

Methods for

Testing and rating fan coil units, unit heaters and unit coolers —

**Part 2: Thermal and volumetric
performance for cooling duties:
without additional ducting**

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- Department of the Environment, Building Research Establishment
- Greater London Council
- Oil Companies Materials Associations
- Unit Heater Manufacturers' Association

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Foreword

Part 2 of this British Standard has been prepared under the authority of the Refrigeration, Heating and Air Conditioning Industry Standards Committee in response to requests from industry.

The committee acknowledge their debt to the Heating and Ventilating Research Association for the Association's work in formulating the psychrometric method of testing which appears in this standard.

Part 1 of this standard covers units for heating duties, without additional ducting, and it is intended that further Parts will deal with units fitted with ducting, and acoustic aspects of testing.

Two different methods of thermal test are given in this Part, a gravimetric method and a psychrometric method. If variations in condensate flow rate are within the requirements specified (see clause 8) it is considered that the gravimetric method provides the data required. If this proviso is not met then the psychrometric test method is used.

The unit cooler psychrometric tests given in this Part are very similar to those given for unit heaters in Part 1, with the exception of the latent cooling tests. Two approaches to the latent loading problem are presented, one a fixed point test which will yield accurate comparative data and a second test series for general rating purposes. The latter is based on the bypass factor method (see for example: Carrier, Cherne, Grant and Rovers. Modern air conditioning, heating and ventilating).

Where reference is made to British Standards for which no metric version is available then the appropriate British Standard in imperial units should be used in conjunction with BS 350 "*Conversion factors and tables*"; attention is also drawn to BS 3763 "*The International System of units (SI)*" and PD 5686 "*The use of SI units*".

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

Part 2 of this British Standard deals with methods of carrying out thermal and volumetric tests of unit coolers without additional ducting. The unit coolers operate with or without condensation on the coils. The unit coolers are of the type used for cooling and dehumidifying purposes under frost-free conditions of operation. The cooling medium used is water or other heat transfer fluid (excluding volatile refrigerants). The range of approximate air volume flow rates is between $25 \times 10^{-3} \text{ m}^3/\text{s}$ and $5 \text{ m}^3/\text{s}$.

The tests are to be carried out on units in an essentially clean condition.

This standard applies to units having operating temperatures of primary fluid within the range 0°C to 27°C .

The primary fluids used are; water, brine, glycol, heat transfer fluid.

The minimum temperature differential (see 14.2) of the primary fluid under test is 3°C .

There is no restriction on the mounting of these units for testing provided that they are tested whilst mounted in a way representative of their intended use.

The standard specifies performance characteristics that are to be obtained from a unit. Although the requirements of the methods for individual tests may be followed to determine the performance of a unit at one specified set of conditions, where the performance at conditions other than those of the actual test are to be stated the full schedule of tests specified in the standard have to be made.

2 References

The titles of the British Standards referred to in this standard are listed on the inside back cover.

3 Definitions

For the purposes of this Part of this British Standard the following definitions apply.

3.1

unit cooler or fan coil unit

a fluid-to-air heat exchanger apparatus through which air is passed by an electrically powered fan. This unit may or may not contain filters

3.2

reference air conditions (cooling)

temperature 20°C , absolute pressure 1.013 bar^1 , relative humidity 43 %, and density 1.2 kg/m^3

¹⁾ $1 \text{ bar} = 10^5 \text{ N/m}^2 = 100 \text{ kPa}$.

3.3

room discharge air flow of a unit

rate of flow of air from the room-side outlet of the unit

3.4

room intake air flow of a unit

rate of flow of air into the unit from the conditioned space

3.5

local recirculation

flow of conditioned air directly from the room-side outlet to the room-side inlet of the unit

3.6

bypass factor (B)

it is assumed, for calculation purposes, that only a portion of the total air passing over the heat-exchanger surface (the coil) contacts the surface; the remaining air is assumed to bypass the surface and to leave unchanged from its entering condition

$$\begin{aligned} \text{The bypass factor } B &= (t_{a0} - t_B)/(t_a - t_B) \\ &= (h_{a0} - h_B)/(h_{ai} - h_B) \\ &= \exp \{-1/(R_a C_{p_a} m_a)\} \end{aligned}$$

where the symbols are as given in clause 4.

