

TECHNICAL CERTIFICATION RULES OF THE EUROVENT CERTIFIED PERFORMANCE MARK



EVAPORATIVE COOLING

Identification: **ECP-24 EC**

Revision 2021

(This version cancels and replaces any previous versions)

Approbation date: 06/07/2021

Comes into effect from: 01/08/2021

The purpose of this Technical Certification Rules is to prescribe procedures for the operation of the Eurovent Certified Performance (ECP) certification programme for **Evaporative Cooling (EC)**, in accordance with the Certification Manual.

Modifications as against last version:

No.	Modifications	Section	Page
1	New TCR structure away from OM & RS format	all	all
2	Addition to factory audits, now remotely based audits can be performed based on the 'Eligibility' as outlined in the Certification Manual (Appendix L). However, also remote audits can be introduced in case of force majeure as outlined in the Certification manual – Terms of Requirements.	III.1.3.2.	20

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I. GENERAL INFORMATION

I.1. Scope

I.1.1. General

The programme for Evaporative Cooling covers units which aims to cool the “air” for air-conditioning purposes. It does not include adiabatic coolers which have an objective to reject heat to the ambient using evaporative techniques i.e. for Cooling Towers. This programme is divided in three sub-programmes, as it applies to Evaporative Cooling units in the following groups:

- **Direct Evaporative Cooling (DEC)**
- **Indirect Evaporative Cooling (IEC)**
 - o with primary outside air
 - o with separation of external and room air

This rating standard covers two sub-programmes called in this document case A and case B:

- **Case A:** Indirect Evaporative Cooling with primary outside air
- **Case B:** Indirect Evaporative Cooling with separation of external and room air

- **Evaporative Cooling Equipment (ECE)**

This rating standard covers three-sub programmes called in this document **Case A**, **Case B** and **Case C**:

- **Case A:** Water Spray System
- **Case B:** Wet Media
- **Case C:** Ultrasonic unit

Companies may apply to participate in any of the above certification sub-programmes

a. Direct Evaporative Cooling (DEC)

The following units are specifically excluded from the scope:

- Units with an air flow less than 2,500 m³/h
- Units with an air flow greater than 120,000 m³/h
- Portable air-cooling units

b. Indirect Evaporative Cooling (IEC)

The scope includes:

- Indirect Evaporative Cooling units with primary outside air
- Indirect Evaporative Cooling units with separation of the outside and room air

Indirect Evaporative Cooling units with direct evaporative cooling stage are accepted under the scope. Indirect Evaporative Cooling units with DX coil (integrated in the unit) or chilled water coil (integrated in the unit) are accepted under the scope.

The following units are specifically excluded from the scope:

- Units with an air flow less than 2,500 m³/h
- Units with an air flow greater than 120,000 m³/h

c. Evaporative Cooling Equipment (ECE)

The following technologies are accepted under the scope of Evaporative Cooling Equipment:

- Water spray system
- Wet pads/media
- Ultrasonic units

The following units are specifically excluded from the scope:

- Units with an water flow less than 0.5 l/h
- Units with an water flow greater than 5,000 l/h
- ECE with integrated heat exchanger

I.1.2. Certify-all Principle

This certification programme is not a certify-all programme and is specified ranges provided by the participant.

I.2. Certified Performances

Direct Evaporative Cooling performance characteristics, declared by the applicant/participant shall be verified by tests:

- Cooling Capacity [kW]
- Air Flow [m³/h]
- Evaporation Efficiency [%]
- EER
- Water Consumption [l/h]

Indirect Evaporative Cooling performance characteristics, declared by the applicant/participant shall be verified by tests:

Case A:

- Total Cooling Capacity [kW]
- Room Cooling Capacity [kW]
- Air flow [m³/h]
- Cooling Effectiveness [%]
- Water Consumption [l/h]
- Energy Efficiency Ratio (EER)

Case B:

- Total Cooling Capacity [kW]
- Air flow [m³/h]
- Wet bulb approach effectiveness [%]
- Dry bulb approach effectiveness [%]
- Water Consumption [l/h]
- Energy Efficiency Ratio (EER)

Evaporative Cooling Equipment performance characteristics, declared by the applicant/participant shall be verified by tests:

- Cooling Capacity [kW]
- Evaporation Efficiency [%]
- EER
- Water Consumption [l/h]

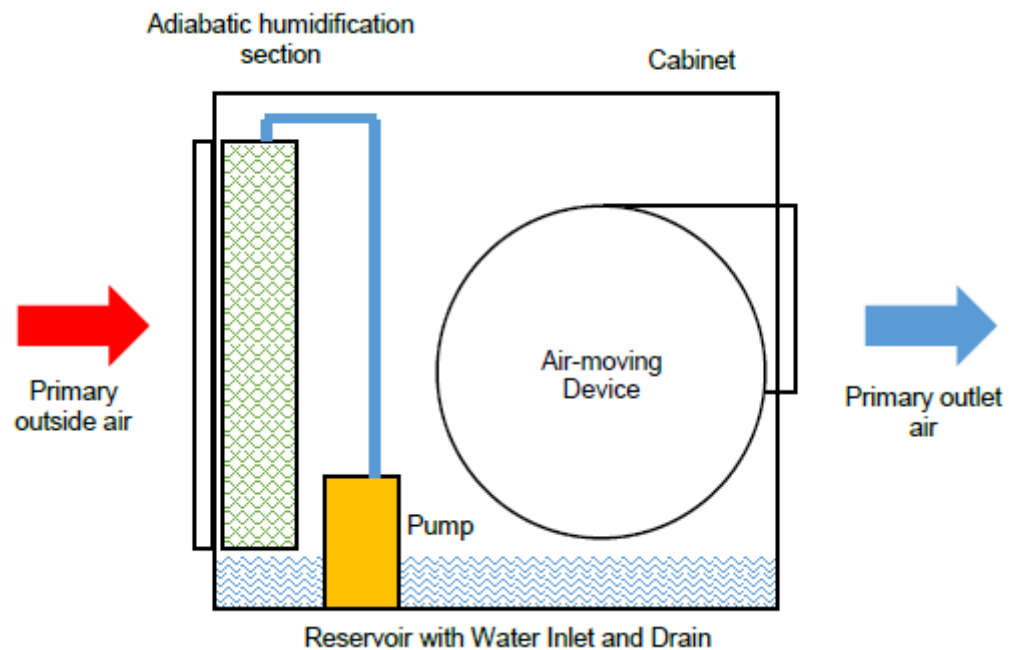
- Wet Pressure drop [Pa]
- Dry Pressure drop [Pa]

The performance listed above are certified for a direct application only. A manufacturer using ECE for indirect application shall certify its ECE for a direct application and then apply the efficiency of the heat exchanger, however the results of this calculation will not be certified.

I.3. Definitions

I.3.1. Direct Evaporative Cooling

A self-contained unit, including a fan and fan motor, whose primary functions are the conversion of the sensible heat of unsaturated air passing through the cabinet to latent heat by the process of evaporating recirculating or non-recirculating water directly exposed to this air and the movement of this air through the unit.



I.3.1.2. Air Flow

The rate of air discharged by an evaporative cooler, expressed in litres per second (l/s) or metres cubed per second (m³/s), corrected to standard temperature and pressure.

I.3.1.3. Primary Outside Air

In the case of this sub-programme for Direct Evaporative Cooling the primary outside air is the external air.

I.3.1.4. Adiabatic Humidification Section

Section where the supply air is cooled and humidified, this could be made through a wet media or a water spray system.

I.3.1.5. Primary Outlet Air

Conditioned air supplied to the room.

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I.3.1.6. Evaporation Efficiency

A measure of the cooling performance of the equipment, representing the extent to which the available wet bulb depression will be achieved as the dry bulb temperature drops.

The evaporation efficiency is calculated as follows:

$$e = \frac{(t_i - t_o)}{(t_i - t_{wi})} \times 100\%$$

Where:

- t_i = air inlet dry bulb (as measured from test) [°C]
- t_o = air outlet dry bulb (as measured from test) [°C]
- t_{wi} = air inlet wet bulb (as measured from test) [°C]

I.3.1.7. Cooling Capacity

As defined in the AS 2913-2000 standard (Appendix A), the cooling capacity of a DEC units is the cooling effect of the cooler calculated from the following equation, the nominal rating is calculated where the conditions, specified for nominal rating below, are substituted as shown:

$$S = \frac{qv \rho c_p}{1000} \left(\frac{e}{100} (t_i - t_{wi}) + t_r - t_i \right)$$

Where:

- S = Cooling Capacity (kW)
- qv = airflow (l/s) = as measured from test
- ρ = air density (1.20 kg/m³ for standard air)
- c_p = specific heat of air = 1.024 kJ/kgK
- t_i = standard inlet dry bulb condition for rating calculation – see Appendix A - A.2.1.a
- t_{wi} = standard inlet wet bulb condition for rating calculation – see Appendix A - A.2.1.a
- t_r = standard room air outlet dry bulb condition for rating calculation – see Appendix A - A.2.1.a
- e = Evaporation efficiency - as calculated under section I.3.1.6.

I.3.1.8. EER

The energy Efficiency Ratio (EER) is the ratio of cooling capacity to the power input:

$$EER = \frac{\text{Cooling Capacity (kW)}}{\text{Power Input (kW)}}$$

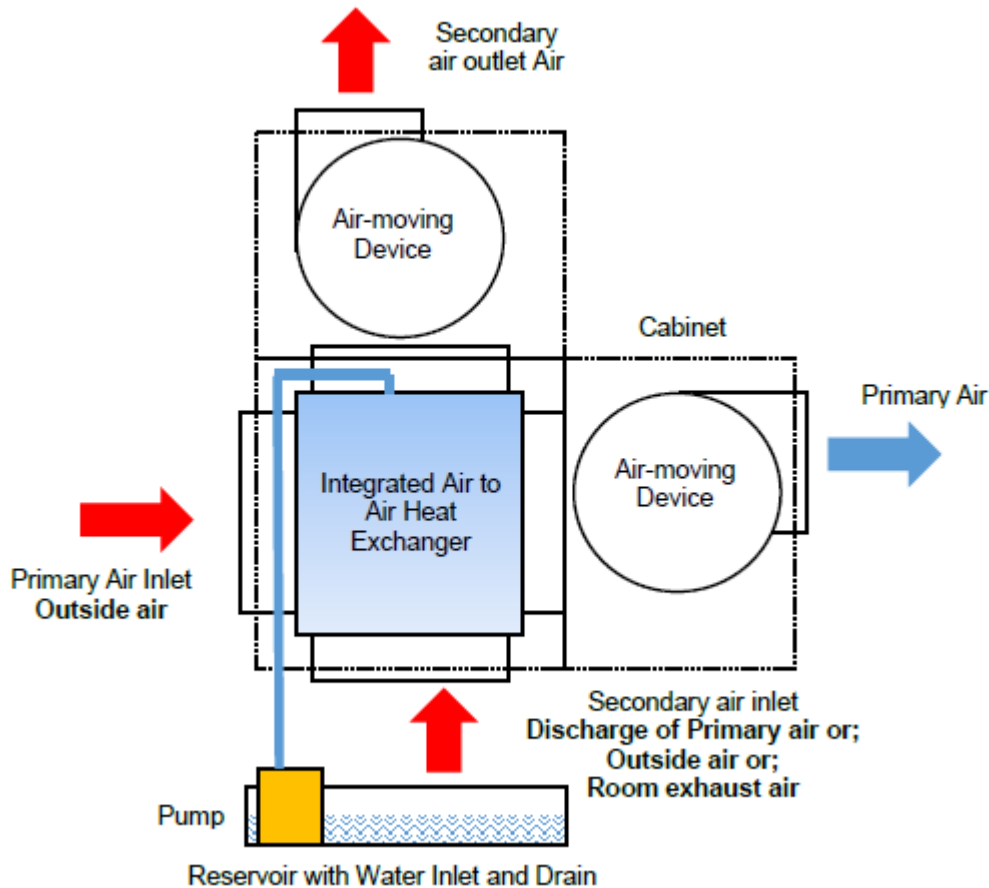
Where:

Cooling capacity is as calculated under section I.3.1.7.

Power input is as measured from the tests.

I.3.2. Case A: Indirect Evaporative Cooling with Primary Outside Air

An indirect evaporative cooler with integrated primary and secondary air passages and provided with both primary and secondary air-moving devices. Depending on product configuration a single air-moving device may be used for primary and secondary air. This device also includes the entire water distribution, collection, and might also include recirculation system with pump and piping. This type may have provisions for installation of other heat and mass transfer devices, such as a direct evaporative cooler and auxiliary heating and cooling coils. These additional devices are not covered by this certification programme. Primary air is always drawn from outside. Some discharged primary air may or may not be used as secondary air (from ASHRAE 143:2015 packaged indirect evaporative cooler (packaged IECU) definition, page 3).



