AS/NZS 4740:2000

AS/NZS 4740

Australian/New Zealand Standard™

Natural ventilators—Classification and performance

Accessed by CSR LIMITED on 06 Dec 2010

Standards Australia

STANDARDS NEW ZEALAND

Paerewa Aotearoa

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Paerewa Aotearoa

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee ME/62, Ventilation and Airconditioning. It was approved on behalf of the Council of Standards Australia on 22 December 1999 and on behalf of the Council of Standards New Zealand on 22 February 2000. It was published on 30 March 2000.

The following interests are represented on Committee ME/62:

Air Conditioning and Mechanical Contractors Association of Australia
Air-conditioning and Refrigeration Equipment Manufacturers Association of Australia
Australasian Fire Authorities Council
Australian Building Codes Board
Australian Institute of Building Surveyors
Australian Institute of Refrigeration, Air Conditioning and Heating
Chartered Institution of Building Services Engineers
CSIRO—Division of Building, Construction and Engineering
Department of Contract and Management Services, W.A.
Fire Protection Industry Association of Australia
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/62, Ventilation and Airconditioning.

The objective of this document is to provide standardized requirements and performance test methods for natural ventilators for use by manufacturers, suppliers, testers, specifiers and consumers of these products.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

Natural ventilators—Classification and performance

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies minimum requirements for ventilators designed to provide ventilation of enclosures by means of the natural flow of air.

This Standard includes classification, performance and marking requirements. It also includes appendices outlining the performance test methods. It does not apply to electrically powered ventilators or to smoke and heat exhaust ventilators.

1.2 APPLICATION

The method of tests used for the performance assessment of natural ventilators will depend on the required type, performance and application of the ventilator. This document should not be called up in contracts without specifying the detail to be derived from it.

NOTES:

1 Purchasing guidelines are provided in Appendix A.

2 This Standard is a product Standard and does not include requirements for the design or installation of natural ventilation systems. Manufacturers and suppliers should be contacted for design and installation information appropriate to their products.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1199	Sampling procedures and tables for inspection by attributes
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
1745	Outdoor weathering of plastics in the Australian environment
1745.2	Part 2: Guide for design purposes
2360	Measurement of fluid flow in closed conduits
2360.1.1	Part 1.1: Pressure differential methods—Measurement using orifice plates, nozzles or Venturi tubes—Conduits with diameters from 50 mm to 1200 mm
2427	Smoke/heat release vents
AS/NZS	
2312	Guide to the protection of iron and steel against exterior atmospheric corrosion
2728	Prefinished/prepainted sheet metal products for interior/exterior building applications—Performance requirements
ISO	
5801	Industrial fans—Performance testing using standardized airways

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ISO
9000 Quality management and quality assurance standards
9000.1 Part 1: Guidelines for selection and use

9004 Quality management and quality system elements
9004.1 Part 1: Guidelines

SAA
HB.18 Guidelines for third-party certification and accreditation
HB.18.28 Guide 28—General rules for a model third-party certification scheme for products

ANSI/ASHRAE
70 Method of testing for rating the performance of air outlets and inlets

1.4 DEFINITIONS

For the purpose of this Standard the definitions below apply.

1.4.1 Discharge coefficient (coefficient of discharge)

A coefficient determined for each natural ventilator by type testing in accordance with Appendix D.

1.4.2 Effective aerodymanic area

The equivalent area of a theoretical aerodynamically perfect orifice (i.e. theoretically perfect opening with a coefficient of discharge of 1.0), and equals the throat area multiplied by the discharge coefficient.

1.4.3 Final upper limit load

The maximum load at which results of a load test have been obtained.

1.4.4 Flow coefficient (coefficient of flow)

The velocity ratio of the exhaust air, drawn through the ventilator, to the air passing over a ventilator.

1.4.5 Functional integrity

The ability of a product or part to meet its design performance after undergoing test.

1.4.6 Natural ventilator (herein referred to as ventilator)

A ventilating unit that has no external power source other than wind or temperature gradients.

1.4.7 Permanent deflection

The deformation of a part or product, when a part does not return to its original shape, after the load has been applied and removed.

1.4.8 Pitch

The angle of a roof from the horizontal plane.

1.4.9 Scale model

A model of a ventilator with all dimensions scaled down or up by the same ratio.

1.4.10 Stack height

The mean height between the natural ventilation inlets and outlets of a building.

