation system package with heat recovery

3. TERMS AND DEFINITIONS

The terms and definitions used in this test method are the same as those in standard EN13141-6:2004 and EN13141-7:2010 with the following additions.

3.1 Leakage classification

The leakage classes used in this test methodology shall be those defined in EN13141-7:2010 Clause 6.2.1.2.

3.2 Thermal by-pass facility

"'Thermal by-pass facility' means any solution that circumvents the heat exchanger or controls automatically or manually its heat recovery performance, without necessarily requiring a physical airflow bypass (for example: summer box, rotor speed control, control of air flow)"[1];

During the test procedure, equipment will be assessed to determine if it complies with the above definition. In such cases it will be recorded within the SAP Product Characteristics Database (PCDB) during the data entry process, if applicable.

3.3 Partial thermal by-pass facility

Partial thermal by-pass facility is similar to 'Thermal by-pass facility' definition, but the whole airflow does not circumvent the heat exchanger.

4. TEST METHODS

4.1 General

Tests shall be conducted with a unit containing all components as supplied for intended use, and installed according to the manufacturer's instructions.

When a single value is assigned by the manufacturer as rated voltage, this shall be the test voltage. Where a voltage range is assigned to the product by the manufacturer that includes 230 V, the test voltage shall be 230 V.

This test voltage shall be maintained to ± 1% throughout testing.

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[1] Definition from: *Commission Regulation (EU) No 1253/2014 of 7 July 2014 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for ventilation units*

4.2 Performance testing of aerodynamic characteristics

4.2.1 Leakages

The internal and external leakages shall be determined as defined in EN13141-7:2010 Clause 6.2.1.2.

4.2.2 Test installation

The following conditions must be satisfied:

- The test shall be undertaken with all components supplied by the manufacturer directly connected in accordance with the manufacturer's instructions.
- The test configurations shall include all combinations of room supply and extract air valve devices specified as being suitable by the manufacturer.
- The minimum number of room extract valve devices shall be two; representing one kitchen and one additional wet room.
- The maximum number of room extract valve devices shall be specified by the manufacturer, but include one kitchen and additional wet rooms.
- The number of room supply valve devices shall exceed the number of extract valve devices by one.

Normal supply and extract conditions

The system shall be tested under the following supply and extract condition:
The pressure on the outdoor side of the fresh air and exhaust terminals shall be 0 ± 0.5 Pa.

Temperature

The temperature of the test room shall be in accordance with EN 13141-7:2010 Clause 6.3.2.4, i.e. 20°C ± 1°C.

Air flow measurements

Air flow measurements shall be in accordance with EN 13141-7:2010 Clause 6.2.2.

Electrical power measurement

The electrical power of the ventilation system package shall be determined in accordance with EN13141-7:2010 Clause 6.5 for all assessed fan speed / supply and extract valve configurations.

Installation of duct connecting roof/wall outlet terminal to the fan unit

The exhaust and fresh air fan spigots shall be connected to the wall/roof outlet terminal by the following ducting:

- Straight duct 0.5 m long
- 90^{o} elbow
- Straight duct 2.0 m long

The fresh air and exhaust duct sizes shall be based on the duct spigots of the fan as detailed in Table 1.

Fan spigot diameter	Test duct size
150 mm or greater diameter	150 mm diameter rigid duct
125 mm diameter rigid	125 mm diameter rigid duct
204 x 60 mm rectangular	204 x 60 mm rectangular duct
100 mm or smaller diameter rigid	Same diameter as fan spigot
100 x 50 mm rectangular	100 x 50 mm rectangular duct

Table 1 - Fresh air and exhaust duct sizes to be used for testing

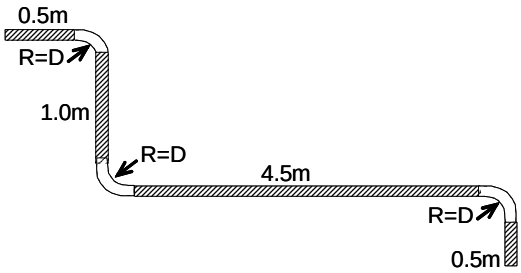
Installation of the fan unit

Where a fan unit has many spigots, the spigots not in use must be capped using the device supplied by the manufacturer for this purpose.