I.3.2. Case B: Indirect Evaporative Cooling with Separation of External and Room Air

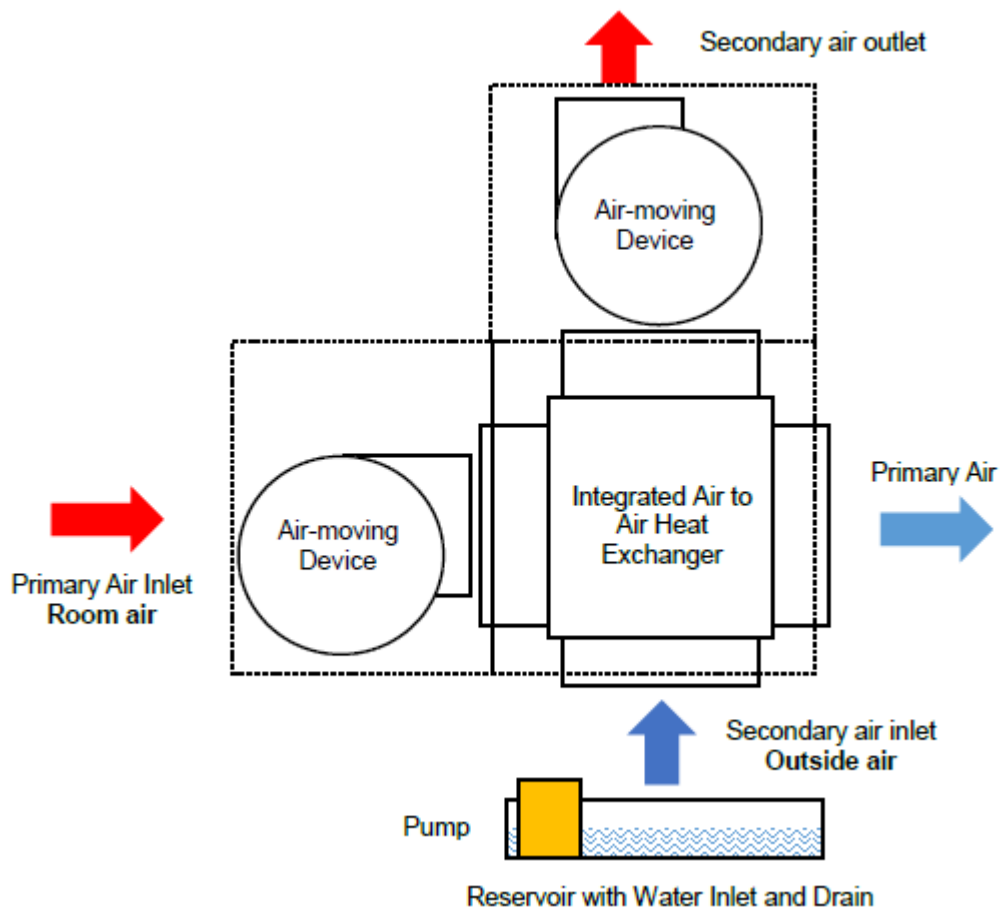
A packaged indirect evaporative cooling unit with integrated primary and secondary air passages and provided with both primary and secondary air-moving devices. This device also includes the entire water distribution, collection, and recirculation system with pump and piping. This type may have provisions for installation of other heat and mass transfer devices, such as a direct evaporative cooler and auxiliary heating and cooling coils. These additional devices are not covered by this standard (definition from ANSI/ASHRAE standard 143-2015 page.3 packaged indirect evaporative cooler)

a. Dry Mode

During dry mode, room air is cooled through the heat exchange process with external air. A complete separation of external and room air flow is maintained. Separate fans sections allows independent air flows for room and external air.

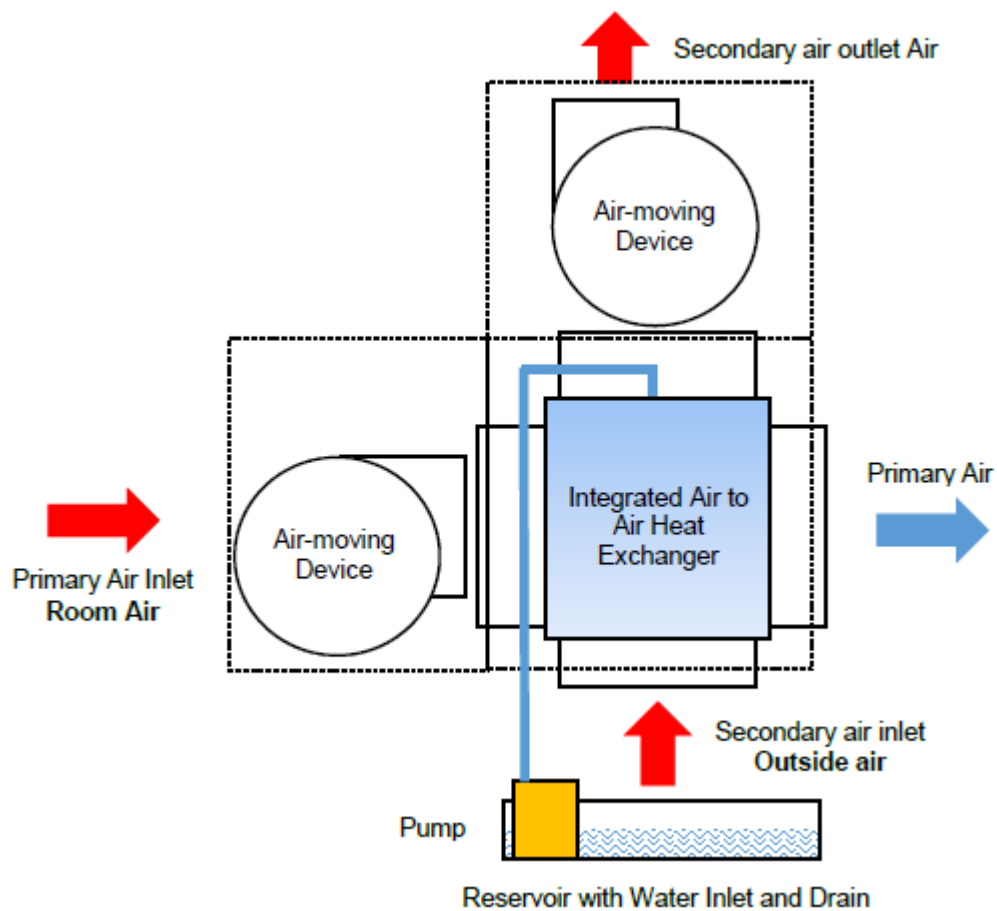
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b. Wet Mode

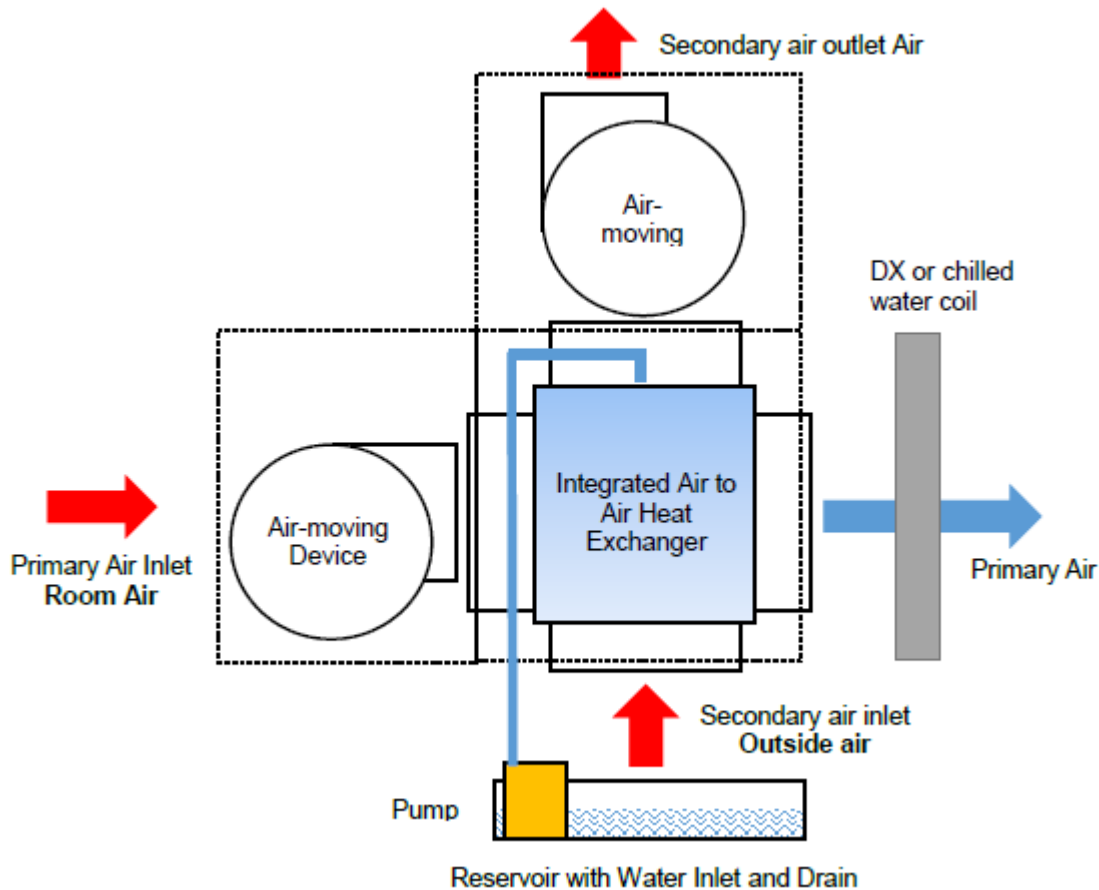
When external temperature increases, the evaporative system is running in order to cool the air according to the need. This enables the unit to cool the room air through a heat exchanger even with higher external dry bulb air temperatures.



c. DX Integration

The Indirect Evaporative Unit can be equipped also with an additional direct expansion system or chilled water section in order to achieve the target supply air temperature even in the most critical external air conditions.

This mode is not tested under this certification programme.



I.3.2.1. Air Flow

The rate of air discharged by an evaporative cooler, expressed in litres per second (l/s) or metres cubed per second (m³/s), corrected to standard temperature and pressure.

I.3.2.2. Primary Air Inlet

In the case of this sub-programme for Indirect Evaporative Cooling the primary air inlet is:

- **Case A:** The external air
- **Case B:** The room air

I.3.2.3. Primary Air

Conditioned air going to the building.

I.3.2.4. Secondary Air Inlet

In the case of this sub-programme for Indirect Evaporative Cooling the secondary air inlet is:

- **Case A:** for this scenario the secondary can be from different sources:
 - From primary air (i.e. some discharged primary air is used for the secondary air)
 - From room exhaust
 - From a combination of the exhaust air and primary air
 - From external air

- **Case B:** The external air

With regard to case A, if the source of the secondary air is a discharged of the primary air then when testing and calculating the total cooling capacity and the room cooling capacity only the air supplied to the building can be used. In other words, if the secondary air inlet is a combination of the two (primary air and room exhaust air) then it cannot be accepted for the tests.

I.3.2.5. Secondary Air Outlet

Hot air rejected to the atmosphere.

I.3.2.6. Cooling Effectiveness

The cooling effectiveness (also called evaporation efficiency) of an Indirect Evaporative Cooling Unit shall be calculated as per ANSI/ASHRAE Standard 143-2015 – Section 11: Calculation of the results.

The cooling effectiveness is calculated as follows:

$$e = \frac{(td1 - td2)}{(td1 - tw3)} \times 100\%$$

Where:

td1 = Primary air inlet dry bulb temperature (as measured from test) [°C]

td2 = Primary air outlet dry bulb temperature (as measured from test) [°C]

tw3 = Secondary air inlet wet bulb (as measured from test) [°C]

The cooling effectiveness is calculated for **Case A** only.

I.3.2.7. Wet bulb Approach Effectiveness

Room air dry bulb reduction divided by the room air entering dry bulb temperature less the entering process wet bulb temperature.

The scope of the test shall be to measure the maximum external process air wet bulb temperature, for which we can guarantee the room supply air temperature.

$$\varepsilon_{Wet\ Bulb\ approach\ effectiveness} = \frac{t_{d1} - t_{d2}}{t_{d1} - t_{w3}}$$

The wet bulb approach effectiveness is calculated for **Case B** only and is the equivalent of the cooling effectiveness defined under section I.3.2.6.

I.3.2.8. Dry bulb Approach Effectiveness

Room air dry bulb reduction divided by the room air entering dry bulb temperature less the entering process Dry Bulb temperature.

The scope of the test shall be to measure the maximum external process air dry bulb, for which we can guarantee the room supply air temperature.

$$\varepsilon_{Dry\ Bulb\ approach\ effectiveness} = \frac{t_{d1} - t_{d2}}{t_{d1} - t_{d3}}$$

The dry bulb approach effectiveness is calculated for **Case B** only. This formula is applicable only for scenario 4 of **Case B**.

I.3.2.9. Total Cooling Capacity

The Total Cooling Capacity (kW) of the Indirect Evaporative Cooling Units shall be calculated as per the ANSI/ASHRAE Standard 143-2015 – Section 11: Calculation of the results.

The total cooling capacity is calculated as follows:

$$q_{tot} = 1.21Qp(td1 - td2)$$

Where:

- t_{d1} = Primary air inlet dry bulb temperature (as measured from test) [°C]
- t_{d2} = Primary air outlet dry bulb temperature (as measured from test) [°C]
- Qp = Primary air flow rate (as calculated under section 11.3.6 of the ANSI/ASHRAE Standard 143-2015) [m³/s]

I.3.2.10. Room Cooling Capacity

For **case A** only a second cooling capacity shall be calculated as follows, this cooling capacity is named hereafter “Room cooling capacity”:

$$q_{room} = 1.21Qp(td2 - tde)$$

Where:

- t_{d2} = Primary air outlet dry bulb temperature (as measured from test) [°C]
- t_{de} = Room exhaust air dry bulb temperature (fixed at 27.4°C for the tests) [°C]
- Qp = Primary air flow rate (as calculated under section 11.3.6 of the ANSI/ASHRAE Standard 143-2015) [m³/s]

I.3.2.11. EER

The energy Efficiency Ratio (EER) is the ratio of the total cooling capacity to the power input:

$$EER = \frac{\text{Total Cooling Capacity (kW)}}{\text{Power Input (kW)}}$$

Where:

Total Cooling capacity is as calculated under section I.3.2.9.

Power input is as measured from the tests

I.3.3. Evaporative Cooling Equipment

In this certification programme for Evaporative Cooling an Evaporative Cooling Equipment is the device/product ensuring the evaporative cooling in a host system.

The evaporative cooling equipment can be:

- A water spray system
- A wet pad/media
- A ultrasonic unit

I.3.3. Case A: Water Spray System

A water spray system is a device connected to the water supply through an automatically or manually actuated flow control cabinet with or without pressurizing equipment (e.g. pump). Water is piped to specially designed nozzles which distribute water over a given area.

I.3.3. Case B: Wet Pads/Media

A wet media is a product made out of corrugated sheets of glass fibre paper, cellulose paper or other material. The incoming air going through the media is in contact with a wet surface and thus enabling the water to evaporate, cool and humidify the supply air.

I.3.3. Case C: Ultrasonic unit

One or more piezoelectric transducers immersed in a reservoir of water. The transducer converts an electronic signal into a mechanical oscillation. The mechanical oscillation is directed at the surface of the water, where it creates a fine mist.

I.3.3.1. Air Flow

The rate of air discharged by an evaporative air conditioner, expressed in litres per second (l/s) or metres cubed per second (m³/s), corrected to this TCR testing conditions.