3.7

net total room cooling effect (of a unit)

total available capacity of the unit for removing sensible and latent heat from the space to be conditioned

3.8

room dehumidifying effect

available capacity of the unit for removing moisture from the space to be conditioned

3.9

net room sensible cooling effect

available capacity of the unit for removing sensible heat from the space to be conditioned

3.10

total heat transferred

the total heat transferred (Q_T) is assumed to be related to the thermal resistances of the unit, thus:

$$Q_T = \Delta t_m / (SR_a + R_{wm})$$

where the symbols are as given in clause 4

NOTE By rearranging this equation it can be seen that for a given air and water flow rate, a graph of $\Delta t_m/Q_T$ versus S will yield a straight line of slope R_a and will intercept R_{wm} . Once R_a is known, it is possible to calculate the bypass factor and consequently to obtain the coil performance for various inlet conditions.

3.11**rated voltage(s)**

voltage(s) shown on the nameplate of the unit

3.12**rated frequency (s)**

frequency(s) shown on the nameplate of the unit

4 Nomenclature

For the purposes of this Part of this British Standard the following nomenclature applies.

Symbol	Quantity	Unit	Symbol	Quantity	Unit
A	Free area of unit's cooled air outlet	m^3	Q_T	Total heat transferred (primary fluid side)	kW
B	Bypass factor	—	Q_{Ta}	Total heat transferred (air side)	kW
c_{pa}	Specific heat capacity of air	$\text{kJ}/(\text{kg K})$	Q_{TR}	Total heat transferred with no recirculation	kW
c_p	Specific heat capacity of primary fluid	$\text{kJ}/(\text{kg K})$	q_f	Primary fluid volume flow rate	m^3/s
c_{pw}	Specific heat capacity of water	$\text{kJ}/(\text{kg K})$	q_{fr}	Primary fluid volume flow rate at reference temperature (8°C)	m^3/s
E	Power dissipated in the room by the unit	kW	q_m	Air volume flow rate at measured conditions	m^3/s
h_{ai}	Inlet air enthalpy	kJ/kg (dry air)	q_r	Air volume flow rate at reference conditions	m^3/s
h_{ao}	Outlet air enthalpy	kJ/kg (dry air)	R	Overall appliance thermal resistance	$^\circ\text{C}/\text{kW}$
h_B	Enthalpy of saturated air at temperature t_B	kJ/kg (dry air)	R_a	Air side appliance thermal resistance	$^\circ\text{C}/\text{kW}$
Δh	Difference of air enthalpy across coil	kJ/kg (dry air)	R_m	Mean overall appliance thermal resistance	$^\circ\text{C}/\text{kW}$
K_w	Temperature correction factor	—	R_{wm}	Primary fluid plus coil metal appliance thermal resistance	$^\circ\text{C}/\text{kW}$
L	Latent heat of evaporation	kJ/kg	ρ_a	Air density at measured conditions	kg/m^3
M	Total mass flow of primary fluid	kg	ρ_F	Air density at the temperature and absolute pressure of the flow meter	kg/m^3
M_r	Net weight of condensate formed during test	kg	ρ_f	Primary fluid density at mean liquid temperature	kg/m^3
m_a	Air mass flow rate	kg/s	ρ_{fr}	Primary fluid density at reference temperature (98°C)	kg/m^3
m_r	Condensate mass flow rate	kg/s	ρ_r	Air density at reference condition	kg/m^3
m_w	Primary fluid mass flow rate	kg/s	S	Ratio of sensible heat to total heat	—
Δp_m	Primary fluid pressure drop	Pa	T	Duration of test	s
Δp_t	Primary fluid pressure drop at reference temperature (8°C)	Pa	t_a	Unit inlet air temperature (dry bulb)	$^\circ\text{C}$
Q	Net total room cooling effect	kW	t_{ao}	Unit outlet air temperature (dry bulb)	$^\circ\text{C}$
Q, Q_2	Total heat transferred when connected to air flow chamber	kW	t_B	Apparatus dew point temperature	$^\circ\text{C}$
Q_D	Room dehumidifying effect	kW	t_i	Inlet primary fluid temperature	$^\circ\text{C}$
Q_S	Net room sensible cooling effect	kW	t_o	Outlet primary fluid temperature	$^\circ\text{C}$

Symbol	Quantity	Unit
t_R	Room air temperature (dry bulb)	°C
t'_R	Room air temperature (wet bulb)	°C
t_r	Condensate temperature	°C
Δt_m	Logarithmic mean temperature difference $\frac{[(t_a - t_o) - (t_{ao} - t_i)]/1_n}{[(t_a - t_o)/(t_{ao} - t_i)]}$	°C
V_F	Measured air volume flow rate	m ³ /s
V_r	Air volume flow rate at reference air density (1.2 kg/m ³)	m ³ /s
V_m	Mean air volume flow rate	m ³ /s

5 Objects of the tests

The object of the tests is to establish the performance of the unit over a specified range of primary fluid conditions and room temperatures. The test procedures set out in this standard are for the determination of.