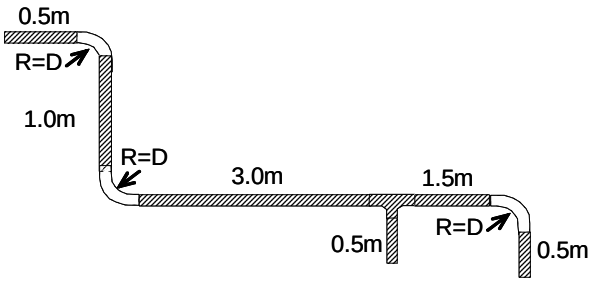
Installation of ducts connecting room supply, extract air valve devices and the fan unit

All room supply and extract air valve devices shall be connected to the fan unit using long or long branched ducts in accordance with Figure 2.

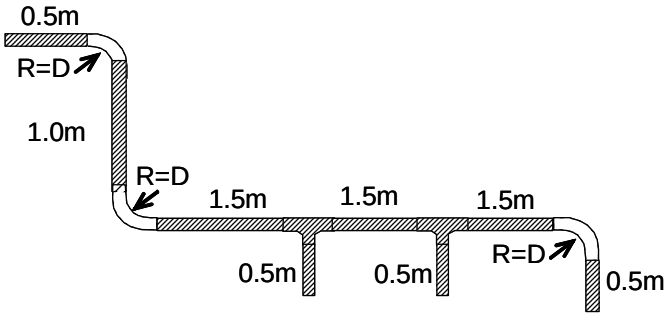
Long duct



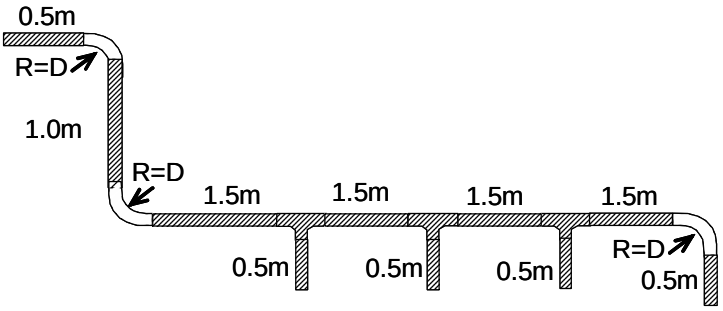
Long branched duct, 2 valves



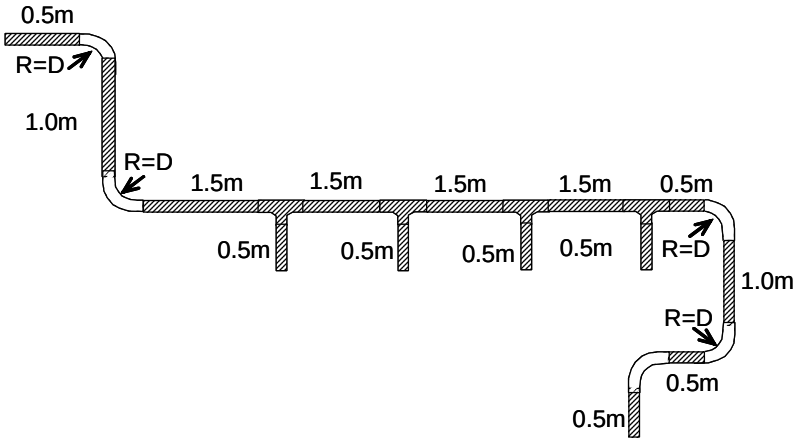
Long branched duct, 3 valves



Long branched duct, 4 valves



Long branched duct, 5 terminals



Long branched duct, 6 valves

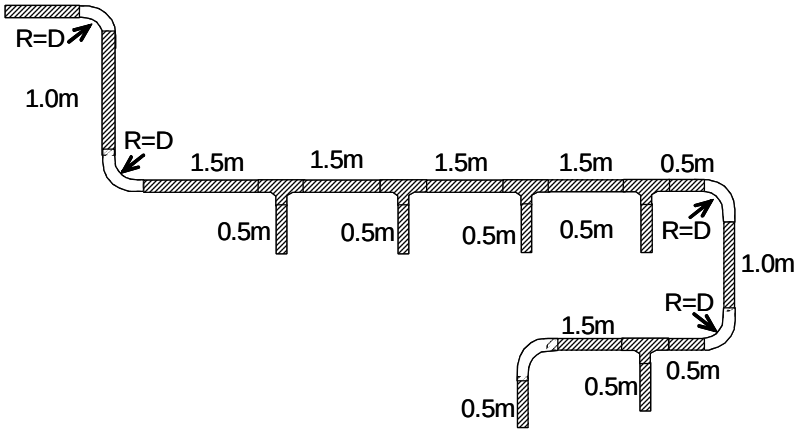


Figure 2 - Examples of duct connections

For the purpose of testing long branched duct configurations the following configuration rules must always be satisfied:

- The main living room will always be assumed to be the furthest supply valve from the fan.

- The kitchen will always be assumed to be the furthest extract valve from the fan.

When rigid ducts are specified by the manufacturer, the size of the test duct connected to the fan extract and supply duct spigots shall be as defined in Table 2 for the first 3 m of duct.

Fan spigot diameter	**Test duct size**
150 mm or greater diameter	150 mm diameter rigid duct
125 mm diameter	125 mm diameter rigid duct
204 x 60 mm rectangular	204 x 60 mm rectangular duct
100 mm or smaller diameter	Same diameter as fan spigot
100 x 50 mm rectangular	100 x 50 mm rectangular duct

Table 2 - Duct sizes for first 3 m of rigid duct connecting room supply and extract air valve devices and the fan unit - sizes to be used for testing

When flexible ducts are provided or specified, the size of the test duct connected to the fan extract and supply duct spigots shall be as defined in Table 3 for the first 3 m of duct.

Fan spigot diameter	Test duct size
150 mm or greater diameter	150 mm diameter flexible duct