I.3.3.2. Air Inlet

In the case of this sub-programme for Evaporative Cooling Equipment the air inlet is the air going to the EC Equipment (wet media or water spray system). The source of the air depends on the application, it could be external air or room exhaust air.

I.3.3.3. Adiabatic Humidification Section

Also called humidification chamber this is the section where the supply air is cooled and humidified after the Evaporative Cooling Equipment.

I.3.3.4. Air Outlet

Cooled air leaving the adiabatic humidification section.

I.3.3.5. Evaporation Efficiency

The evaporation efficiency is calculated as follows:

$$e = \frac{\text{Evaporated water}}{\text{Supplied water}} \times 100\%$$

Where:

Evaporated water: quantity of water that has been evaporated (l/h)

Supplied water: quantity of water supplied to the equipment (l/h)

I.3.3.6. Cooling Capacity

The cooling capacity is the cooling effect of the cooler calculated from the following equation, the nominal rating is calculated where the conditions, specified for nominal rating below, are substituted as shown:

For Direct EC application:

$$S = \frac{q_v \rho c_p}{1000} (t_{outlet} - t_{inlet})$$

Where:

S = Cooling Capacity (kW)

q_v = airflow (l/s) = as declared by manufacturer

ρ = air density (1.20 kg/m³ for standard air)

c_p = specific heat of air = 1.024 kJ/kgK¹

t_{outlet} = Dry-bulb temperature downstream

t_{inlet} = Dry-bulb temperature upstream

I.3.3.7. EER

The energy Efficiency Ratio (EER) is the ratio of cooling capacity to the power input:

$$EER = \frac{\text{Cooling Capacity (kW)}}{\text{Power Input (kW)}}$$

Where:

Cooling capacity is as calculated under section I.3.3.6.

Power input is as measured from the tests.

I.3.3.8. Basic Model Groups

Within a range, models which are essentially the same or comparable in terms of basic components and/or configurations combinations are gathered into basic model groups (BMG).

For **Case A** (water spray system) the following variation distinguish one BMG from another:

- Type of droplet separator
- Type of pumping station

The **type of nozzle** is also a variation but is not used to distinguish a BMG from another, this parameter must be used by the auditor to diversify the products selected for the repetition campaigns.

For **Case B** (wet media) the following variation distinguish one BMG from another:

- Type of droplet separator
- Depth of the pad (every 100 mm)
- Material of the media

The **profile (corrugation height + flute angle)** is also a variation but is not used to distinguish a BMG from another, this parameter must be used by the auditor to diversify the products selected for the repetition campaigns.

For **Case C** (ultrasonic unit) the following variation distinguish one BMG from another:

- Water flow (every 6 l/h)

¹ The specific heat capacity is based on the following:

Humidity ration = 0.01

C_p (dry air) = 1.006 kJ/kgK

C_p (water vapour) = 1.84 kJ/kgK

I.4. Contributors

The lists of contributors are given for information and may be modified by EUROVENT CERTITA CERTIFICATION whenever necessary.

I.4.1. Audit Body

The audit functions are performed by the following body(ies), called audit body:

EUROVENT CERTITA CERTIFICATION SAS

48/50 rue de la Victoire

F- 75009 PARIS

Tel : + 33 1 75 44 71 71

www.eurovent-certification.com - www.certita.fr

EUROVENT CERTITA CERTIFICATION Ltd

Kemp House 152-160 City Road

London, EC1V 2NX

United Kingdom

Tel : +44 07896711612

I.4.2. Independent Laboratory / Test body

When the checks carried out involve product tests, these are performed at the request of EUROVENT CERTITA CERTIFICATION by the following laboratories, known as Independent laboratory:

TUV SUD Industrie Service GmbH

Center of Competence fur

Kalte – und Klimatechnik

Ridlerstrabe 65, 80339

Munchen, Germany

Tel : +49 89 5190-3656

www.tuev-sued.de

II. REQUIREMENTS OF THE REFERENCE DOCUMENT

II.1 Reference Documents

II.1.1. Product and Test Standards

The test procedure is detailed in the technical appendix and in the product and test standards.

The applicable standards are as follow (non-exhaustive list):

- **AS/NZS 2913-2000** - Testing standards for Evaporative air-conditioning equipment.
- **ANSI/ASHRAE Standard 133-2015** - Method of Testing Direct Evaporative Coolers, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta.
- **EN 14511-3: 2013.** – Air-conditioner, Liquid Chiller packages & Heat Pumps with electrically driven compressor for space heating & cooling – Part 3 - Tolerance for reading temperature measurement.
- **ANSI/ASHRAE Standard 143-2015** - Method of Test for Rating Indirect Evaporative Coolers, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta.
- **ASHRAE Standard 41.2-2018** - Standard Methods for Air Velocity and Airflow Measurement
- **ISO 5801-2017** - Fans Performance testing using standardised airways

II.2. Specific Requirements and Quality Management

Production Requirements

Use of Mark Logo

The participant shall respect the marking requirements of the present certification manual and of the Technical certification rules if the logo is used on its products and/or services on all the relative documentations.

Management of Customer Claims

Customer claim and their treatment related to certified products shall be done, recorded, and maintained available.

II.3. Marking

It is highly recommended that the participating company indicates participation in the EUROVENT CERTIFIED PERFORMANCE (ECP) programme for Evaporative Cooling by the following means.

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

The mark shall include the mentions indicated in the logo below:



Figure 1: ECP mark for Evaporative Cooling (EC)

II.3.1. Display of Eurovent Certified Performance logo on Production Units

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

Each Participant shall display the ECP mark, in an authorised manner, on units of models which have been certified. The participant shall display the symbol on each certified production unit by means of a label, approved by Eurovent Certita Certification. It shall be noted that should the range name & diploma number not be included on the ECP mark, then this information shall be required on an alternative permanent location on the unit e.g. unit data name plate. The name of the relevant programme shall be declared as “Evaporative Cooling” or the corresponding short name “EC”.

No data or other marking shall be added to the label. The participant may affix the ECP mark at any location thereon satisfactory to him.

II.3.2. Display of Eurovent Certified Performance logo on Technical Documentation

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

When used in technical documentation as defined in the Certification Manual (electronic and printed catalogues, websites, on-line and off-line selection software, and specification sheets), carrying ratings or claiming certification of certified models, the Eurovent Certified Performance mark shall be used only for certified products. Non-certified products shall be clearly distinguished or presented in a separate document.

Whenever displayed on technical documentation, the ECP mark shall include in the dedicated area (see Certification Manual) the name of the relevant programme the product is certified for, i.e. “Evaporative Cooling” or the corresponding short name “EC”.

The ECP mark alone may be used in literature without certified performance data (general leaflets, advertising etc.).

III. CERTIFICATION PROCESS

III.1. Admission Procedure

III.1.1. Declaration of Data

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

The Applicant, after signing the Certification Agreement, shall send to EUROVENT CERTITA CERTIFICATION all information required for the qualification: software name and version, the software itself, declaration file and relevant literature.

All characteristics and performances shall be expressed in SI units. Maximum of 3 significant digits shall be used for:

- In the case of DEC: cooling capacity, air flow, EER, saturation efficiency, water consumption, sound power level (optional)
- In the case of IEC: Total cooling capacity, room cooling capacity, air flow, EER, saturation efficiency, water consumption, sound power level (optional)
- In the case of ECE: cooling capacity, Evaporation Efficiency, EER, water consumption, pressure drop (wet and dry)

Submittal of data shall be made by filling in the forms provided by EUROVENT CERTITA CERTIFICATION as .xls or .xlsx files. The forms shall be sent by e-mail to EUROVENT CERTITA CERTIFICATION within the time limits specified in Certification Schedule (see Appendix – Campaign schedule, if applicable).

Copies of the forms are part of this Technical Certification Rules (see Appendix C):

- Declaration file EC-1 will be used
 - for manufacturing companies (Original Equipment Manufacturer – OEM) to declare ranges, Basic Model Groups (BMG), performance ratings and technical data.
 - for Brand Name (BN) companies to identify the corresponding model's number of the original equipment manufacturer
- Technical data sheet EC-2 will be used to complete technical description of all raw material or incoming goods for the units selected.
- Selection Software update record sheet EC-3

A special unit is a unit with configurations affecting the performance at laboratories condition and not included in the latest version of the selection software. If a special unit is produced, the manufacturer has the right to not declare it.

Manufacturer shall declare special units non-certified Eurovent products.

III.1.2. Admissibility of the Application

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

When the declaration file is completed, units selected by Eurovent Certita Certification shall be tested in the independent laboratory or applicant's laboratory according to the procedure detailed in III.1.3.4. If the tests show conformity with the relevant Technical Certification Rules (TCR), certification is granted until delivery deadline of the next testing campaign +3 months. At the end of each year of testing, a diploma could be issued for the product range of Evaporative Coolers.

III.1.3. Implementation of Checking Operations

The provisions of the Certification Manual apply.

III.1.3.1. Software Checking Procedure – Software Pre-Check

Acquisition and Initial Check of the Software

The software shall be sent together with all required data when the applicant subscribes for the qualification procedure.

The software compliance to general (see dedicated chapter in the Certification Manual) and specific requirements (as listed below) is to be checked by Eurovent Certita Certification prior to selection.

Brand Name companies shall also send the operating version of the software to Eurovent Certita Certification to check the consistency with the OEM software version.

In case only in-house programmes are available, a person designated by Eurovent Certita Certification shall undertake himself the selection on site, during a specific visit for Brand Name (BN) companies or the factory audit for OEM.

Specific Requirements

In addition to the general software requirements which are described in the dedicated appendix of Certification Manual, the software must comply with the following:

- If the technical selection is protected by a username and/or password these shall be provided to the Eurovent Certita Certification representative.
- Software must comprise a reference (e.g. in bracket) with the vocabulary used in this TCR document, at least for the following terms:
 - Every terms listed under the definition section of this TCR document
 - Every certified data
- Standard air density is set at 1.20 kg/m³. Other values are authorized if accompanied by the underlying air density. The air density shall be clearly stated and present in the printouts. The selection software must have an option to print with the outputs at standard conditions.

III.1.3.2. Initial Admission Audit

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

The audit will consist of the on-site checking of software and the verification that the applicable requirements specified in the audit requirements below are fulfilled.

Whenever necessary, Eurovent Certita Certification has the right to ask an auditor to conduct an additional audit to the applicant/participants' factory as well as to collect data directly from customer and perform extra checking of software.

If audits are not conducted within the time limitations specified in the notification received from Eurovent Certita Certification, it is considered as non-application of procedures (see Certification Manual).

Factory audits can be performed also remotely based on the 'Eligibility' as outlined in the Certification Manual (Appendix L). However, also remote audits can be introduced in case of force majeure as outlined also in the Certification Manual – Terms of Requirements.

Audit Requirements

During the audit, the auditor will:

- check that the ECP mark is displayed on the production units and on the documentation in compliance with the requirements specified in the Certification Manual;
- check the operating software consistency as per paragraph IV.4.c;
- check that the products in the sales record and/or production line and/or stock are compliant with the declaration file EC-1;
- check that the corrective actions plan (see §IV.5.c) is completed or under implementation.

- check that the Eurovent Certified Performance logo must be displayed on every certified unit.

If the applicant is not ISO 9001 certified, then the auditor will also perform a complete review of the quality management system to check that:

- the suppliers are regularly evaluated and that the corresponding evaluations are recorded;
- the basic/key components and/or raw material are controlled at their reception;
- the products conform with the bill of material (BOM) specifications is regularly evaluated and the corresponding evaluations are recorded;
- the manufacturing process key steps are submitted to a validation check which results are recorded.
- the factory personnel are qualified to perform the specific tasks if any;
- calibration of measuring devices is performed on a regular basis;
- production non-conformities are recorded, and corrective actions initiated;
- customer complaints are registered and treated;

On-site / Re-mote Checking of the Software

The auditor appointed by Eurovent Certita Certification shall check the selection software consistency by selecting one (1) order at random from the applicant/participant sales records. This check shall be conducted:

- during factory audits for OEM;
- during the facility audit (where the orders to the customers can be accessed) for BN.

Whenever possible, the specific visit for BN shall be scheduled once the OEM has undertaken the testing procedure and/or the OEM on-site checking of software has been performed in order to compare the BN software results to recent OEM software results. Otherwise, the software will be checked against the results of campaign N-1.

Whenever possible, one of the checks shall be performed on an order under manufacturing (for OEM) or preparation (for BN) so that the entire composition and technical specifications can be checked on site. For the OEM, the other check shall be performed for a unit similar or identical to one of the production units selected for the test campaign.

The applicant's representative shall fully inform the auditor by submitting all relevant assembly drawings, specifications, and technical data sheets of the units under check.

For OEM, in case the products under manufacturing at the audit date do not fall into the certification programme scope, the auditor shall at least check the stock to verify that the raw material or incoming goods under common use in the factory are the same as that appearing in the declaration file EC-1.

The composition, technical specifications and performance from recalculation shall be the same as the one specified and announced to the customer. If one of the performance values obtained by the auditor differs by more than the acceptable tolerance, this is considered as a software consistency failure and the applicant/participant shall update his software according to the relevant procedure (see §IV.6.e). If in the meantime the applicant/participant has officially launched a new software version and recalculation is made with this version, deviations should be traceable in the software update record sheet (sheet EC-3, see C.III).

If it appears that different software had been used, this shall be considered as a non-respect of procedures (see Certification Manual).

Audit Non-conformity

After evaluation, a non-conformity is classified as critical when, on the basis of objective evidence, the following cases are identified:

- there is a significant risk to the product conformity with respect to specified requirements;
- there is a significant risk regarding the quality management system ability to control the product conformity to specified requirements;
- there is systematic or repeated non-conformity to a specified requirement;

Otherwise, the non-conformity is classified as not-critical.

In case of non-conformity, the applicant/participant shall be requested to provide Eurovent Certita Certification with a corrective action plan within four (4) weeks, and as defined by the auditor in case of critical non-conformity (see also below for the audit failure treatment procedure).

Failure Treatment: In case of non-conformity, Eurovent Certita Certification shall initiate the appropriate failure treatment procedures. The outcome of the failure treatment procedures may be that the product range is suspended from certification for a minimum period of one year or longer until the non-conformity has been corrected.

The applicant shall examine the reasons of the failure (see CM (latest version in force)).

In case the software is proved inconsistent during the initial on-site check, the applicant shall update his software according to the re-rating procedure.

