



RS 6/C/002A-2017

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RATING STANDARD
for the
CERTIFICATION
of
Ducted FAN COIL UNITS

RS 6/C/002A-2017

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Nb	Modifications	Section	Page
1	Scope: Air flow also expressed in m3/h	II	4
2	Editorial: <= replaced by ≤	II	4
3	Editorial: sound power replaced by sound power level.	IV	5
4	Reversal of conditions (standard and application ratings) in heating	V.1	6
5	Update of the part about high failure in the OM-1A	VII	8
6	Adaptation of the testing tolerances	VII	8
7	Case of unit with a controller	A	10
8	Titles of Figures 1 and 2 completed	A	10 and 11
9	Editorial: Manufacturer instead of manufacturer	All the document	

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I. PURPOSE

The purpose of this Rating Standard is to establish definitions and specifications for testing and rating of **Ducted** Fan Coil Units (FCU) in the related Certification Programme for Fan Coil Units (FCU) of Eurovent Certified Certification, in accordance with the Operational Manual OM-1A.

II. SCOPE

This Sub-Programme is part of the Certification Programme for Fan Coil Units (FCU) where “certify-all” applies. To fall under this Sub-Programme, the **Ducted** Fan Coil units have to meet the following criteria:

1. Total cooling and Heating capacities ≤ 30 kW
2. Air flow ≤ 1 m³/s (3600 m³/h)
3. Available pressure ≤ 300 Pa
4. Direct driven motor
5. Unit with fan, coil and filter at inlet (filter can be mounted separately)
6. No heat recovery
7. No double skin

The declaration is mandatory for all the units which meet the criteria 1 to 6 and optional for units with criteria 7.

III. DEFINITIONS

A **Ducted Fan Coil Unit** is a factory-made assembly which provides the functions of cooling and/or heating air using hot or chilled water with air flow to the room ensured by one or more electrically driven fans. Fan Coil Units may be of the chassis style, concealed within the building structure with ducting appropriately connected to the inlet and/or outlet of the unit.

The principal components are:

- one or more heat exchangers
- one or more fans with electric motors
- an appropriate enclosure
- condensed water collecting facilities when cooling
- air filter
- discharge plenum

For definitions, see RS 6/C/002.

Energy Efficiency Classes in cooling and heating: A to E energy efficiency scale for Ducted Fan Coil Units based on FCEER and FCCOP are defined in the table below.

Table 1 - Energy Efficiency Classes in cooling and heating for ducted Fan Coil Units:

Class	Cooling mode	Heating mode
A	FCEER \geq 85	FCCOP \geq 85
B	85 \gt FCEER \geq 60	85 \gt FCCOP \geq 60
C	60 \gt FCEER \geq 40	60 \gt FCCOP \geq 40
D	40 \gt FCEER \geq 25	40 \gt FCCOP \geq 25
E	25 \gt FCEER	25 \gt FCCOP

IV. TESTING REQUIREMENTS

Standard and Application Ratings shall be established respectively at the Standard Rating conditions and the Application Rating conditions (non-standard conditions) specified in Section V.

Standard and Application Ratings shall be verified by tests conducted by the Eurovent Certita Certification-selected laboratory in accordance with the following standards:

The thermal test has to be performed according to **EN 1397:2015** “Heat exchangers - Hydronic room fan coil units – Test procedures for establishing the performance” at the speed chosen by Eurovent Certita Certification (Low, Medium or High speed)

- with discharge plenum
- with standard filter
- with static pressure of 50 Pa at Medium speed. If the Low or the High speed is chosen for the test the same setting of installation shall be set. (The speed of choice has to be hard-wired to the fan)

The air flow rate test has to be performed according to **EN 1397:2015** “Heat exchangers - Hydronic room fan coil units – Test procedures for establishing the performance” for the 3 declared speeds (Low, Medium and High speed).

Beside test for Medium speed, a test will be performed for High and Low speed with the same setting of installation.

The sound power test has to be performed according to **EN 16583:2015** “Heat exchangers - Hydronic room fan coils units – Determination of the sound power level” for the 3 declared speeds (Low, Medium and High speed)

Units will be installed between two reverberation rooms. Two sound power levels will be measured: discharge and inlet + radiated. Testing will be performed for all three speeds used for air flow rate measurements. Any duct end correction shall be added to the sound power level outlet values.