1.4.11 Stack pressure

The pressure difference between the inside and outside of a building, created by buoyancy effects which are in turn created by changes in density caused by air temperature variations.

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1.4.12 Static load test

A test carried out using a static load.

1.4.13 Streaming

Continuous visible signs of non-airborne water particles.

1.4.14 Structural integrity

The ability of a product or part or any component to remain, without partial or full dislodgment from the structure, after undergoing test.

1.4.15 Throat area

The minimum cross-sectional area of a ventilator through which air can pass.

NOTE: Throat area is not equal to free area which is a quantity that is not used in this Standard but if quoted should be calculated in accordance with the procedures of ANSI/ASHRAE 70.

1.4.16 Vent pressure drop

The pressure difference across a natural ventilator, at a specified flowrate, as measured by the vent pressure meter.

1.4.17 Wind siphoning pressure

The pressure difference between the immediate inside and outside of a roof-mounted ventilator created by air passing over the top of the ventilator.

1.5 CLASSIFICATION

1.5.1 Type classification

Ventilators shall be classified according to type as follows:

(a) Type 1: Fixed grilles, louvre panels.

(b) Type 2: Fixed roof ventilators, hoods, ridge vents.

(c) Type 3: Wind directional vane ventilators.

(d) Type 4: Rotating wind-driven roof ventilators.

Typical ventilator designs are illustrated by type in Figure 1.1.

1.5.2 Performance classification

Ventilators shall be classified according to their performance requirements in accordance with Tables 1.1 and 1.2 as applicable. For a ventilator to be classified in accordance with Tables 1.1 and 1.2 it shall be tested in accordance with the requirements of Section 2.

1.5.3 Dual classification

Where smoke and heat release ventilators are intended to be used also as natural ventilators they shall comply with the requirements of this Standard and AS 2427.

1.5.4 Corrosion resistance

Corrosion resistance requirements for ventilators shall be by agreement (see Appendix A).

NOTE: Corrosion resistance of ventilators should be designed in accordance with an appropriate Standard such as AS 1745.2, AS/NZS 2312 or AS 2728.

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TABLE 1.1

PERFORMANCE CLASSIFICATION—TYPE 1 VENTILATORS

Characteristic	Performance level	Summary
Rain resistance	Class A	A – 1 to 0.99% effectiveness
(Appendix B)	Class B	B – 0.989 to 0.95% effectiveness
	Class C	C – 0.949 to 0.80% effectiveness
	Class D	D – Below 0.80% effectiveness
Effective aerodynamic area	Class 1	1 – Cd = 0.7 and above
(Appendix D)	Class 2	2 – Cd = 0.5 to 0.699
	Class 3	3 – Cd = 0.3 to 0.499
	Class 4	4 – Cd = 0.1 to 0.299
Wind loading	Level 1	Pass criteria at 57 m/s
(Appendix F)	Level 2	Pass criteria at 44 m/s
	Level 3	Pass criteria at 31 m/s
	Level 4	Pass criteria at 16 m/s

TABLE 1.2

PERFORMANCE CLASSIFICATION—TYPE 2, 3 OR 4 VENTILATORS

Characteristic	Performance level	Summary
Rain resistance	Class A	A – No water at 50 m/s min.
(Appendix C)	Class B	B – No water at 35 m/s min.
	Class C	C – No water at 20 m/s min.
	Class D	D – No rain resistance requirement
Effective aerodynamic area	Class 1	1 – Cd = 0.7 and above
(Appendix D)	Class 2	2 – Cd = 0.5 to 0.699
	Class 3	3 – Cd = 0.3 to 0.499
	Class 4	4 – Cd = 0.1 to 0.299
Flow coefficient	Class 1	1 – C_f = 0.7 and above
(Appendix E)	Class 2	2 – C_f = 0.5 to 0.699
	Class 3	3 – C_f = 0.3 to 0.499
	Class 4	4 – C_f = 0.1 to 0.299
Wind loading	Level 1	Pass criteria at 57 m/s
(Appendix G or H)	Level 2	Pass criteria at 44 m/s
	Level 3	Pass criteria at 31 m/s
	Level 4	Pass criteria at 16 m/s