The applicant shall resolve the non-conformity within the time limitation agreed in the corrective actions plan.

In case of critical non-conformity, the certification may be suspended/not granted until the critical non-conformity resolution and the corresponding verification.

Challenge Procedure: Under special conditions a challenge procedure may be carried out as described in the Certification Manual.

Traceability: To ensure the traceability of the products each certified product shall be marked to ensure traceability with respect to the plant (e.g. serial number) and factory address location.

III.1.3.3. Selection of Units to be Tested

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

Eurovent Certita Certification shall select units to be tested on the basis of its evaluation of the declaration file EC-1 communicated by the applicant.

- **In the case of DEC:**

Two (2) units per range with an airflow less than 20,000 m³/h to be tested in the independent laboratory shall be selected.

One (1) unit per range with an airflow greater than 20,000 m³/h to be tested in the applicant's laboratory (approved by Eurovent Certita Certification) shall be selected. This test will be supervised by an independent agency selected by Eurovent Certita Certification. If the applicant is not able to provide testing facilities to perform the test 1 additional unit of the same range shall be sent to the independent laboratory for testing, the air flow of this unit shall correspond to the maximum testing capacity of the independent laboratory. The tests will be performed on an existing unit, the selection shall then be based on the applicant's orders. For this purpose, the applicant shall issue to Eurovent Certita Certification his orders and technical specification 6 months prior to the test in order to select the unit to be tested.

- **In the case of IEC:**

One (1) unit per range to be tested in the applicant's laboratory (approved by Eurovent Certita Certification) shall be selected. This test will be supervised by an independent agency selected by Eurovent Certita Certification. If the applicant is not able to provide testing facilities to perform the test one unit per range shall be sent to the independent laboratory for testing, the air flow of this unit shall correspond to the maximum testing capacity of the independent laboratory.

Eurovent Certita Certification is responsible for the selection of a unit for testing and may select any unit as defined below.

Units with an airflow greater than the maximum capacity of the participant laboratory cannot be tested. If a range of the software is required, the complete range of airflow will thus be affected.

Selection from the existing available stock is preferable, even if only a single unit is available. If no stock is available a selection will be made from the Participant production schedule within a 6-month period.

If within this 6 months period only special units (as defined under section III.1.1.) have been produced by the manufacturer a special unit will be selected for the tests. The special unit configuration selected must then be added into the selection software of the manufacturer before it is tested.

For the penalty tests, Eurovent Certita Certification shall select the additional units from the failed range, if applicable.

- **In the case of ECE:**

At least one (1) unit per Basic Model Group (BMG) shall be selected in order to cover the variations declared (see system and BMG definition in this TCR document). The units will be tested in the independent laboratory.

Products with a water flow greater than 200 l/h are included in the scope (up to 5,000 l/h) but won't be tested due to the limits of the laboratory's capacity. If a range of the software is required, the products with an airflow greater than 200 l/h will thus be indirectly affected.

III.1.3.4. Tests at the Independent/Participant Laboratory

General

Within the programme, tests may be conducted under the following procedures:

- Scheduled tests in qualifying procedure
- Scheduled tests in repetition procedure
- Penalty test in repetition procedure
- Challenge procedure test

Tests shall be performed at the independent laboratory selected by Eurovent Certita Certification for DEC (unit less than 20,000 m³/h) and ECE and in the participant laboratory supervised by an expert of the independent laboratory for DEC (unit with an air flow greater than 20,000 m³/h) and IEC.

Test at an Independent Laboratory:

The laboratory shall have the responsibility of unpacking, handling, testing and re-packing the unit for shipment.

Before testing, the laboratory shall check the product dimensions against the values declared in the technical datasheet to ensure that the unit corresponds to the selection.

The laboratory shall not perform the test and contact Eurovent Certita Certification who shall ask the applicant/participant to send a new unit in the following cases:

- one of the dimensions is not compliant with the technical datasheet (review this TCR document for acceptance criteria),
- one of the units components appears damaged (see below c. Failure Treatment "Initial Test failure").

Units shall be assembled and installed in the test facility by the laboratory personnel in accordance with the manufacturer's published installation instructions. The applicant/participant shall therefore provide the laboratory with full information about the installation.

Upon justified request the applicant/participant's staff may be allowed by Eurovent Certita Certification to attend the preparation and installation of units but not the test itself.

No applicant's personnel shall be present in the laboratory test facility during the tests.

If the test establishes that the unit fails to meet one or more of the requirements of this TCR document, the laboratory shall promptly notify Eurovent Certita Certification to receive instructions regarding further actions.

Test at the Participant Laboratory

Tests shall be performed by an independent agency, selected by and under contract with Eurovent Certita Certification. The same procedure as for testing at an independent laboratory shall be applied except that the Participant's personnel is permitted in the laboratory test room facility. The test requirements in Participant laboratory are given in the relevant Rating Standards.

Testing Competitor Products at a Participant Laboratory

Tests shall be performed by an independent agency, selected by and under contract with Eurovent Certita Certification. The application forms shall be checked by an independent agent and shall not be disclosed to the competitor laboratory. Problems of confidentiality shall be solved by a mutual agreement between Participants.

Report of Test Results and Test-check

Upon completion of the tests on each unit, the laboratory will send the complete report as a .pdf file to Eurovent Certita Certification. Eurovent Certita Certification shall recalculate the values with the software according to the test operating conditions displayed in the test report ("test-check").

For each test, a performance item fails when relative/absolute deviation is not in accordance with the acceptance criteria. When one or more performance items fail, the test status is considered FAILED and the failure treatment corresponding to unit failure shall be applied.

Eurovent Certita Certification will forward a copy of the report together with the test check result sheet (EC-4) and, if applicable, the test rerate form (EC-5) to the applicant/participant (see Appendix C).

a. Time Limitation of Acquisition and Recovery of Units

In addition to the provisions laid down in the Certification Manual, the following requirements apply: Deadline for delivery of units to the laboratory, together with the technical data sheet completed and the payment, is defined in the Certification Schedule. For the qualifying procedure the deadline is specified in the notification received from Eurovent Certita Certification.

If elements are not delivered within the time limitations, it is considered as non-application of procedures (see Certification Manual).

Eurovent Certita Certification has discretion not to discontinue the certification when the applicant/participant provides a definite and acceptable date of supply.

The applicant has to recover the product(s) maximum six (6) working weeks after receiving the test reports and results. If the products are not recovered after this delay, the laboratory can destroy them, and the corresponding invoice will be sent by Eurovent Certita Certification to the applicant.

b. Test Conditions

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

The tests shall be conducted at the conditions stated in this TCR document within section Appendix A - A.2.

c. Failure Treatment

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

Initial Test Failure

If the unit is damaged this is considered as a “component failure”. The independent laboratory shall immediately inform Eurovent Certita Certification who will notify the applicant. The applicant shall deliver within four (4) working weeks a new copy of the same model, which then shall be tested according to the availability of the laboratory.

Unit Failure

For each failed test, the applicant has four (4) working weeks from the notification of failure to select between the following alternatives:

- Rerate the data by adapting the software to the test results. The corrected software with its new version number shall be sent to Eurovent Certita Certification who will check the consistency of the modifications. If the new software is in accordance with all the measurements, the range is published on the ECP website with the new rating and certification is granted/maintained. After verification (“test-recheck”), if the software is still not in accordance with the test results the certification shall be temporarily suspended until the software update proves consistency with the tests results.
- Ask for a second test on a new copy of the same unit scheduled by Eurovent Certita Certification according to the availability of the laboratory. This request shall be accompanied by a cause analysis and a relevant corrective actions plan. If this second test is successful, no revision of selection software will be required, otherwise the data will have to be rerated and the software updated as explained in the rerating procedure in the Certification Manual.

In both cases and in the case of a repetition, penalty tests might be requested as described in III.1.5 Penalty Test section below.

III.1.4. Evaluation and Decision

In addition to the provisions laid down in the Certification Manual, the following requirements apply: The certification is granted on condition that:

- The aforementioned checks prove compliance with the requirements specified in this TCR.
- All fees have been settled.

If not, then the procedure for failure treatment shall be applied.

III.1.5. Penalty Tests

In case of established failure, units for penalty tests have to be selected as follows:

In the case of DEC:

- One (1) unit in case of failure on one of the certified performances

In the case of IEC:

- One (1) unit in case of failure on one of the certified performances

In the case of ECE:

- One (1) unit in case of failure on one of the certified performances

The penalty tests are full tests and shall be performed during the following year, in addition to scheduled repetition tests if any.

Eurovent Certita Certification shall select units for penalty tests from the range which failed (see III.1.5.). If this range is no longer produced in year N+1 (status “deleted” or “obsolete”) then the selection will be made from the range which is the most similar to the one that failed.

III.2. Surveillance Procedure

The provisions of the Certification Manual apply.

III.2.1. Implementation of Surveillance Operations

The Participant must ensure that there is conformity between the Evaporative Cooling designs he manufactures and sells, and the design described in the application form and tested. Thermal performance conformity is verified on an annual base by an independent test agency. If the verification on site is done, then the site must not be older than 12 (twelve) months from date of inspection.

If the participant makes changes to his design, this will require a new application file and a new test. When all the results show conformity with the requirements in this TCR, including factory audit and all fees have been settled, series / range certification is renewed according to the certification schedule.

Schedule of participation for Participants can be found in APPENDIX B.III. – Table 1.

III.2.1.1. Surveillance Audit

In addition to the provisions laid down in the Certification Manual, the following requirements apply:
For the surveillance procedure, the surveillance audit follows the same rules than the admission audit.

III.2.1.2. Selection of Units to be Tested

In addition to the provisions laid down in the Certification Manual, the following requirements apply:
For the repetition procedure, Eurovent Certita Certification shall select for testing:

- In the case of DEC:

One (1) unit every five (5) models per range with the same conditions defined under the qualifying procedure.

- In the case of IEC:

If not ISO 9001 certified one (1) unit per range every year to be tested in the participant's laboratory.

If ISO 9001 certified one (1) unit per range every two years to be tested in the participant's laboratory.

- In the case of ECE:

At least one (1) unit per Basic Model Group (BMG) shall be selected in order to cover the variations declared (see system and BMG definition in section I.3.3.) in the case of case A and B (see definition of case A and B. The units will be tested in the independent laboratory.

At least one (1) unit every two (2) Basic Model Groups (BMG) shall be selected in order to cover the variations declared (see system and BMG definition in section I.3.3.) in the case of case C (see definition of case C). The units will be tested in the independent laboratory.

If possible, a configuration different from that previously tested shall be selected.

III.2.1.3. Surveillance Tests

In addition to the provisions laid down in the Certification Manual, the following requirements apply:
For the surveillance procedure, the surveillance tests follow the same rules than the admission tests.

III.2.1.4. Software Checking Procedure

In addition to the provisions laid down in the Certification Manual, the following requirements apply:
For the surveillance procedure, the surveillance software checking procedure follows the same rules than the admission audit.

III.2.1.5. Technical and Commercial Documentation Check

In addition to the provisions laid down in the Certification Manual apply and following the same rules than the admission documentation check.

III.2.2. Evaluation and Decision

The provisions of the Certification Manual apply.

III.3. Declaration of Modifications

The provisions of the Certification Manual apply. In addition, the participant shall inform Eurovent Certita Certification of any declaration modifications using the correct FORM as outlined in the data application, admission procedure (see APPENDIX C).

III.3.1. Changes Concerning the Participant

The provisions of the Certification Manual apply. In addition, the participant shall inform Eurovent Certita Certification of any declaration modifications using the correct FORM as outlined in the data application, admission procedure (see APPENDIX C).

III.3.2. Changes Concerning the Production Entities

The provisions of the Certification Manual apply. In addition, the participant shall inform Eurovent Certita Certification of any declaration modifications using the correct FORM as outlined in the data application, admission procedure (see APPENDIX C).

III.3.3. Changes Concerning the Quality Organisation of the Manufacturing and/or Marketing Process

The provisions of the Certification Manual apply.

III.3.4. Additional Admission for a New Model and/or New Range

The provisions of the Certification Manual apply. In addition, the participant shall inform Eurovent Certita Certification of any declaration modifications using the correct FORM as outlined in the data application, admission procedure (see APPENDIX C).

III.3.5. Changes Concerning the Certified Product

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

Participants shall inform Eurovent Certita Certification of any modification of the product portfolio by updating the declaration file (EC-1) and sending the updated selection software together with the software update record sheet EC-3. Non-compliance of the applicant/participant is considered as non-application of procedure as outlined in this TCR.

EUROVENT CERTITA CERTIFICATION decides whether the modification is significant for the certified performance data or not. In the case of significant modifications EUROVENT CERTITA CERTIFICATION is entitled to review this and to make additional test/s to check the influence on performance data. Note, shall not be considered as a repetition test.

Naming Non-certified Product Ranges

When a participant also produces a product series or range that does not require to submit for certification, they shall have a significantly different range name from the certified range. If the non-certified range can be selected in the same selection software tool, it shall be clear that this range is not certified. This rule has been included to avoid confusion between certified and non-certified ranges.

III.3.6. Temporary or Permanent Cessation of Production of a Certified Product

The provisions of the Certification Manual apply

III.4. Suspension / Cessation Conditions

The provisions of the Certification Manual apply.

APPENDIX A. TECHNICAL APPENDIXES

A.1. Purpose

The purpose of this document is to establish definitions and specifications for testing and rating of Evaporative Cooling (EC) for the related Programme/ Sub-Programme's: (DEC, IEC & ECE).

A.2. Testing Requirements

A.2.1. Direct Evaporative Cooling(DEC)

Tests shall be conducted in accordance with the AS 2913-2000 standard, "Evaporative air-conditioning equipment".

The following elements will be determined through the tests:

- Airflow (according to AS 2913-2000 – section 3.2.3)
- Evaporation efficiency (according to AS 2913-2000 – section 3.2.4), by determining:
 - o Entering dry bulb temperature
 - o Entering wet bulb temperature
 - o Leaving dry bulb temperature
- Power Consumption (according to AS 2913-2000 – section 3.2.6)

Sound output level is not a certified performance of this programme and therefore section 3.2.5 shouldn't be considered.

The ASHRAE 133-2015 shall be used for the water consumption testing (section 6.5).