125 mm diameter	125 mm diameter flexible duct
100 mm or smaller diameter	Same diameter as fan spigot

Table 3 - Duct sizes for first 3 m of flexible duct connecting room supply and extract air valve devices and the fan unit - sizes to be used for testing

The remaining test duct size shall be based on the duct sizes specified by the manufacturer for installation of the fan as detailed in Table 4.

Manufacturer's specified duct size for installation	Test duct size
125mm or greater diameter rigid duct or, 204 x 60mm rectangular duct.	204 x 60mm rectangular duct
100mm or smaller diameter rigid duct or, 100 x 50mm rectangular duct.	100 x 50mm rectangular duct
All sizes of flexible duct	100mm diameter flexible duct

Table 4 - Duct sizes for ducts connecting room supply and extract air valve devices and the fan unit, excluding first 3 m - sizes to be used for testing

When flexible ducts are provided or specified, they shall be extended to 90% of their maximum length and shall be supported to prevent sagging and to maintain the specified elbow radius.

Test conditions - Extract air flow rates

If the air flow rate through each valve device is set after installation, the continuous extract air flow rate shall be with the air flow rate through each valve device configured to meet the following:

Kitchen	13 l/s
Additional wet rooms	8 l/s

Air flow rates are at 20^{o}C and 101.325KPa

If the system is configured to self-regulate air flow rates by the manufacturer, the air flow rates through each valve device shall be balanced proportionally to the air flow rates defined above for the kitchen and additional wet rooms.
Balancing of the air flow rate through valve devices shall be undertaken using standard commissioning instrumentation.

Total extract air flow rate shall be determined in accordance with the requirements of EN 13141-7:2010 Clause 6.2.2.