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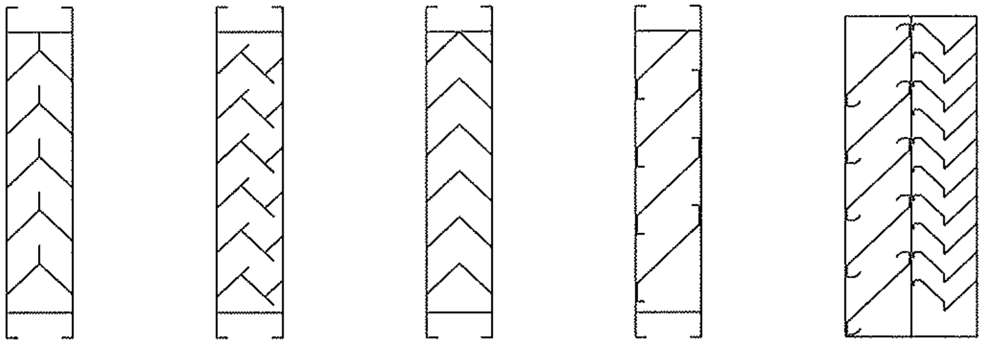
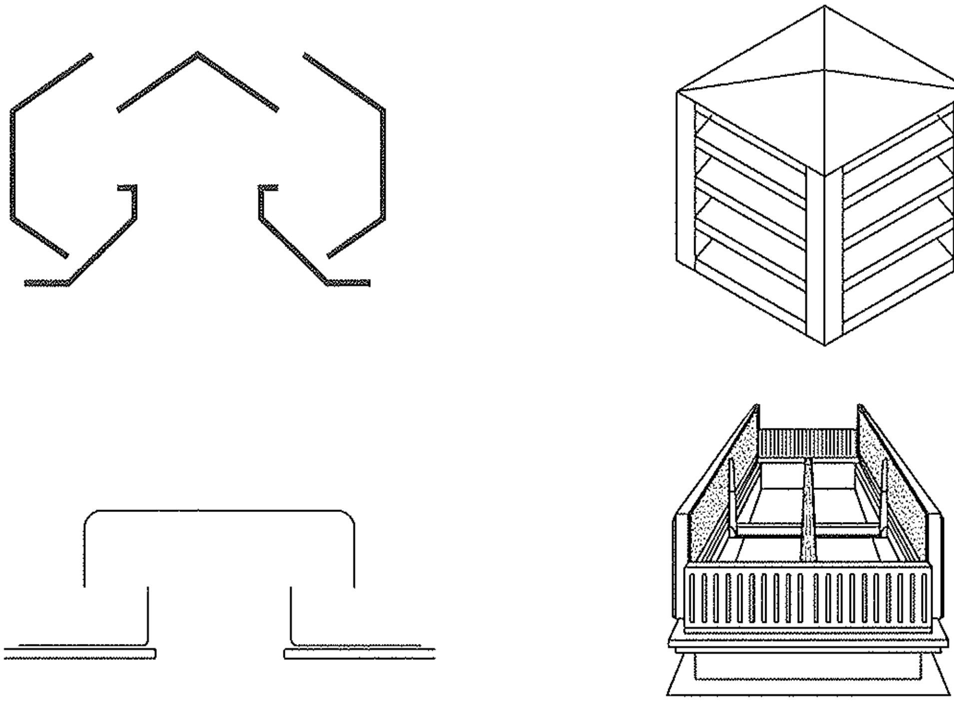