Particular Specifications for Testing (DEC)

The following specifications are applicable for qualification tests and repetition tests.

a. Operating Conditions

As defined in the AS 2913-2000 the operations conditions and target room conditions are specified as follows:

- Inlet dry bulb temperature: 38°C
- Inlet wet bulb temperature: 21°C
- Room dry bulb temperature: 27.4°C

b. Water Consumption

Water consumption shall be tested as per the ASHRAE 133-2015 section 6.5.

The measurement shall be made for a period of at least 20 minutes on the unit supply water line.

If there is an intermediate water tank, it will need to be refilled at least 4 times to have a better accuracy on the efficiency.

Any water flushing cycles are excluded from the measurement.

c. Water inlet

The water inlet temperature shall not be less than 10°C.

d. Water quality

The quality of the water supplied to the distribution header must be declared by the manufacturer with the following minimum information:

- Range of Conductivity
- Range of Total Dissolved Solids (TDS) or Total Salt Content (TSC)
- Range of Total Hardness
- Range of PH

e. Airflow

Airflow shall be tested as per the AS 2913-2000, section 3.2.3 or as per ASHRAE 133-2015 with the following condition on the fixed external static pressure:

- 80 Pa for an air flow less than 14,400 m³/h
- 120 Pa for an air flow greater than 14,400 m³/h

f. Power Consumption

Power Consumption shall be measured as per the ASHRAE 133-2015 section 6.4.

g. Measurement of the Wet bulb Temperature

Wet bulb temperature can be measured directly (as per the ASHRAE 133-2015, i.e. by using an air sampling device) or indirectly through a measurement of the dry bulb temperature (same accuracy than the ASHRAE 133-2015 shall be used) and relative humidity (with an accuracy of 2%).

If the wet bulb temperature is measured indirectly it shall be measured with minimum 2 sensors equally distributed at the inlet of unit.

h. Measurement of the Dry bulb Temperature

Dry bulb temperature can be measured directly (as per the ASHRAE 133-2015, i.e. by using an air sampling device) or indirectly with a minimum of 4 sensors equally distributed at the inlet of unit.

i. Tolerance on the reading of the Temperature Sensors

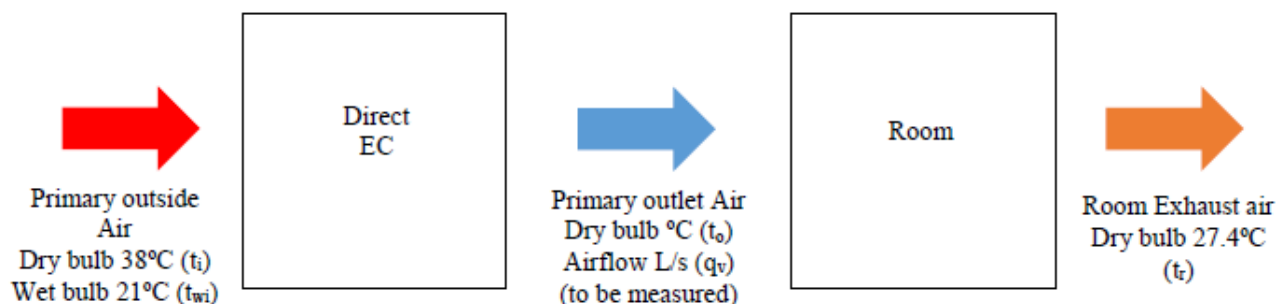
The reading of the temperature sensor for the inlet condition shall be according to the EN 14511-3:2013.

j. Particular Specification for Primary Outlet air Flow Rate

The mass flow rate of primary outlet air defined under section 9.3.1.6 of the ASHRAE 133-2015 shall refer back to actual air condition (recalculated from standard air condition).

Testing Procedure Details for Cooling Capacity and Saturation Efficiency

- ⇒ Tests shall be performed as per the Australian Standard AS 2913-2000 Evaporative air-conditioning equipment.
- ⇒ Evaporation Efficiency calculation as per AS2913-2000, Section 3.2.4.
- ⇒ Cooling Capacity calculation as per AS2913-2000, Appendix A.
- ⇒ Primary outside air Dry bulb: 38°C, Primary outside air Wet bulb: 21°C.
- ⇒ Room Exhaust Dry bulb: 27.4°C.



A.2.2. Indirect Evaporative Cooling (IEC) with Primary Outside Air/Separation of External & Room Air)

Tests shall be conducted in accordance with the ANSI/ASHRAE Standard 143-2015 testing methodology, "Method of test for rating indirect evaporative coolers".

Particular Specifications for Testing (IEC)

The following specifications are applicable for qualification tests and repetition tests.

a. Operating Conditions

Case A: IEC with Primary outside air

As defined under section I.3.2.2. for case A the primary air inlet is the external air.

The following operating conditions and target room conditions must be used for the test of IEC with primary outside air, the following scenario must be tested:

Scenario 1:

- Primary air inlet dry bulb temperature: 38°C
- Primary air inlet wet bulb temperature: 21°C
- Room exhaust dry bulb temperature: 27.4°C

Depending on the source of the secondary air inlet the operating conditions must be as follows:

- Secondary air from primary air: as defined by the construction of the unit
- Secondary air from external air: 38°C dry bulb and 21°C wet bulb
- Secondary air from room exhaust air: 27.4°C dry bulb, 17.7°C wet bulb

Refer to appendix A.I for further details.

Case B: IEC with Separation of the External and Room Air

As defined under section I.3.2.2. for case B the primary air inlet is the room air.

The following operating conditions and target room conditions must be used for the test of IEC with separation of the external and room air, the four following scenarios must be tested:

Scenario 1, Wet:

- Secondary air inlet dry bulb temperature: 35°C
- Secondary air inlet wet bulb temperature: 24°C
- Primary outlet air dry bulb temperature: 27.4°C
- Room air dry bulb temperature: 39.4°C
- At declared total cooling capacity

Scenario 2, Wet:

- Secondary air inlet dry bulb temperature: 38°C
- Secondary air inlet wet bulb temperature: 21°C
- Primary outlet air dry bulb temperature: 27.4°C
- Room air dry bulb temperature: 39.4°C
- At declared total cooling capacity

Scenario 3, Wet:

- Secondary air inlet dry bulb temperature: 20°C
- Secondary air inlet wet bulb temperature: 15°C
- Primary outlet air dry bulb temperature: 27.4°C
- Room air dry bulb temperature 39.4°C
- At 60% of reference total cooling capacity declared for scenario 1

Scenario 4, Dry:

- Primary outlet air dry bulb temperature: 27.4°C
- Room air dry bulb temperature: 39.4°C
- At 60% of reference total cooling capacity declared for scenario 1
- The scope of the test shall be to measure the maximum secondary air inlet dry bulb temperature, for which the room supply air temperature can be guaranteed.

Refer to Page 35 - Testing procedure details for Total Cooling Capacity and wet/dry bulb approach effectiveness: Case B for further details.

b. Water Consumption

Water consumption shall be tested as per the ASHRAE 133-2015 section 6.5.

The measurement shall be made for a period of at least 20 minutes on the unit supply water line. If there is an intermediate water tank, it will need to be refilled (topped up) at least 4 times to have a better accuracy on the efficiency.

Any water flushing cycles are excluded from the measurement.

c. Water Inlet

The water inlet temperature shall not be less than 10°C.

d. Water Quality

The quality of the water supplied to the distribution header must be declared by the manufacturer with the following minimum information:

- Range of Conductivity
- Range of Total Dissolved Solids (TDS) or Total Salt Content (TSC)
- Range of Total Hardness
- Range of PH

e. Airflow

Airflow shall be tested as per the ASHRAE 143-2015 with the following condition on the fixed external static pressure:

- 80 Pa for an air flow less than 14,400 m³/h
- 120 Pa for an air flow greater than 14,400 m³/h

Only the primary air shall be measured, it is not necessary to measure the secondary air. The primary air shall be measured at the outlet of the heat exchanger in order to take into account any losses through the heat exchanger.

Air flow can be measured as per the ASHRAE standard 41.2 with flow nozzles or Pitot tubes. For the test the air flow of the secondary air shall be as declared by the manufacturer.

Important note: The measurement of the airflow shall be done with the measuring devices of the applicant/participant. Therefore, the test bench of the applicant/participant shall be in accordance with the ASHRAE 143-2015 for this measurement.

f. Power Consumption

Power Consumption shall be measured as per the ASHRAE 133-2015 section 6.4.

g. Measurement of the Secondary Air Outlet

For the sake of this certification programme for IEC the measurement of the secondary air outlet is not required.

h. Measurement of the Wet bulb Temperature

Wet bulb temperature can be measured directly (as per the ASHRAE 143-2015, i.e. by using an air sampling device) or indirectly through a measurement of the dry bulb temperature (same accuracy than the ASHRAE 143-2015 shall be used) and relative humidity (with an accuracy of 2%).

If the wet bulb temperature is measured indirectly it shall be measured at minimum 2 sensors equally distributed at the inlet of unit.

i. Measurement of the Dry bulb Temperature

Dry bulb temperature can be measured directly (as per the ASHRAE 143-2015, i.e. by using an air sampling device) or directly with a minimum of 4 sensors equally distributed at the inlet of unit.

j. Tolerance on the Reading of the Temperature Sensors

The reading of the temperature sensor for the inlet condition shall be according to the EN 14511-3:2013.

k. Particular Specification for Primary Air Flow Rate

The mass flow rate of primary air defined under section 11.3.7 of the ASHRAE 143-2015 shall refer back to actual air condition (recalculated from standard air condition, see Appendix A – A.3.).

l. Dry mode, Wet mode and DX Integration

During the tests only the wet and dry mode shall be tested.

If a DX coil is integrated in the unit it must be turned off during the tests.

Testing procedure details for Total Cooling Capacity, Room Cooling Capacity and Cooling Effectiveness: Case A

As stated in this rating standard for the case A the primary air inlet is the external air and the secondary air inlet is either:

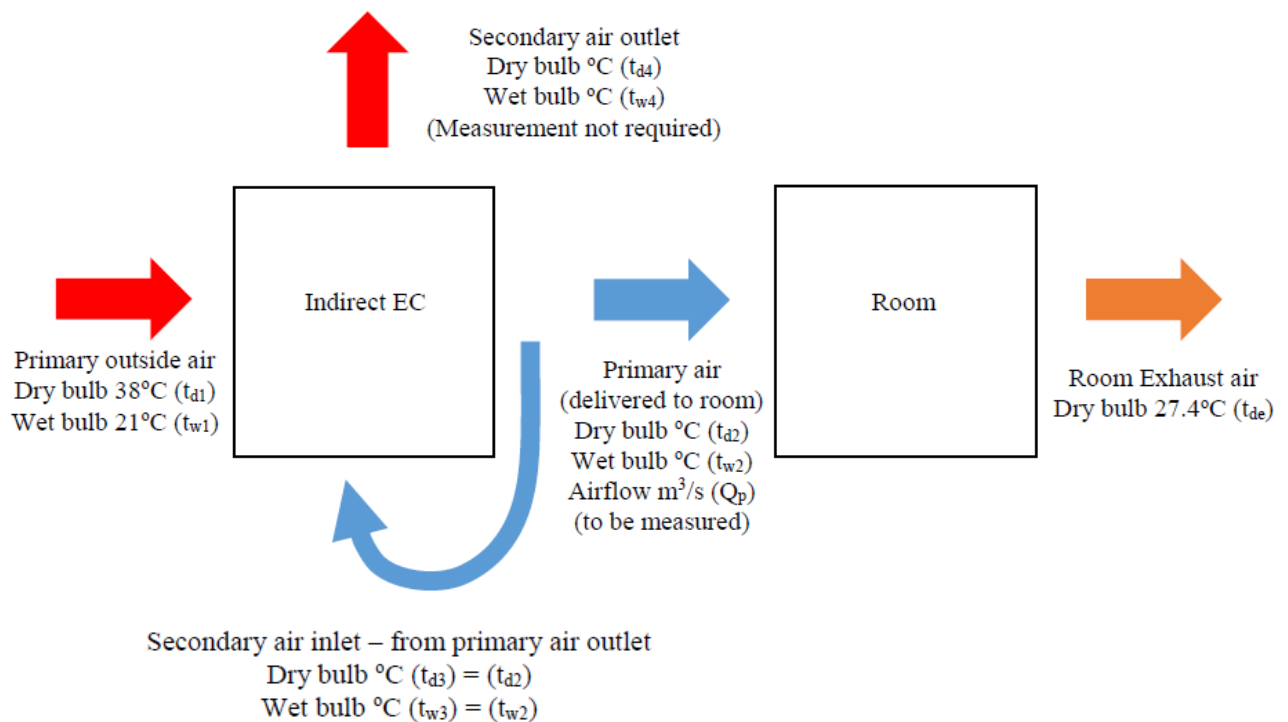
- The external air
- A discharge of the primary air

- The room exhaust air

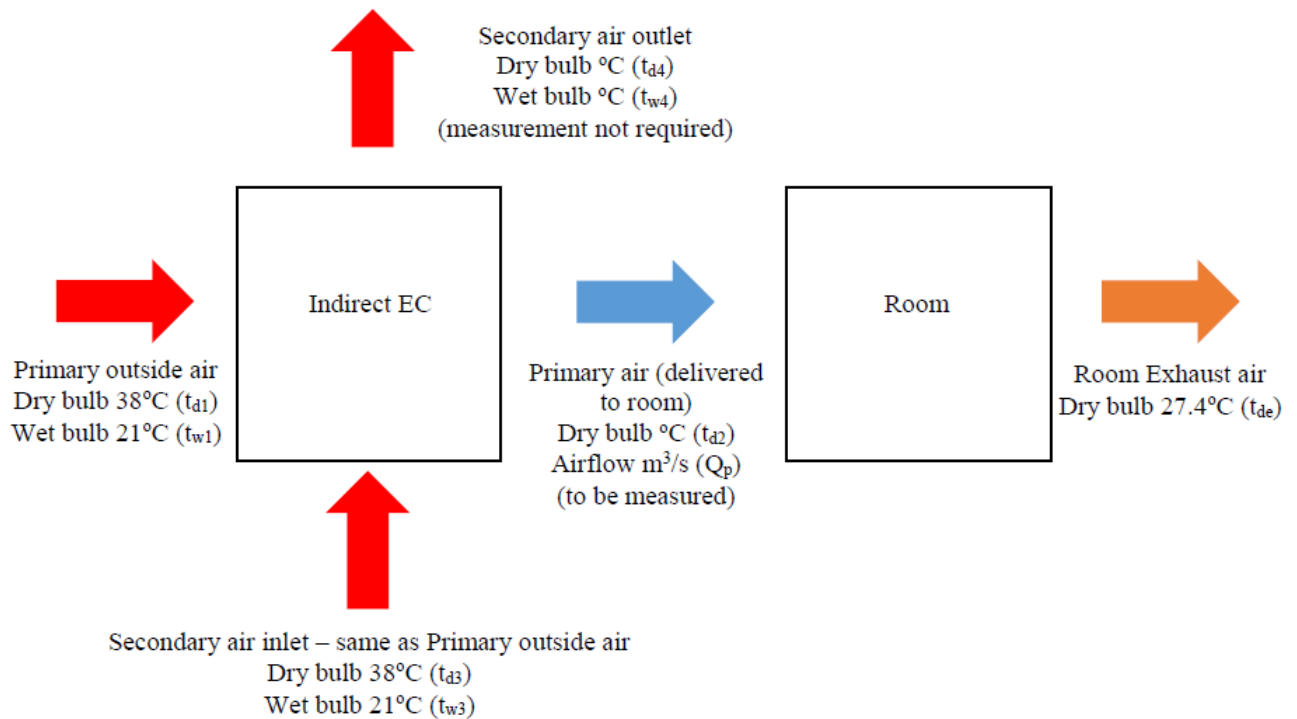
Tests shall be performed as per ASHRAE standard ANSI/ASHRAE 143-2015 Method of Test for Rating Indirect Evaporative Coolers.