- the net total room cooling effect;
- the room dehumidifying effect,
- the net room sensible cooling effect;
- the primary fluid mass flow rate and pressure drop;
- the nominal air flow rate,
- freedom from sweating on the unit enclosure or casework;
- adequate condensate disposal

6 Limits of accuracy of the test method

The test method, including the instrumentation, is suitable for obtaining results within the following limits of accuracy:

thermal duty:	± 5 % (psychrometric) ± 8 % (gravimetric)
primary fluid flow rate:	± 3 %
air volume flow rate:	± 10 %

7 Testing conditions

7.1 Primary fluid. The unit shall be tested at a minimum of three primary fluid inlet temperatures. The selected temperatures shall cover the range of duty over which the unit is to be rated.

7.2 Room air conditions. The room air temperature (dry bulb) range shall be chosen within the limits 5 °C to 30 °C, depending on the intended use of the unit.

The room air (wet bulb) temperatures shall be then chosen to cover the related range corresponding to the intended use of the unit.

7.3 Primary fluid flow rate. For duties to be quoted over a range of primary fluid flow rates, tests shall be carried out at a minimum of three primary fluid flow rates spaced approximately equally to cover the range over which the unit is to be rated.

7.4 Electrical supply conditions. The tests shall be carried out at the rated voltage and frequency of the unit.

7.5 Nominal rating. In the absence of a specified set of conditions, where a single nominal rating figure is required, the total cooling capacity under the following conditions shall be used:

room air temperature:	21 °C dry bulb 15 °C wet bulb
primary fluid inlet temperature:	5 °C
primary fluid outlet temperature:	10 °C

7.6 Complete description of unit performance. Where a complete description of the unit's performance over a range of conditions is required, it will be necessary to vary the primary fluid temperature, the room air conditions and the primary fluid flow rate so that a family of the required performance curves may be made.

The quantities shown on the four curves will be Q_s , Q_D plotted against, respectively, t'_R , t_R , t_i and m_w .

8 Steady state conditions

Tests shall be carried out under steady state conditions and these are considered to be established if, during 60 min, the measurements do not vary by more than the amounts specified in Table 1.

Table 1 — Steady state conditions

Quantity	Permitted variation from 60 min mean of individual 10 min readings
Room air temperature (as defined in 11.1)	0.5 °C dry bulb; 0.3 °C wet bulb
Entering air temperature (as defined in 11.2)	0.5 °C dry bulb; 0.3 °C wet bulb
Entering liquid temperature	0.5 °C
Primary fluid flow rate	2 %
Supply voltage	± 2.5 % of rated voltage

The condensate removal rate shall not vary by more than ± 3 % from the mean rate during 60 min. If the variation exceeds ± 3 %, the tests shall be continued either until a representative average rate of moisture extraction can be assessed or for a total period of 3 h, whichever first occurs. If, after 3 h, a representative rate of moisture extraction is not evident, the methods described in clauses 18, 19 and 20 shall be used.

9 Instrumentation

9.1 Primary fluid

9.1.1 Temperature. The measurement of temperature of the primary fluid at entry and exit shall comply with the appropriate recommendations of BS 1041. If liquid-in-glass thermometers are used, they shall be graduated at intervals of 0.1 °C and shall comply with the requirements of BS 593.

Thermometers, thermocouples and resistance thermometers shall be calibrated against a NPL class A thermometer for partial immersion and shall be used in pockets similar to those shown in Figure 1, situated at the entry and outlet of the unit between 100 mm and 200 mm from the unit connections.

For temperature differences below 5 °C it will be necessary to take special care and the differential thermocouple system shown in Figure 2 is recommended, together with a separate measurement of inlet temperature.

9.1.2 Pressure. The pressure drop across the unit shall be measured with an inverted U-tube manometer similar to that shown in Figure 3. The manometer shall be vertical and calibrated in intervals not exceeding 2 % of the measured drop.

9.1.3 Mass flow. Mass flow shall be preferably measured by direct weighing. Weighing machines shall have an error not greater than 0.2 % over the range weighings used in the test. Collecting vessels shall weigh not more than 50 % of their normal contents. The net weight of each charge shall be recorded by weighing the vessel both after emptying the previous charge and after filling.