(a) Type 1



(a) Type 2

FIGURE 1.1 (in part) TYPICAL VENTILATORS BY TYPE

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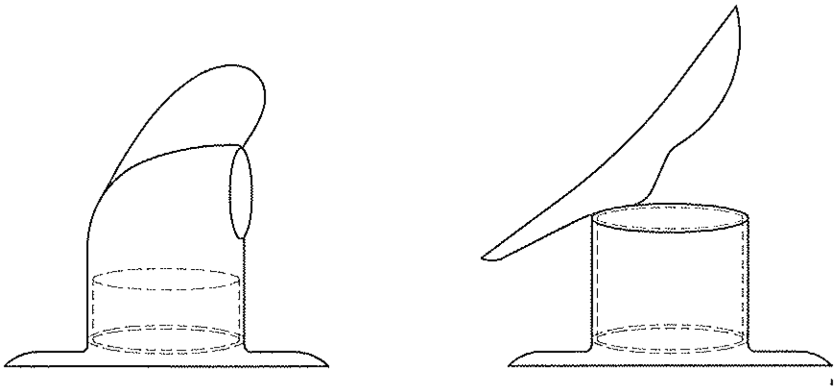
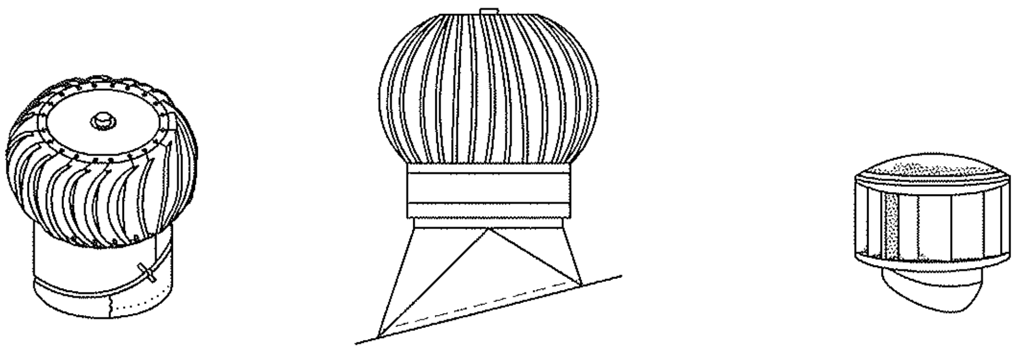


(a) Type 3



(a) Type 4

FIGURE 1.1 (in part) TYPICAL VENTILATORS BY TYPE

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SECTION 2 PERFORMANCE TESTING

2.1 TYPE APPROVAL

For type approval, tests shall be carried out in accordance with Clauses 2.2 and 2.3. For each test a report shall be prepared in accordance with Section 5.

2.2 TYPE TESTING

2.2.1 General

For the purpose of type approval it is not necessary to test every size of ventilator in a product range, provided that the range complies with Clauses 2.2.2 to 2.2.4. Classification of ventilators by performance is given in Clause 1.5.2.

2.2.2 Range type

The range shall comprise the same ventilator classification type, and shall be manufactured to a similar design and with similar materials.

2.2.3 Specimen size

For type approval, at least the smallest, largest and median size of a ventilator range shall be tested. For continuous Type 1 units, tests shall be carried out on a 1.0 m × 1.0 m panel. For continuous Type 2 units, tests shall be carried out on a full size unit with a sectional length sufficient to include one full structural span along its length. Where the largest ventilator cannot be tested due to practical problems with physical size, the test may be carried out on a scaled model subject to the requirements of Clause 2.2.4. Wind load testing shall not be carried out on a scale model.

2.2.4 Scale models

Where allowed by Clause 2.2.3, test specimens may be accurately scaled-down models. Where testing of scale models is undertaken, the models shall be as large as is practicable for the test rig in use. For testing scaled-down models, flow similarity shall be proven.

NOTE: Flow similarity is always achieved if the Reynolds Numbers of the scaled-down model and the full-scale ventilator are identical.

The Reynolds Number similarity requirement usually prescribes model scales of 1/10 or larger. When testing scaled-down models, all features of the ventilators in contact with the airflow (e.g. opening elements, details of flaps, and similar) shall be included and shall satisfy the similarity requirement.

NOTE: Experience has shown that it is difficult to model Type 2 ridge ventilators and Type 1 louvre ventilators.

2.3 PERFORMANCE REQUIREMENTS

2.3.1 Rain resistance

Type 1 ventilators shall be tested in accordance with Appendix B. Types 2, 3 and 4 ventilators shall be tested in accordance with Appendix C.

2.3.2 Effective aerodynamic area

All ventilator types shall have their coefficient of discharge and effective aerodynamic area calculated in accordance with Appendix D.

2.3.3 Flow coefficient

Where ventilators are required to have their coefficient of flow established, it shall be determined in accordance with Appendix E.

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2.3.4 Wind loading

2.3.4.1 *Static load tests*

Type 1 ventilators shall be tested in accordance with Appendix F and the resistance to wind loads shall be determined. Type 2 and 3 ventilators shall be tested in accordance with Appendix G or Appendix H and the resistance to wind loads shall be determined.

2.3.4.2 *Free field tests*

Type 4 ventilators shall be tested in accordance with Appendix H and the resistance to wind loads shall be determined. Tests shall not be carried out on a scale model. As an alternative to Clause 2.3.4.1, Type 2 and 3 ventilators may be tested in accordance with Appendix H.