- ⇒ Wet bulb approach effectiveness calculation as per section III.9 and tests as per ANSI/ASHRAE 143-2015
- ⇒ Dry bulb approach effectiveness calculation as per section III.10 and tests as per ANSI/ASHRAE 143-2015
- ⇒ Water consumption testing as per ANSI/ASHRAE Standard 133-2015
- ⇒ Cooling Capacity calculation as per ANSI/ASHRAE Standard 143-2015, Section 11.5.
 - o Total Cooling Capacity calculation, referenced to Outside air temperature
$$q = 1.21Q_p (t_{d1} - t_{d2})$$
 - o Room Cooling Capacity calculation - referenced to Room Exhaust air temperature
$$q = 1.21Q_p (t_{d2} - t_{de}), \text{ where } t_{de} = 27.4^\circ\text{C}$$
- ⇒ Primary air inlet Dry bulb: 38°C , Primary outside air Wet bulb: 21°C .
- ⇒ Room Exhaust Dry bulb: 27.4°C .

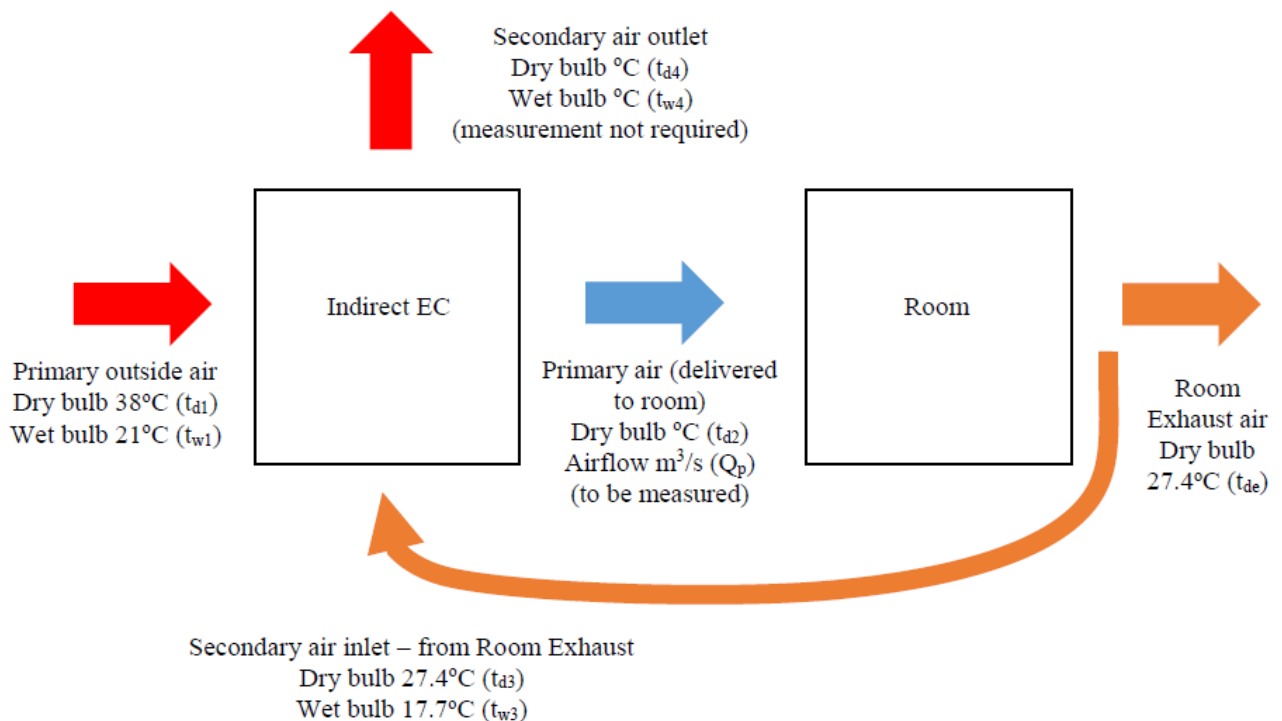
For Secondary air supplied from primary outlet air: Secondary air Dry bulb and Wet bulb conditions as defined by the construction of the Indirect EC under test.



For Secondary air supplied from outside air: Secondary air Dry bulb: 38°C, Secondary air Wet bulb: 21°C



For Secondary air supplied from room exhaust: Secondary air Dry bulb: 27.4°C, Secondary air Wet bulb: 17.7°C

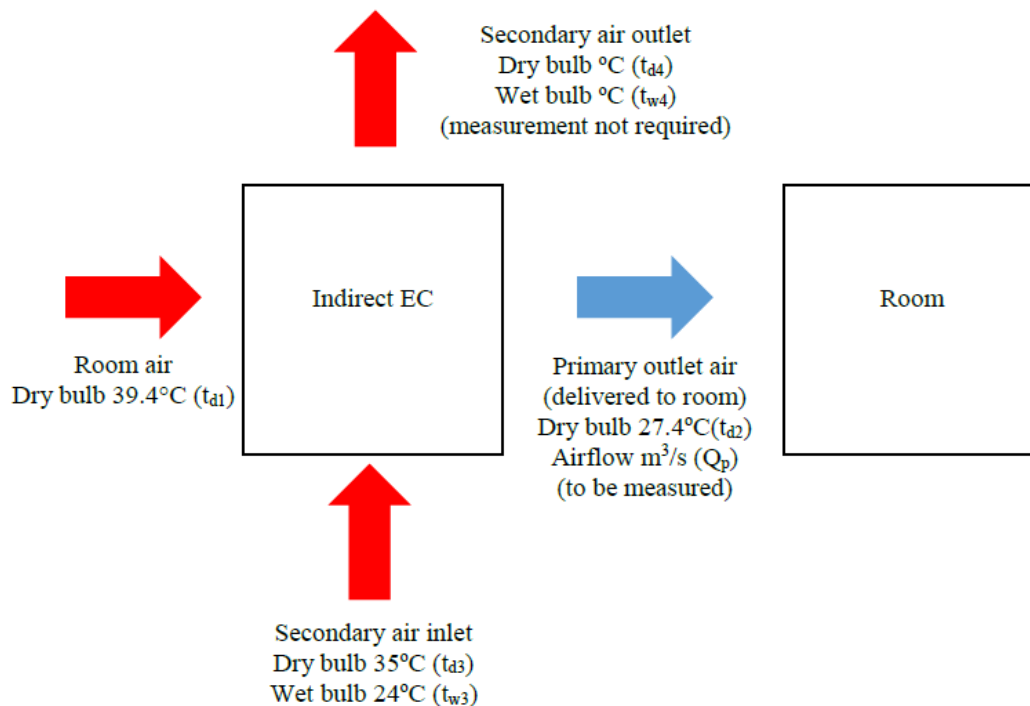


Testing procedure details for Total Cooling Capacity and wet/dry bulb approach effectiveness: Case B

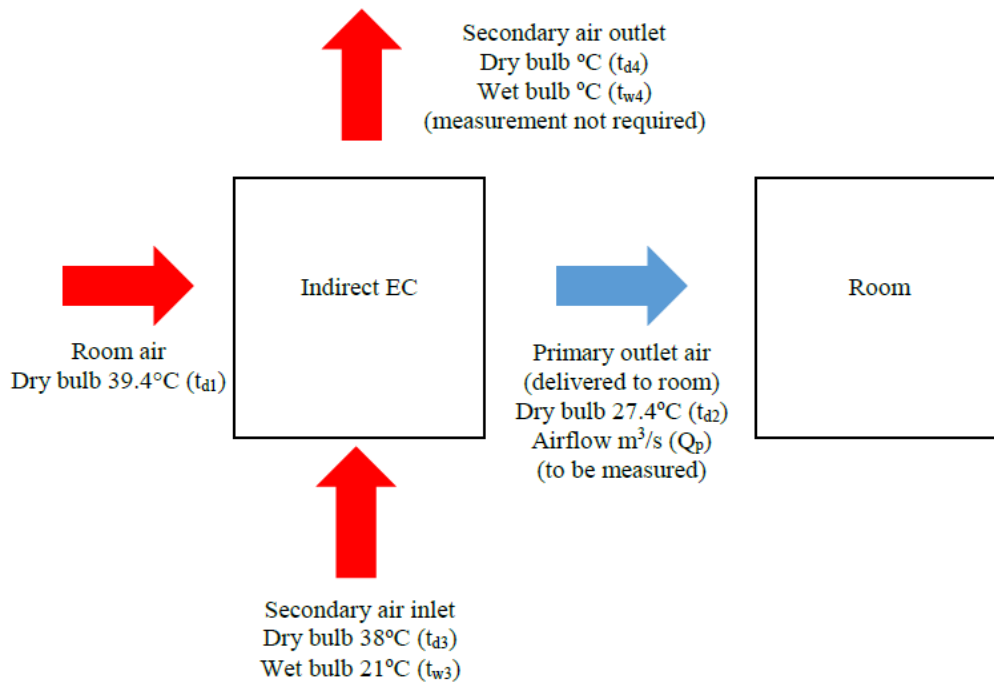
As stated in this rating standard for the case B the primary air inlet is the room air.

- ⇒ Tests shall be performed as per ASHRAE standard ANSI/ASHRAE 143-2015 Method of Test for Rating Indirect Evaporative Coolers.
- ⇒ Wet bulb approach effectiveness calculation as per section III.9
- ⇒ Dry bulb approach effectiveness as per section III.10
- ⇒ Water consumption testing as per ANSI/ASHRAE Standard 133-2015
- ⇒ Total Cooling Capacity calculation as per ANSI/ASHRAE Standard 143-2015, Section 11.5.
- ⇒ Secondary air inlet dry bulb temperature:
 - o Scenario 1: 35°C
 - o Scenario 2: 38°C
 - o Scenario 3: 20°C
 - o Scenario 4: the scope of the test shall be to measure the maximum secondary air inlet dry bulb temperature, for which the room supply air temperature can be guaranteed.
- ⇒ Secondary air inlet wet bulb temperature:
 - o Scenario 1: 24°C
 - o Scenario 2: 21°C
 - o Scenario 3: 15°C
 - o Scenario 4: Not Applicable because dry condition
- ⇒ Primary outlet air dry bulb temperature:
 - o Scenario 1,2,3 & 4: 27.4°C
- ⇒ Room air dry bulb temperature:
 - o Scenario 1 to 4: 39.4°C (i.e. Delta T of 12°C of the primary outlet air dry bulb temperature)

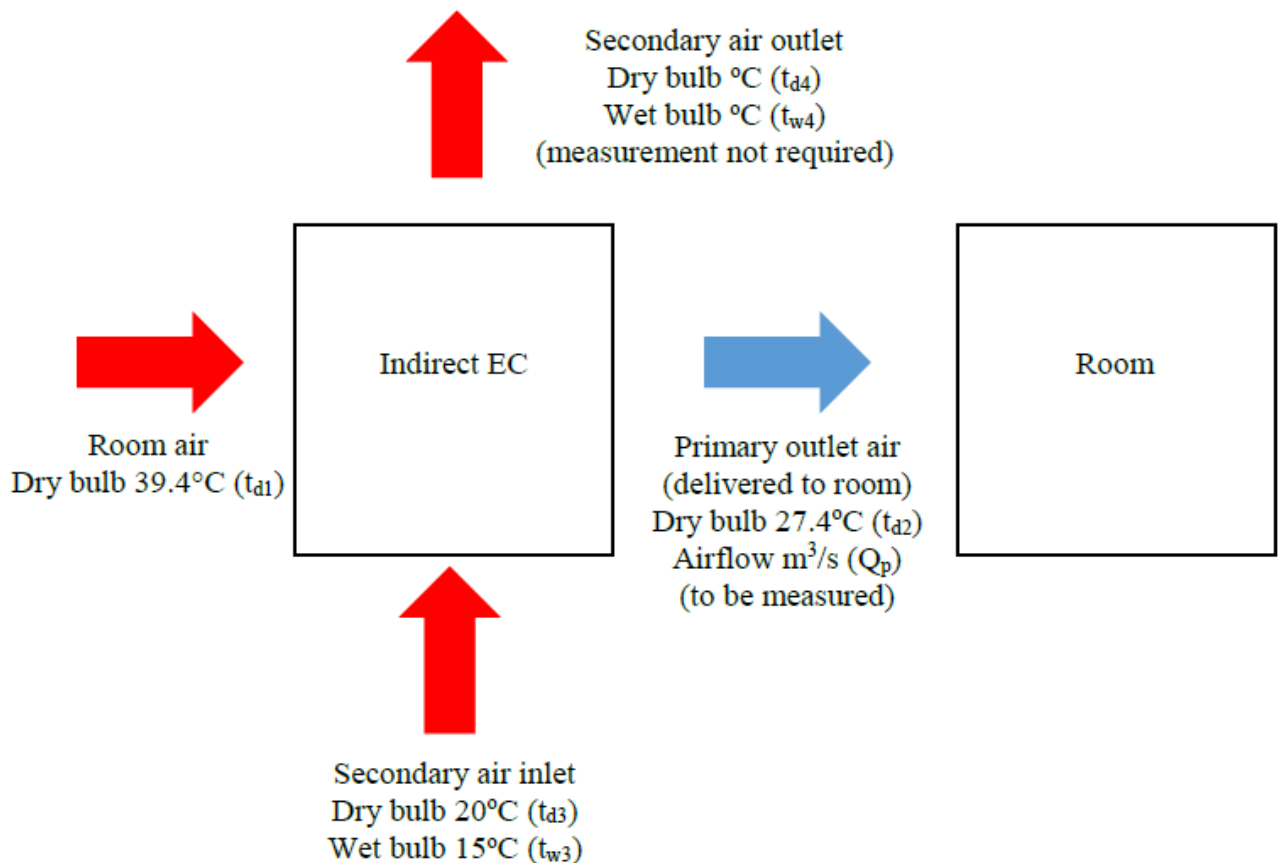
Scenario 1 (Wet):