V. RATING REQUIREMENTS

All tests shall be carried out with the air filter fitted as supplied by the Manufacturer.
Fan Coil Units with variable speed have to be tested according to the procedure described in APPENDIX A.

V.1 Thermal test

For cooling test, the following Standard and Application (non-standard) Rating conditions shall be used:

Table 2 - Standard and Application Rating conditions for cooling tests

	Cooling		District cooling	
	Water temperature [inlet temperature / outlet temperature]	Air temperature [inlet dry bulb (inlet wet bulb)]	Water temperature [inlet temperature / outlet temperature]	Air temperature [inlet dry bulb (inlet wet bulb)]
Standard rating condition	<u>7°C / 12°C</u>	<u>27°C (19°C)</u>	5.5°C / 14.5°C	24°C (18°C)
Application rating condition 1	<u>10°C / 15°C</u>	<u>27°C (19°C)</u>	9°C / 18°C	26°C (18.6°C)
Application rating condition 2	7°C / 12°C	25°C (17.9°C)		
Application rating condition 3	14°C / 18°C	26°C (18°C)		

Note: underlined conditions are in accordance with EN 1397:2015

For heating test, the following Standard and Application (non-standard) Rating conditions shall be used:

Table 3 - Standard and Application Rating conditions for heating tests

	Heating (4 pipes)		Heating (2 pipes)	
	Water temperature [inlet temperature / outlet temperature]	Air temperature [inlet dry bulb (inlet wet bulb)]	Water temperature [inlet temperature / outlet temperature]	Air temperature [inlet dry bulb (inlet wet bulb)]
Standard rating condition	<u>65°C / 55°C</u>	<u>20°C (15°C max)</u>	<u>45°C / 40°C</u>	<u>20°C (15°C max)</u>
Application rating condition 1	<u>70°C / 60°C</u>	<u>20°C (15°C max)</u>	50°C / *	20°C (15°C max)

* = Same water flow as in cooling for standard rating (consequently the outlet water temperature will vary among units).

Note: underlined conditions are in accordance with EN 1397:2015

V.2 Sound power test

Sound power test shall be carried out at ambient conditions without water flow.

V.3 Air flow rate test

Air flow rate test shall be carried out at ambient conditions without water flow. Measured values shall be transposed to the standard conditions.

VI. CERTIFIED PERFORMANCES

VI.1 Thermal performances

a. In Standard Rating conditions

The following performance characteristics at Low, Medium or High speed declared by the Manufacturer, and chosen by Eurovent Certita Certification (one tested speed), shall be verified by tests:

- Total cooling capacity
- Sensible cooling capacity
- Heating capacity
- Water pressure drops in cooling and heating
- Fan power input in cooling and heating

b. In Application Rating conditions

Eurovent Certita Certification shall choose one application rating condition to test among the following: cooling application rating 1, 2 or 3 or heating application rating 1.

The following performance characteristics at Low, Medium or High speed declared by the Manufacturer, and chosen by Eurovent Certita Certification (the same tested speed as for standard rating conditions (VI.1.a)), shall be verified by tests:

If cooling application rating 1, 2 or 3 is chosen:

- Total cooling capacity
- Sensible cooling capacity
- Water pressure drops in cooling
- Fan power input in cooling

If heating application rating 1 is chosen:

- Heating capacity
- Water pressure drops in heating
- Fan power input in heating

VI.2 Acoustic and aeraulic performances

The following performance characteristics at Low, Medium and High speed (three tested speeds) shall be verified by tests:

- Air flow rate
- Available static pressure
- A-weighted sound power level for (inlet + envelope) and outlet duct.

VII.TOLERANCES

When tested by the Eurovent Certita Certification -selected Laboratory, the characteristics obtained shall not differ from the claimed values by more than the tolerance (see Table 4).

Mean Failure: When tested, if the performances obtained differ from the values claimed by the Manufacturer by more than the mean deviation threshold, the failure shall be included in the MVF calculation. See APPENDIX D in the Operational Manual OM-1A.

High Failure: When tested, if the performances obtained differ from the values claimed by the Manufacturer by more than the high deviation threshold, the high failure treatment shall be applied (see part IV.4.d in the Operational Manual OM-1A).