Mass flow may also be obtained by means of an orifice plate installed in accordance with BS 1042-1.

9.2 Air

9.2.1 Temperature. Measurements of air temperature shall be made with mercury-in-glass thermometers, thermocouples or resistance thermometers calibrated against an NPL class A thermometer for total immersion. Thermometers shall be graduated at intervals not greater than 0.1 °C.

Temperature measuring instruments shall be shielded against radiation; suitable shields are shown in Figure 4. Inlet air temperatures shall be measured by thermocouples or resistance thermometers capable of being shielded as shown in Figure 4 (b).

The entry and exit air wet and dry bulb measurements shall be by means of the system given in Appendix D of BS 4194:1967. The measurement system shall be connected to sampling tubes similar to those shown in Figure 5 (a) and Figure 5 (b).

9.2.2 Flow rate. Flow rate shall be measured by means of an orifice plate installed in a chamber as shown in Figure 6 and generally in accordance with the requirements of BS 1042-1. Where the requirements of BS 1042-1 cannot be followed the flow meter may be calibrated in situ. It is suggested that the orifice plate at the junction of a void and duct be employed, as described in clause 49 of BS 1042-1:1964.

9.2.3 Pressure

9.2.3.1 The minimum differential pressure readings for air flow measurement shall be 25 Pa for inclined U-tube manometers and micromanometers, and 500 Pa for vertical U-tube manometers.

9.2.3.2 Manometers shall be calibrated against an accepted standard.

9.2.3.3 It shall be possible to read the manometers to 0.5 Pa over a pressure differential of 25 Pa to 50 Pa and to 1 % at higher differential pressures.

9.3 Condensate

9.3.1 Temperature. Condensate temperature shall be measured in the well of a suitably insulated trap at the unit outlet using instrumentation as specified in 9.1.1. The trap may be the collecting vessel specified in 9.3.2.

9.3.2 Mass flow. Mass flow shall be measured by direct weighing. Weighing machines shall have an error of less than $\pm 1\%$ of the value measured. Collecting vessels shall weigh not more than 50 % of the mass of the contents weighed.

10 Test equipment

10.1 Chilled primary fluid. There shall be available chilled fluid supply and measurement equipment as detailed below and arranged generally as shown in Figure 7.

10.1.1 There shall be available a means for providing a continuous supply of fluid.

10.1.2 There shall be a means for controlling the chilled fluid to any desired temperature which may be required for the tests.

10.1.3 There shall be available a means for providing a constant flow of fluid, such as a constant head tank or a circulation pump.

10.1.4 There shall be a means of controlling the chilled fluid to any desired flow rate which may be required for the test.

10.1.5 The pipework shall be arranged to give an unobstructed straight run at entry to and exit from the appliance, the pipe diameter being equal to that demanded by the unit connections and of length at least equal to five pipe diameters.

10.1.6 Hydraulic resistance side wall tapplings shall be adjacent to the connection to the appliance. The tapplings shall be as shown in Figure 8 and connected to form a piezometric ring.

10.1.7 The lengths of pipe between the temperature measurement positions, the unit connections and the unit casing shall be insulated with at least 40 mm thickness of insulating material having a thermal conductivity not exceeding 0.06 W/(m K).

10.1.8 When mass flow measurement is by weighing, care shall be taken to minimize condensation on and evaporation from vessels awaiting weighing.

10.2 Air flow rate apparatus. There shall be a means for continuously measuring the air volume throughput rate of the unit, under conditions approximating to the normal use of the unit, as detailed below and arranged generally as shown in Figure 6.

10.2.1 The unit shall be connected to a chamber as shown in Figure 6.

10.2.2 The chamber volume shall be such that the number of air changes, with the unit set for maximum flow, is less than 1.7 per second. The cross-sectional area of the chamber shall be such that the mean chamber velocity is no greater than 40 % of the mean discharge velocity from the unit outlet.

10.2.3 The chamber shall be connected to a flow meter and auxiliary fan as shown in Figure 6.

10.2.4 There shall be a means of controlling the auxiliary fan to give any desired air flow rate which may be required for the test.

10.2.5 For the psychrometric test method, the air flow rate apparatus shall be extended, as shown in Figure 9, to include mixers and temperature samples similar to those shown in Figure 5 (a). The whole of the chamber shall be constructed from a non-absorbent material and insulated with at least 50 mm thickness of insulating material having a thermal conductivity not exceeding 0.06 W/(m K).