An extract air valve device shall be deemed to be fully open in the following configuration:

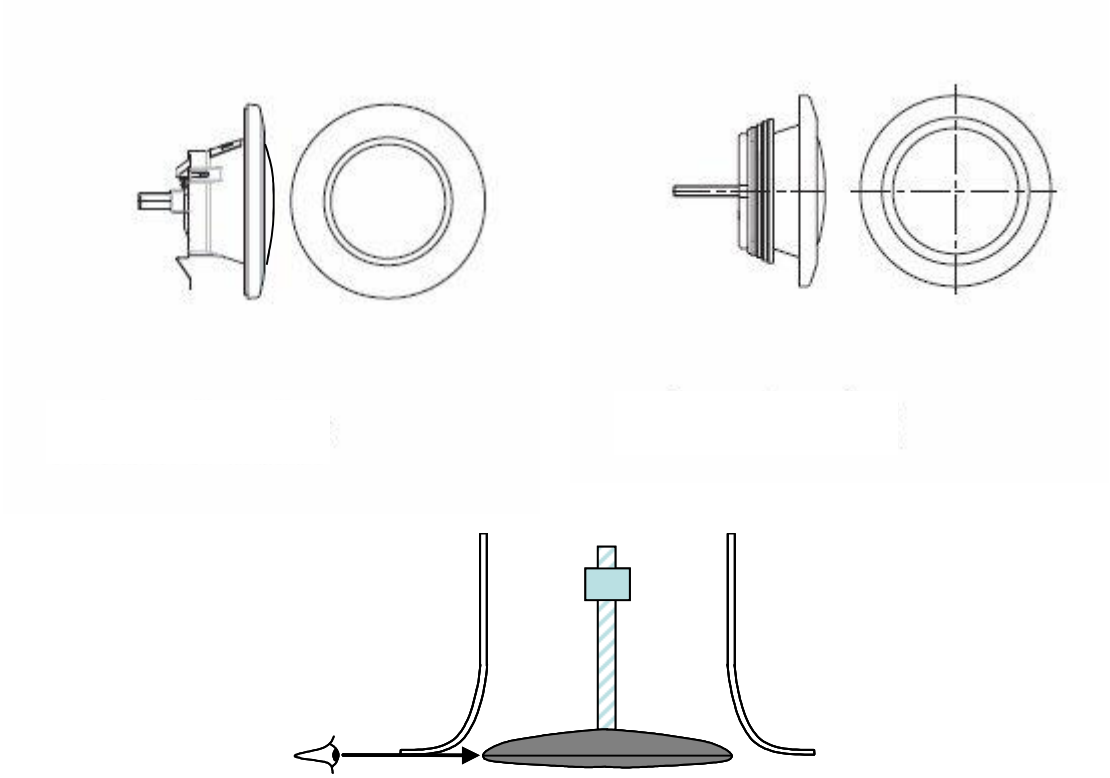


Figure 3 - Examples of extract air valve devices fully open

Test conditions - Supply air flow rates

If the air flow rate through each valve device is set after installation, the continuous supply air flow rate shall be equal through each valve device.

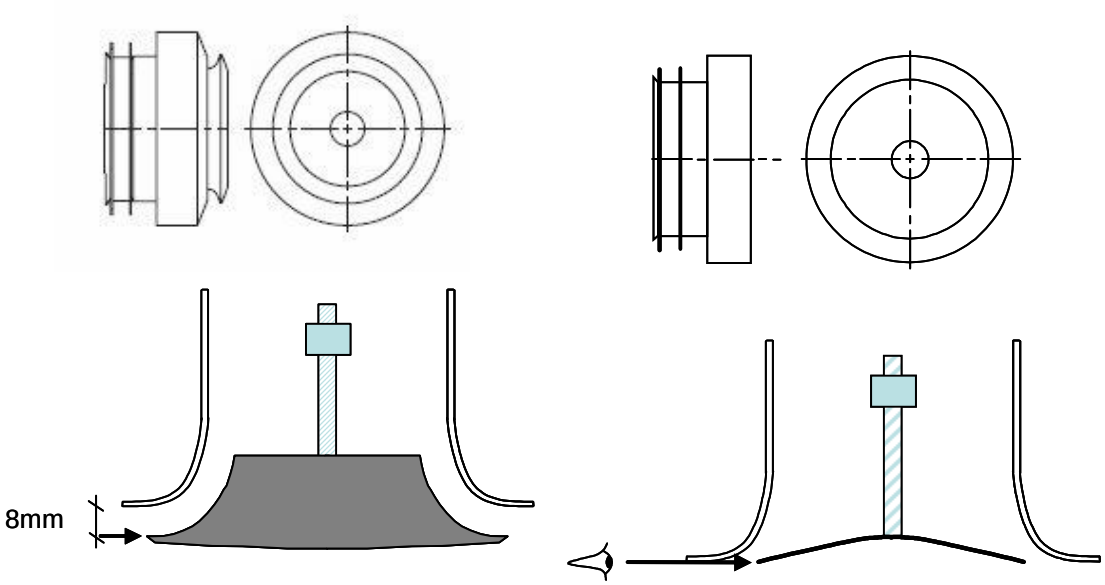
If the system is not configured to self-regulate air flow rates by the manufacturer, the balance between continuous supply and extract air flow rates shall be as follows:

- The total supply and extract air volume flow rates shall be balanced to within ± 3%.

Balancing of the air flow rate through valve devices shall be undertaken using standard commissioning instrumentation.

Total supply air flow rate shall be determined in accordance with the requirements of EN 13141-7:2010 Clause 6.2.2.

A supply air valve device shall be deemed to be fully open in the following configuration:



Valve in the fully open position

Figure 4 - Examples of supply air valve devices fully open

4.2.3 Analysis of results

The electrical power input shall be used to calculate the ‘specific fan power’, the energy consumption per unit of total air flow rate at the air flow rates specified above.

4.3 Performance testing of temperature ratios

Temperature ratios shall be determined at each air flow rate defined above, and according to EN13141-7:2010 Clause 6.3.2.1 on the supply air side. The tests shall be conducted with the duct static pressure immediately up or down stream of the fan spigot at that measured for each valve configuration for each air flow rate.

The inlet air conditions shall be those presented in Table 5. The temperature of the test room shall be maintained at 20 ± 1°C.

Air stream	**Temperature**
Extract air	
Dry bulb temperature	25°C
Wet bulb temperature	< 14°C
Supply air	
Dry bulb temperature	5°C

Table 5 - Air temperatures to be used for temperature ratio determination

No correction for the fan power input or that of other components to the temperature ratio shall be made.

Heaters shall not be operated during these tests.

5. PRESENTATION OF RESULTS

The test configurations and air flow variables shall be clearly described for each supply and extract valve configuration and fan speed setting specified by the manufacturer.

For each supply and extract valve configuration and fan speed setting specified by the manufacturer, aerodynamic, specific fan power and temperature ratio data shall be presented in accordance with Table 6.

Extract valve configuration	Fan speed setting	Total extract flow rate (l/s)	Total supply flow rate (l/s)	Specific fan power (W/l/s)	Temperature ratio (%)
Kitchen + 1 additional wet room					
Kitchen + 2 additional wet rooms					
Kitchen + .. additional wet rooms					

Table 6 - Presentation of test results at minimum flow rate condition – example

6. APPLICATION OF RESULTS

6.1 Building Regulations – Approved Document Part F (2010 Edition)

The Building Regulations – Approved Document Part F (2010) requires determination of the leakage classification and aerodynamic characteristics of MVHR systems at each fan speed and extract valve configuration specified as being suitable by the manufacturer.

The regulation requires that the leakage classification shall be Class A2 or better, i.e. 5% internal and external leakage or less. To set the declared maximum air volume flow, the declared total pressure corresponds to 100 Pa, or to 50 Pa if the intended use declared by the manufacturer is less than 100 Pa. If the unit fails to meet Class A2 or better, the aerodynamic air flow rate and thermal tests shall not be undertaken.

6.2 Building Regulations – Approved Document L (2013 Edition)

Results used for assessing compliance with the requirements of Building Regulations Approved Document L via SAP calculation require that the aerodynamic and electrical power characteristics and temperature ratio are determined at each fan speed and extract valve configuration specified as being suitable by the manufacturer.

If the air flow rate is not pre-set by the manufacturer, one of the following must be provided to ensure effective commissioning can be undertaken on site:

- a fan speed readout or indicator that will allow the fan speed to be set in increments not exceeding 5%, or;
- a means of determining the air flow rate within ±10%.

If neither of these facilities are provided, the fan cannot be tested and therefore entered into the PCDB for building regulation compliance purposes.