Table 4 - Table of tolerances, mean and high deviation thresholds

		Characteristic	Tolerance (Acceptance criterium)	Mean Deviation threshold	High Deviation threshold		
Thermal performances	Standard Rating condition	Sensible capacity	Fixed speed	-8%	-13%		
			Variable speed	-10%	-15%		
		Total cooling capacity	Fixed speed	-7%	-12%	-17%	
			Variable speed	-9%	-14%	-19%	
		Heating capacity	Fixed speed	-7%	-12%	-17%	
			Variable speed	-9%	-14%	-19%	
		Fan power input in cooling		max (+10% ; 1W)			
		Fan power input in heating		max (+10% ; 1W)			
		Water pressure drop in cooling		+ 15%			
	Water pressure drop in heating		+ 15%				
	Application Rating condition	Sensible capacity	Fixed speed	-8%	-18%		
			Variable speed	-10%	-20%		
		Total cooling capacity	Fixed speed	-7%	-17%		
			Variable speed	-9%	-19%		
		Heating capacity	Fixed speed	-7%	-17%		
			Variable speed	-9%	-19%		
		Fan power input in cooling		max (+10% ; 1W)			
		Fan power input in heating		max (+10% ; 1W)			
Water pressure drop in cooling		+ 15%					
Water pressure drop in heating		+ 15%					
Acoustic performance	A-weighted sound power level inlet + envelope		+ 2 dB(A)	+ 3 dB(A)			
	A-weighted sound power level outlet duct		+ 2 dB(A)	+ 3 dB(A)			
Aeraulic performance	Air flow rate		-10%				
	External static pressure		0 Pa for Medium speed and - 5 Pa for other speeds				

APPENDIX A. TESTING PROCEDURE FOR VARIABLE SPEED UNITS

A.I. PURPOSE

The purpose of this appendix is to establish definitions and specifications to be used in connection with the Certification Programme for Ducted Fan Coil Units in order to test these units equipped with variable speed fans.

A.II. SCOPE

The scope is the same as for the standard current testing procedure. It adds a new section within these procedures to specifically test variable speed fans units.

A.III. DEFINITIONS

A variable speed fan is different from a multi-speed fan by the fact that it is capable to continuously change its speed whereas the multi-speed fan has discrete (and limited) outputs to change its own speeds.

The direct measurable outputs are:

- **Fan Power Input:** Electric power absorbed by the fan(s) of the unit.
- **Available Static Pressure:** The available air static pressure at the discharge of the air way cross section of the unit.
- **Sound Power Level:** Total sound power radiated by the Fan Coil Unit
- **A-weighted Sound Power Level:** A single figure on a specific scale which can be related to the subjective assessment of the loudness of a noise.
- **Air Flow Rate:** Volume air flow through the discharge air way cross section of the unit at the air flow testing conditions.
- **RPM:** motor rotational speed for dry coils
- **Low, Medium and High speed:** Speeds published as available on the unit with the corresponding motor control device.

A.IV. TESTING REQUIREMENTS

Standard and Application Ratings shall be established at the conditions specified in Section V. Standard and Application Ratings shall be verified by tests conducted by the Eurovent Certita Certification selected laboratory in accordance with the following specifications:

- The Manufacturer shall select three speeds among the variable fan speed functioning range so called Low speed, Medium speed and High speed.
The Manufacturer will declare the unit performances for these three speeds as it does with multi-speed fans.
- The Manufacturer shall provide to the incumbent laboratory the instructions manual to enable the people in charge of the tests to implement the right settings corresponding to the declared speeds. The laboratory shall preferably use its own

controls. The control voltage used during the measurements shall be reported in the test report for thermal, airflow and acoustic tests. The allowed tolerance on the control voltage is 0.5%. When a unit has a controller, the laboratory shall include the controller consumption in the measurements of fan power inputs.

- The fan power measurement shall be done at the electrical terminals of the fan(s) motor, not at the control device ones.
- The thermal, air flow rate and sound power tests shall be performed with the usual test procedures.
- The laboratory shall always begin a complete test with a test in dry battery (sound power test or air flow rate test).
- To take into account the different types of technologies, for each complete test, the Manufacturer will have the choice between 2 preparatory procedures during the first test in dry battery (sound power test or air flow rate test):
 - Option 1: The laboratory sets the declared control voltages for each speed with its own control or sets the speeds using the unit controller (see below Figure 1).
 - Option 2: (only for units without controller) Control voltages for each speed are adjusted to match with the declared fan rotation speed (see below Figure 2).
- For partial second test on the same unit the laboratory shall set the same control voltages as for the first complete test.
- Only one Component Failure due to deviation on fan rotation speed and/or control voltage is allowed per model.