11 Air temperature measurements

The selection of a suitable fan coil unit or unit cooler is very often based upon its output at some specified values of room temperatures. The room temperatures are not necessarily equal to the unit inlet temperatures. They will not be so if the design of the unit allows a proportion of the air to circulate from outlet to inlet.

11.1 Room air temperature

11.1.1 The room air temperature shall be measured at the stations indicated in Figure 10. If at least 75 % of all the measured temperatures are within 1 °C of the lowest then the mean of the sample within this limit shall be taken as the mean room temperature (t_R). If more than 25 % of the temperatures recorded are greater than 1 °C above the lowest, then the length of the temperature traverse lines shall be doubled, with a corresponding increase in the number of measuring stations. Provided that at least 50 % of the measured temperatures are within 1 °C of the lowest measured temperature the mean of the sample within this limit shall be taken as the mean room temperature (see Table 1).

11.1.2 If the conditions stated in 11.1.1 cannot be met, the size of the space in which the test is being carried out shall be altered until satisfactory conditions are achieved.

11.2 Unit air inlet temperature. Where the mean unit air inlet temperature differs significantly from the mean room temperature, and is required as part of the performance data, then it shall be measured as specified in 11.2.1 to 11.2.4.

11.2.1 The unit inlet temperature (t_a) shall be measured 10 mm in front of the inlet grille (s) by means of shielded point measuring instruments (see Figure 4).

11.2.2 Measuring stations shall be evenly distributed about the inlet(s) as shown in Figure 11. At least four measuring stations per inlet shall be employed and an extra measuring station shall be introduced for every degree Celsius deviation of individual readings from the mean temperature.

For example, if the measured temperatures are: 19.2, 20, 20.6, 18.5 °C, the mean of these is 19.6 °C, and two extra stations will be required.

11.2.3 The extra temperature measuring stations shall be located as shown in Figure 11.

11.2.4 For the psychrometric test method, the inlet wet and dry bulb temperatures shall be measured via an inlet air sampling tube, similar to that shown in Figure 5, located at a point 200 mm in front of the unit air inlet, as indicated in Figure 5.

12 Primary fluid measurements

12.1 The primary fluid temperatures shall be selected in conformity with 7.1.

12.2 Before starting a test the unit and all supply piping shall be thoroughly vented by means of manual or automatic air vents.

12.3 The test shall be started only after a state of equilibrium has been reached. Such a state of equilibrium may be considered to exist when the conditions of clause 8 are satisfied.

12.4 Each test shall be continued until three consecutive sets of readings, each taken over a period of 15 min, give rated outputs agreeing within $\pm 2\%$.

12.5 During any test the variation in primary fluid flow rate shall not exceed 2 % and the air temperature (mean inlet and room) shall not differ by more than ± 1 °C from the mean temperature recorded during the equilibrium period.

12.6 The following measurements shall be taken in the manner specified.

- a) Primary fluid flow rate shall be measured as specified in 9.1.3.
- b) Primary fluid temperatures shall be read at the beginning and end of the test and at intervals of 5 min. The extreme readings of each instrument shall not differ by more than 0.5 °C. The range of temperature difference readings obtained during the test shall not exceed 0.25 °C. The average of the inlet temperatures and the average of the outlet temperatures over the appropriate period shall be used for calculation of the rating.

- c) The pressure drop across the unit under test shall be read at the beginning and end of the test.

13 Test facility

13.1 A room shall be available in which air conditions can be controlled to provide any values which are required for the tests. The room shall be such as to permit the unit under test to be mounted and operated so as to represent the intended manner of use for the particular unit. The room shall be such as to permit the operation of the instruments and of the other detailed requirements given below.

13.2 The unit shall be tested with a clear space in the direction of discharge not less than $5\sqrt{A}$ (m), where A (m²) is the free area of the unit's cooled air outlet.

13.3 Units designed for mounting on or standing against a wall shall be so installed for test. This wall shall extend to a minimum of 1.5 m on either side of the unit and to a height of 2.5 m or to the unit height, whichever is the greater.

13.4 Freely suspended units shall be tested with a minimum of 2 m clear space around them and the requisite space in the direction of discharge (see 13.2).

13.5 If a unit is designed for use in a specific situation then the test facility shall reflect this situation.

13.6 Insulating material with a thermal conductivity not less than 1 W/(m K) and of 10 mm minimum thickness shall be used between the unit and any adjacent surfaces.