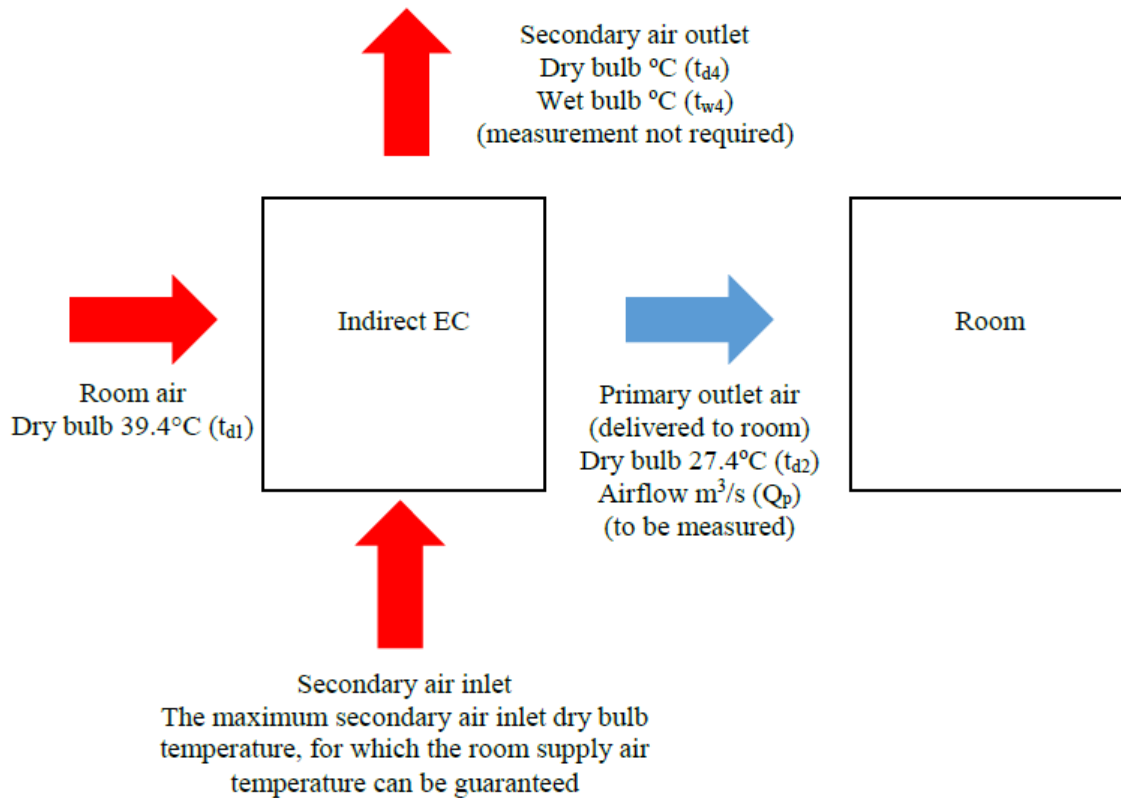
Scenario 2 (Wet):



Scenario 3 (Wet):



Scenario 4 (Dry):



A.2.3. Evaporative Cooling Equipment (ECE)

There are no specific testing standards or methodology which can be used for this sub-programme.

For specific calculation ASHRAE 133-2015 shall be used.

The testing methodology for Evaporative Cooling Equipment is detailed in Appendix A.

Particular Specifications for Testing

The following specifications are applicable for qualification tests and repetition tests.

a. Operating conditions

For a Direct EC application the operating conditions are specified as follows:

- Inlet dry bulb temperature: 38°C
- Inlet wet bulb temperature: 21°C
- Outlet dry bulb temperature: 27.4°C
- Air flow as declared by the manufacturer
- Supply water temperature: not less than 10°C

b. Water quality

The quality of the water supplied to the distribution header must be declared by the manufacturer with the following minimum information:

- Range of Conductivity
- Range of Total Dissolved Solids (TDS) or Total Salt Content (TSC)

- Range of Total Hardness
- Range of PH

c. Water Consumption

Water consumption shall be tested as per the ASHRAE 133-2015 section 6.5.

The measurement shall be made for a period of at least 20 minutes on the unit supply water line.

Water meters shall have an accuracy of $\pm 1\%$ of observed reading.

If there is an intermediate water tank, it will need to be refilled at least 4 times to have a better accuracy on the efficiency.

Any water flushing cycles are excluded from the measurement.

d. Air flow

Air flow shall be measured before the ECE as per the ASHRAE 133 6.3-2015 or in accordance with the ISO 5801-2017.

Air flow can be measured as per the ASHRAE standard 41.2 with flow nozzles or Pitot tubes.

e. Pressure

Pressure shall be measured as per the ASHRAE 133 6.2.

Pressure difference shall be measured as per the ASHRAE 41.2

f. Power Consumption

Power Consumption shall be measured as per the ASHRAE 133-2015 section 6.4.

g. Droplet Separator

The droplet separator used for the sake of the test must be provided by the manufacturer with the Evaporative Cooling Equipment (not applicable for Case C)

The following characteristics must be determined through the tests:

- Cooling Capacity
- Evaporation Efficiency
- Energy Efficiency Ratio
- Wet/dry pressure drop

A.I. General test condition

Tests shall be conducted by respecting the markings and data of the equipment, such as the power supply, etc.

Tests shall be conducted for a direct application, i.e. the AHU or equivalent ventilation device used for the tests shall not comprise a heat exchanger.

A.II. Preparation of the test

A.II.1) Humidification Chamber

The test shall be conducted in the adiabatic humidification section (humidification chamber) of an AHU or an equivalent ventilation device.

A droplet separator (provided by the manufacturer) must be installed in the humidification chamber as shown on figure 1 below. The droplet separator shall be able to stop the non-evaporated drops at the end of the humidification section.

In the case of a wet media tests shall be performed with and without a droplet separator.

In the case of an ultrasonic unit (**Case C**) the test shall be performed without a droplet separator.

The length of the humidification chamber (net available distance for the evaporation of the drops from the nozzles to the drop separator) must be as declared by the manufacturer, if not declared a length of 1.5m must be used.

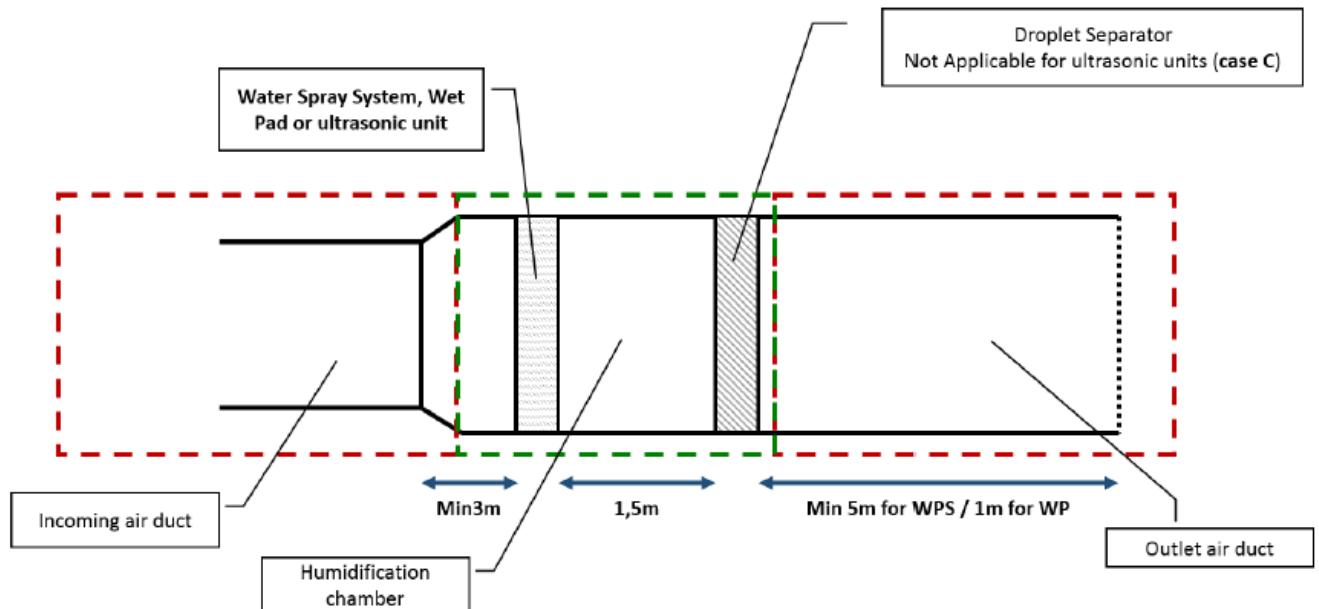


Figure 1: Humidification chamber schematic for ECE test

The bottom of the humidification chamber must be shaped to drain any water which could be collected.

The incoming air duct and the outlet air duct (squared in red in figure 1) shall be provided by the independent laboratory.

In order to ensure a proper mixing of the outlet air the distance after the droplet separator shall be of minimum 5m for **Case A** (Water spray system) and 1m for **Case B** (Wet media).

For **Case A** (Water spray system) and **Case C** (ultrasonic units) the structure of the humidification chamber holding the water spray system (squared in green in figure 1) must be provided by the independent laboratory.

For **Case B** (Wet media) the structure of the humidification chamber holding the wet media (squared in green in figure 1) must be provided by the manufacturer with the wet media.

Air Flow Setting

The air speed in the humidification chamber shall be modulated as per manufacturer specification, to a maximum of 5 m/s.

The air speed shall be measured before the Evaporative Cooling Equipment (wet media or water spray system).

The pressure difference shall be measured by a calibrated flange with differential pressure gauge. The air speed shall be calculated based on the pressure difference calculated. Pressure difference shall be measured as per the ASHRAE 41.2.

Inlet Air Condition (before the nozzles)

Outdoor air shall be drawn and pre-heat up to 38°C dry bulb and 21°C wet bulb before the nozzles (e.g. with electric heaters inside the AHU or equivalent).

The dry bulb temperature and the relative humidity must be measured by probing some points avoiding the turbulence zones inside the AHU or equivalent (e.g. nearby corners and the inner walls).

Outlet Air Conditions

As for Inlet air define in section A.II.3).

The measurement shall start when the outlet temperature is stable.

Additionally, before calculating the humidity ratio W (g/kg), the heat gain of the outlet blower and of any other apparatus that generates heat between the drop separator and probes must be deducted.

Water Supply

The water shall be supplied via piston pumps or non-volumetric pumps (e.g. vane pumps)
In case of piston pumps or non-volumetric pump the water supplied to the ECE shall be measured from a numeric flow meter.
Water meters shall have an accuracy of $\pm 1\%$.

Power Consumption

Power consumption shall be measured as per the ASHRAE 133-2015 section 6.4.

Pressure Measurement

Pressure shall be measured as per the ASHRAE 133-2015 section 6.2.

Drained Water

As stated in section A.II.1) the drained water must be collected in a drain pan. This collected water must be measured (e.g. by a scale).

Rating Methodology

Step 1: Install the ECE according to the IOM (Installation and Operational Manual) provided by the manufacturer.

Step 2: Start the AHU or equivalent ventilation device and record the various inlet and outlet dry bulb temperature and relative humidity readings and the supplied water (measured by the digital flow meter).

Note: the tank collecting the drained water must be weighted by a scale any time before the tank overflows.

Step 3: A whole rating must last at least 20 minutes.

Step 4: Once the test is finished, check the parts of the recording data where the representative value of the inlet dry bulb temperature lies within a band of $\pm 0.3^{\circ}\text{C}$ and the representative value of the inlet relative humidity lies within a band of $\pm 2\%\text{rh}$. Any such band is considered at steady state for the inlet.

Step 5: Once the corresponding bands of the inlet are identified, calculate:

- Inlet air: the arithmetic means of the inlet representative dry bulb temperature and relative humidity across each band, hence the representative humidity ratio W (g/kg) from them.
- Outlet air: the arithmetic means of the outlet representative dry bulb temperature and relative humidity across each band by deducting the heat gains of the outlet blower and of any other apparatus that generates heat between the drop separator and probes from the representative value of dry bulb temperature, hence the representative relative humidity is corrected and then calculate the humidity ratio W (g/kg) from the corrected representative dry bulb temperature and relative humidity.
- The total amount of supplied water
- The total amount of drained water

- The power input (kW)

Step 6: The test shall be repeated at least 3 times at different air speeds:

- Mean value of air speed declared by the manufacturer
- Minimum air speed value declared by the manufacturer
- Maximum air speed value declared by the manufacturer

The mean value of the tests shall be determined and used for the calculation of the characteristics below.

For case B (Wet media) only, the tests shall be repeated with and without droplet separator (i.e. 6 tests overall).

The cooling capacity (kW), the evaporation efficiency and the EER shall then be calculated as defined under section III.9, III.10 and III.11

A.3. Rating Requirements

Test -Check: Eurovent Certita Certification shall conduct a “test-check”, i.e. the performances will be recalculated at the test operating conditions using the selection software.

A performance item fails when the difference between the recalculated value and the test results is not in accordance with the acceptance criteria (see below A.5.).