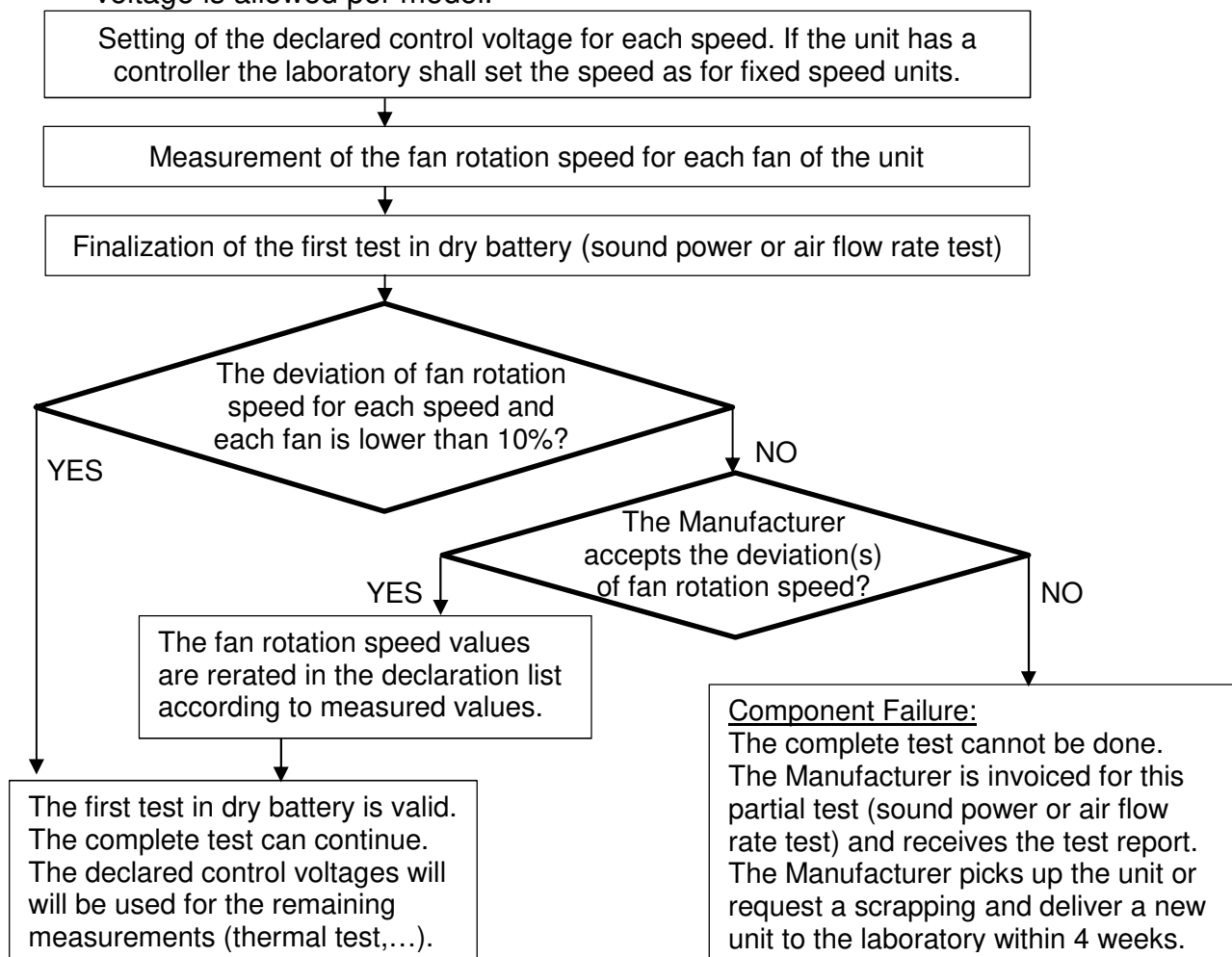


Figure 1: Preparatory procedure – Option 1 (Voltage setting)