13.7 The test shall take place in a space where vertical and horizontal temperature gradients do not exceed 0.5 °C/m when the unit is not operating.

13.8 Any air supply outlet, or inlet, used for stabilizing the test environment shall have a face velocity not greater than 0.5 m/s.

14 Thermal rating: results and analysis

14.1 General. The thermal rating shall be determined as indicated in this clause and shall comprise the values obtained for the following:

- a) net total room cooling effect (see 14.2);
- b) room dehumidifying effect (see 14.3);
- c) net room sensible cooling effect (see 14.4);
- d) room air wet bulb and dry bulb temperatures;
- e) primary fluid (nature to be stated) flow rate and temperature;
- f) electricity supply nominal voltage and frequency.

14.2 Net total room cooling effect (Q). The rating of the unit shall be calculated for each test using the formula:

a) for weight or volume method

$$Q = \left[\frac{M c_p (t_i - t_o)}{T} \right] - E - \left[\frac{M_r c_{pw} (t_R - t_r)}{T} \right]$$

b) for direct mass flow measurement (i.e. orifice plate)

$$Q = [m_w c_p (t_i - t_o)] - E - [m_r c_{pw} (t_R - t_r)]$$

where

Q is the output, net total room cooling effect (kW);

M is the total primary fluid mass flow (kg);

M_r is the net weight of condensate formed during test (kg);

T is the duration of test;

t_i is the average fluid inlet temperature (°C);

c_p is the specific heat capacity of primary fluid (kJ/kg K);

c_{pw} is the specific heat capacity of water kJ/(kg K);

t_o is the average outlet liquid temperature (°C);

t_R is the room air temperature (°C);

t_r is the condensate temperature (°C);

m_w is the primary fluid mass flow rate (kg/s);

E is the power dissipated in the room by the unit (kW);

m_r is the condensate mass flow (kg/s).

NOTE Where, for example, the fan motor is effectively isolated from all contact with the room air, then E is equal to the room air impeller shaft horse power measured by the method described in BS 848.

14.3 Room dehumidifying effect (Q_D). The room dehumidifying effect (Q_D) is the rate of energy extraction due to removal of water and is given by the formula:

$$Q_D = LM_r/TM_r \text{ (kW)}$$

where

L is the latent heat of evaporation of water (kJ/kg);

M_r is the net weight of condensate formed during test (kg);

T is the duration of test;

m_r is the condensate mass flow rate (kg/s).

14.4 Net room sensible cooling effect (Q_s). The net room sensible cooling effect (Q_s) is the difference between the net total room cooling effect and the room dehumidifying effect and is given by the formula:

$$Q_s = Q - Q_D \text{ (kW)}.$$

14.5 Primary fluid mass flow rate and pressure drop

14.5.1 The primary fluid mass flow rate shall be determined either from the formula $m_r = M_r/T$ by direct weighing or by means of an orifice plate (see 9.1.3).

14.5.2 The primary fluid pressure drop determined in accordance with the provisions of 9.1.2 and 10.1 shall be corrected for any difference in height between the inlet and outlet measuring stations and converted to the pressure drop at a mean water temperature of 8 °C by means of the equation:

$$\Delta p_c = \Delta p_m / K_w$$

where

Δp_c is the hydraulic pressure drop at 8 °C (Pa);

Δp_m is the measured hydraulic pressure drop corrected (Pa) for height difference;

K_w is the temperature correction factor, obtained from Figure 12, at the mean test water temperature.

14.5.3 Δp_c shall be plotted against the primary fluid mass flow rate (m_r) on logarithmic graph paper and the best line through the test points shall be used (in conjunction with the above equation) to determine the pressure drop at any flow rate within, and to $\pm 10\%$ outside, the range of the test variables.

NOTE At least three readings are required for the case of a single nominal flow rating.

15 Air volume flow rate measurements

15.1 The unit shall be connected to the chamber described in 10.2 (see Figure 6).

15.2 The chamber and the junction between the chamber and the unit shall be carefully sealed against leaks.

15.3 The necessary equipment for primary fluid supply shall be connected to the appliance (see clause 10).

15.4 All primary fluid measurements shall be carried out as described in clause 12.

15.5 The desired unit fan speed shall be selected and primary fluid conditions set at 5 ± 0.5 °C ON and 10 ± 0.5 °C OFF and room conditions set to nominal temperatures 21 °C dry bulb and 15 °C wet bulb.