A test fails when one or more performance items fail.

Air density: Standard air density is set at 1.20 kg/m³. It is mandatory to display the certified performances items under the standard conditions in the software outputs. It is allowed to display any other values if accompanied by the underlying air density.

A.4. Certified Performance Items

Note: The list of certified performance items can be found in I.2 of this TCR document.

A.5. Acceptance Criteria

When tested in the laboratory the obtained performance data shall be in accordance with below acceptance criteria:

A.5.1. DIRECT EVAPORATIVE COOLING

	Accepted Relative deviation
Cooling Capacity [kW]	≥ -5%
Air Flow [m ³ /hr]	≥ -5%
Saturation Efficiency [%]	≥ -5%
Water Consumption [l/hr]	≤ 5%
EER	≥ -5%

The relative deviation (in %) between the measured value X_{meas} and the recalculated value X_{recal} is calculated as follows:

$$\Delta_{rel} = (X_{meas} - X_{recal}) / X_{recal}$$

If any of individual points of measurement shows a deviation not in accordance with the acceptance criteria, the failure shall be declared, and the failure procedure applied.

A.5.2. INDIRECT EVAPORATIVE COOLING

Case A:

	Accepted Relative deviation
Total Cooling Capacity [kW]	≥ -5%
Room Cooling Capacity [kW]	≥ -5%
Air Flow [m³/hr]	≥ -5%
Cooling Effectiveness [%]	≥ -5%
Water Consumption [l/hr]	≤ 5%
EER	≥ -5%

Case B:

	Accepted Relative deviation
Total Capacity [kW]	≥ -5%
Air Flow [m³/hr]	≥ -5%
Wet bulb approach effectiveness [%]	≥ -5%
Dry bulb approach effectiveness [%]	≥ -5%
Water Consumption [l/hr]	≤ 5%
EER	≥ -5%

The relative deviation (in %) between the measured value X_{meas} and the recalculated value X_{recal} is calculated as follows:

$$\Delta_{rel} = (X_{meas} - X_{recal}) / X_{recal}$$

If any of individual points of measurement shows a deviation not in accordance with the acceptance criteria, the failure shall be declared, and the failure procedure applied.

A.5.3. EVAPORATING COOLING EQUIPMENT

	Accepted Relative deviation	Accepted Absolute deviation
Cooling Capacity [kW]	≥ -5%	-
Evaporation Efficiency [%]	≥ -5%	-
EER	≥ -5%	-
Water Consumption [l/h]	≤ 5%	-
Wet Pressure drop [Pa]	-	≤10 Pa
Dry Pressure drop [Pa]	-	≤10 Pa

The relative deviation (in %) between the measured value X_{meas} and the recalculated value X_{recal} is calculated as follows:

$$\Delta_{rel} = (X_{meas} - X_{recal}) / X_{recal}$$

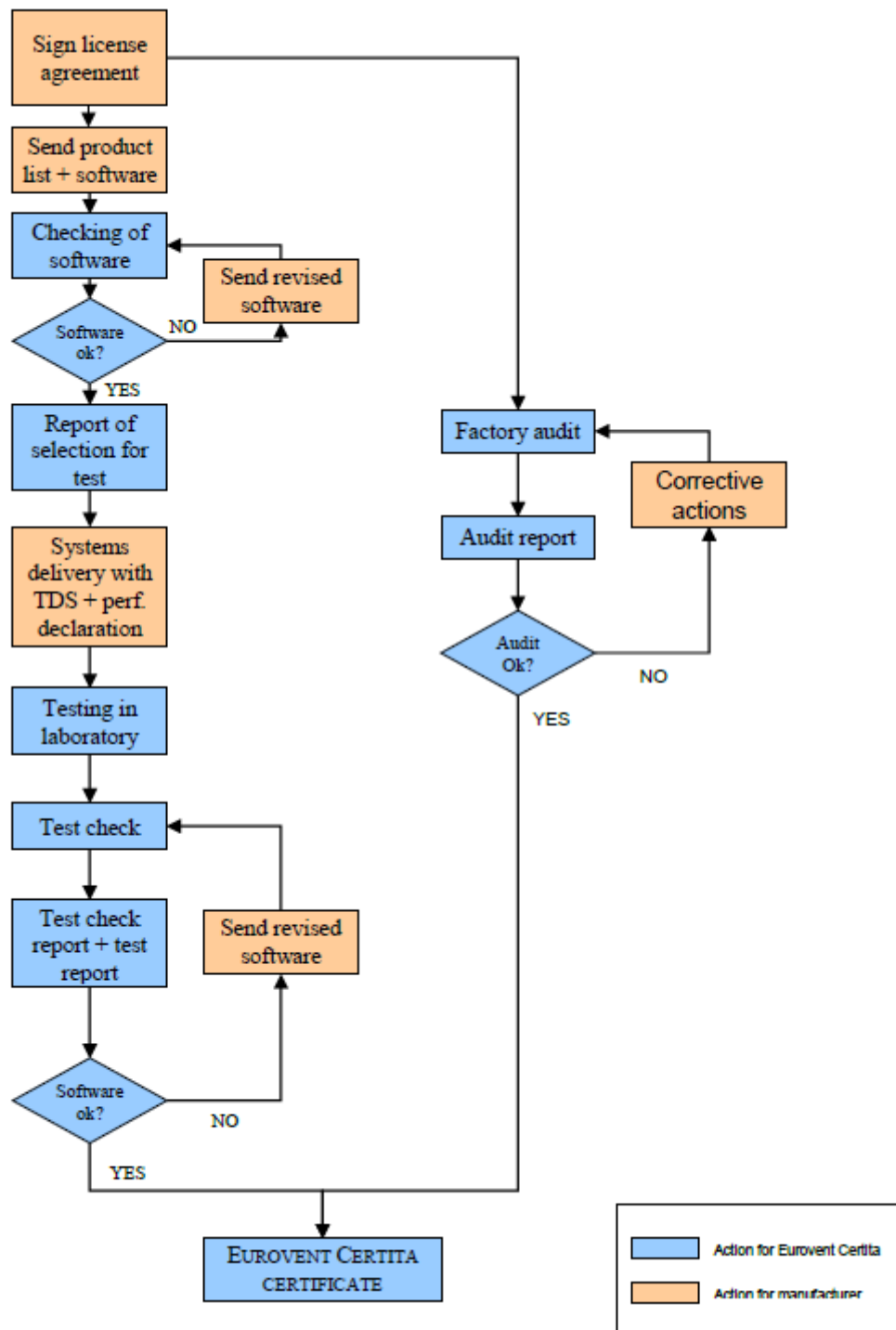
The absolute deviation between the measured value X_{meas} and the recalculated value X_{recal} is calculated as follows:

$$\Delta_{abs} = X_{meas} - X_{recal}$$

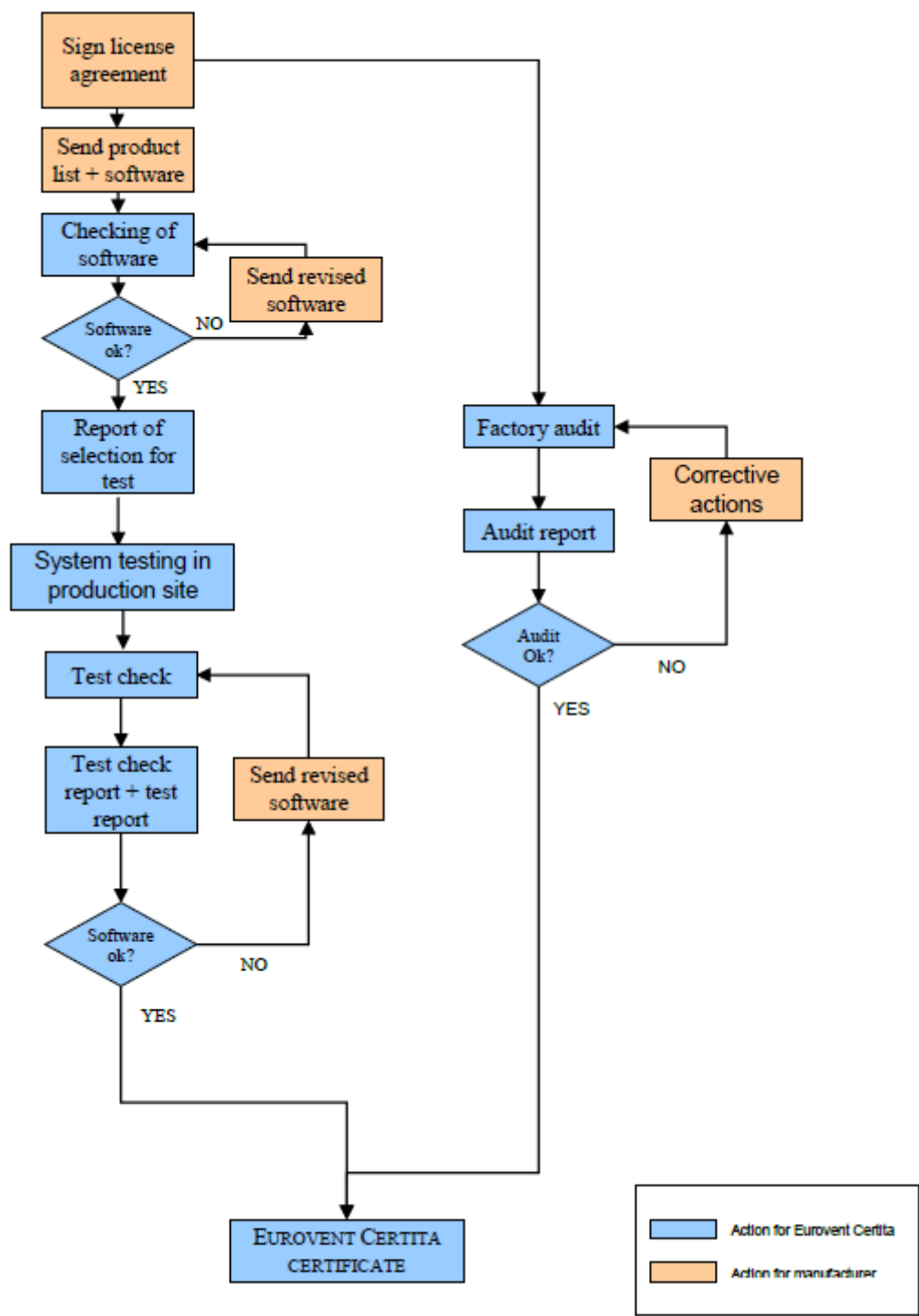
If any individual points of the measurement are not in accordance with the acceptance criteria, the failure shall be declared, and the failure procedure applied.

APPENDIX B. CERTIFICATION PROCESS AND SCHEDULE

B.I. Scenario 1: Qualification Procedure when the tests are performed in the Independent Laboratory.



B.II. Scenario 2: Qualification Procedure when the tests are performed in the Participant Laboratory.



B.III. Repetition procedure

Table 1 : Certification Schedule for the Repetition Procedure

Certification step	Deadline
Eurovent Certita Certification asks for update of declaration list and software from the participant	30/11/n-1
The participant sends the up-dated products declaration list and software	31/12/n-1
Eurovent Certita Certification checks the software compliance to requirements. When the software does not meet the certification requirements the manufacturer has to correct it and send a new version. When the software meets the requirements the selection list is sent to the participant for performance declaration	31/01/n
The participant returns the completed performance declaration file and the software printouts for selected systems.	15/02/n
Product delivery (not applicable for part-lab) + Technical data sheet transmission + payment are completed by the participant	31/03/n
All regular tests, and penalty tests when applicable, are completed and test reports sent by the independent laboratory or participant laboratory to Eurovent Certita Certification	31/05/n
The auditor audits the participant's facility and checks the software consistency.	15/06/n
The participant sends the audit non-conformity corrective actions plan when applicable	Deadline set up by auditor
Eurovent Certita Certification performs a "test-check" to verify that the software is in accordance with the test results. Eurovent Certita Certification forwards the test reports together with the "test-check" results to the participant.	30/06/n
The participant can ask for second tests before	31/07/n
The auditor evaluates the corrective actions plan relevance	31/07/n
Product delivery + Technical data sheet transmission + payment are completed by the participant for second tests (when applicable).	15/09/n
Re-rated software is sent to Eurovent Certita Certification (when applicable).	15/09/n
Eurovent Certita Certification sends the diploma if all requirements are fulfilled.	31/10/n
Diploma validity	30/09/n+1
Second tests are completed and test reports sent by the laboratory to ECC (when applicable).	15/11/n
Eurovent Certita Certification verifies the software compliance with the second test results ("test-recheck") and forwards the second test report together with the "test-recheck" results to the participant (when applicable).	15/12/n
Final corrections of the software in case of second failure	31/12/n

APPENDIX C. FORMS

C.I. Form EC-1 : Declaration File

The form EC-1 (declaration file) to be filled in shall be sent by Eurovent Certita Certification to:

- applicants who have signed the license agreement,
- participants on an annual basis before the deadline specified in the Certification schedule.

A template will be available for information and upon request.

C.II. Form EC-2 : Technical Datasheet (TDS)

The form EC-2 (Technical Data Sheet) to be filled in shall be sent by Eurovent Certita Certification to applicants/participants who have returned the form EC-1 duly completed.

A template will be available for information and upon request.

C.III. Form EC-3 : Software Update Record Sheet

COMPANY LOGO

XXXX Software name
Software update record sheet

Prepared by:

Software version	Revision date	Brief description of the update

C.IV. Form EC-4 : Test report result sheet

The form EC-4 (Test report result sheet) shall be sent by Eurovent Certita Certification to applicants/participants together with the test report.

A template will be available for information and upon request.

C.V. Form EC-5 : Test Rerate Form

CERTIFICATION PROGRAMME FOR EVAPORATIVE COOLING
<u>RESPONSE FORM AFTER FAILURE ON TESTED UNIT</u>
This response form shall be sent back by e-mail to Eurovent Certita Certification <u>within four (4) working weeks maximum.</u> Without news from you within this delay, revision of selection software with rerated data will be required.

Date : _____ Name : _____ Signature : _____

According to the document OM-24-2018, you are asked to select one of the following alternatives:

- ☐ Ask for a second test, i.e. on another copy of the same unit.
- ☐ Rerate the software in line with test results



Performances on line
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