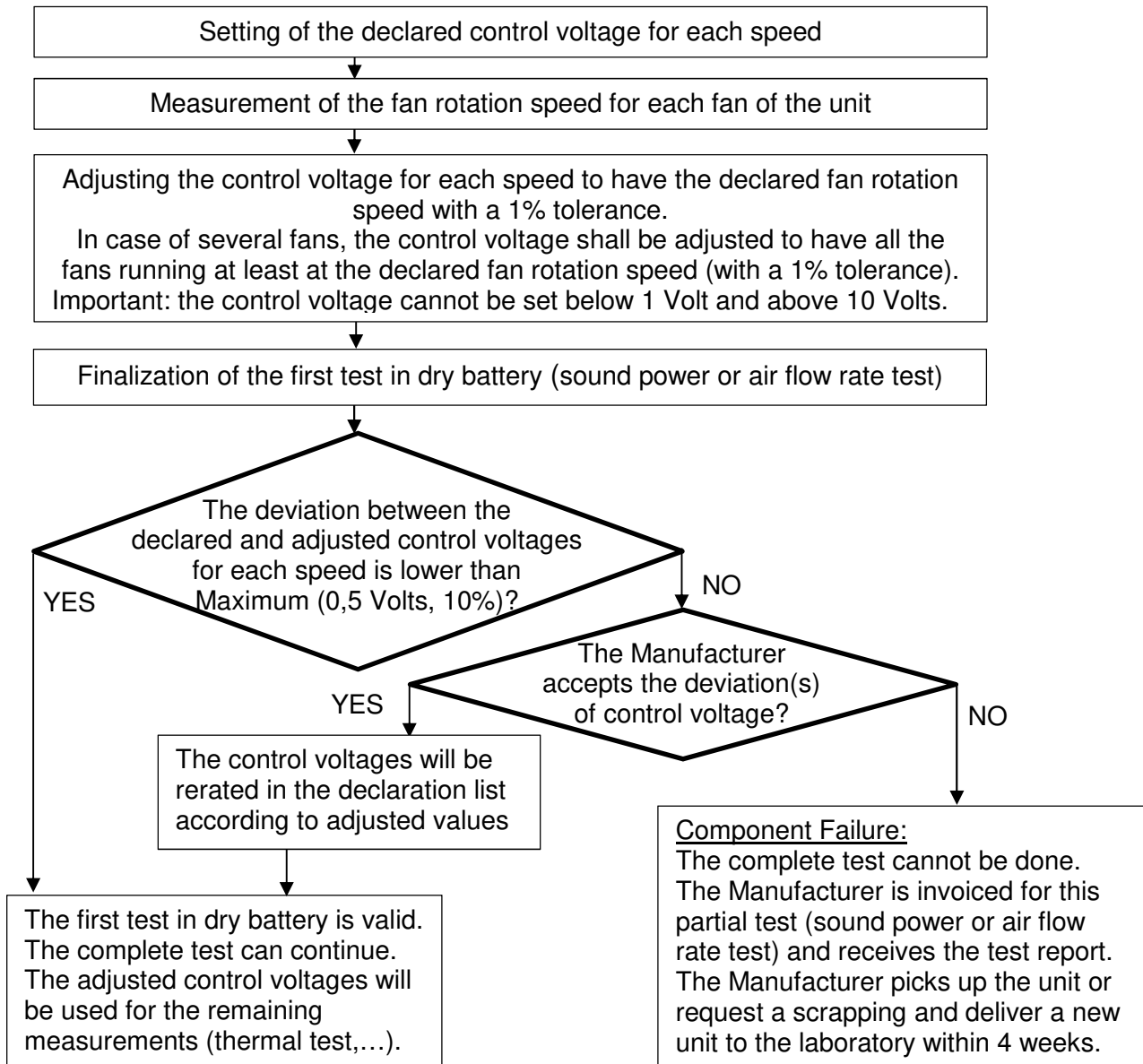


Figure 2: Preparatory procedure – Option 2 (Voltage adjustment)

A.V. RATING REQUIREMENTS

See usual rating requirements defined in the proper procedures.

In addition, the airflow information will have to be published for ducted Fan Coils programme. For non-ducted Fan Coils the airflow information is kept optional.

A.VI. CERTIFIED PERFORMANCES

The same performances as for multi-speed units shall be verified by test.

A.VII. TOLERANCES

The same tolerances as for the multi speed units shall be applied (see section VII).