NOTE: It should be noted that compliance with the test requirements of Clause 2.3.4 does not automatically provide compliance with the wind loading requirements of building regulations which need to be complied with on an installation-specific basis.

2.4 INSTRUMENTATION

2.4.1 Airflow rate

2.4.1.1 *Measurement*

Airflow meters shall have the ranges and accuracies given in Table 2.1.

Airflow meters may be calibrated in situ by means of pitot-static tube traverse techniques.

TABLE 2.1

AIRFLOW METER ACCURACIES

Range m^3/s	Accuracy of measurement %
From 0.07 to 7	±2.5
From 0.007 to 0.07	±5

2.4.1.2 *Calibration*

Airflow meters shall be checked at intervals, as appropriate, but not exceeding 12 months. This check may take the form of one of the following:

(a) A dimensional check of all flow meters not requiring calibration.

(a) A check calibration over their full range using the original method employed for initial calibration or meters calibrated in situ.

2.4.2 Pressure

2.4.2.1 *Measurement*

Pressure in the duct shall be measured by means of a liquid-filled calibrated manometer, or any other device complying with this Clause.

The maximum scale interval shall not be greater than the characteristics given in Table 2.2.

For airflow measurements, the minimum pressure differential shall be as follows:

(a) 25 Pa with an inclined tube manometer or micro-manometer.

(b) 500 Pa with a vertical tube manometer.

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TABLE 2.2

MAXIMUM SCALE INTERVAL

Range, Pa	Maximum scale interval, Pa
≤25	1.0
>25 ≤250	2.5
>250 ≤500	5.0
>500	25.0

2.4.2.2 *Calibration*

Calibration standards shall be as follows:

(a) for instruments with a range ≤25 Pa, a micro-manometer accurate to ±0.5 Pa;

(b) for instruments with a range >25 ≤500 Pa, a manometer accurate to ±2.5 Pa (hook gauge or micro-manometer);

(c) for instruments with a range >500 Pa, a manometer accurate to ±25 Pa (vertical manometer).

2.4.3 Temperature measurement

Measurement of temperature shall be by means of mercury-in-glass thermometers, resistance thermometers or thermocouples. Instruments shall be graduated to give readings in intervals not greater than 0.5 K and calibrated to an accuracy of 0.25 K.

2.4.4 Water flow meters

Water flow meters shall have an accuracy of measurement within 0.5% of the indicated flow rate. Water flow meters shall be calculated against a known weight of water flowing for a measurement time period.

2.4.5 Timers

Timers for determining flow rates shall have a minimum accuracy of 0.2 s.

2.4.6 Rain gauge

Rain gauges shall have an accuracy of ±2% of reading.

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SECTION 3 CALCULATIONS

3.1 SCOPE

This Section outlines a method of calculation to assess the airflow performance of a ventilator under assumed conditions. Airflow due to stack pressure, wind siphoning pressure; or a combination of both, may be calculated.

3.2 STACK PRESSURE AIRFLOW

3.2.1 Stack pressure

Stack pressure shall be calculated in accordance with the following equation:

$$P_s = \varrho\, g\, h\, \Delta T / T \qquad \ldots 3(1)$$

where

P_s = stack pressure (Pa)

ϱ = air density at ambient temperature (kg/m^3)

g = gravitational constant (9.81 m/s^2)

h = stack height (m)

ΔT = assumed temperature differential between air intake and air exhaust (K)

T = assumed outside ambient temperature (K)

3.2.2 Airflow

The airflow due to the stack pressure shall be calculated in accordance with the following equation:

$$Q_s = F \times \left(\frac{2 P_s}{\varrho} \right)^{1/2} \qquad \ldots 3(2)$$

where

Q_s = stack volume flow rate (m^3/s)

F = effective aerodynamic area of the ventilator calculated in accordance with Appendix D (m^2)

P_s = stack pressure (Pa)

ϱ = air density at ambient temperature (kg/m^3)

3.3 WIND SIPHONING AIRFLOW

3.3.1 Wind siphoning pressure

Wind siphoning pressure shall be calculated in accordance with the following equation:

$$P_w = (\varrho / 2)\, (C_f V_t)^2 \qquad \ldots 3(3)$$

where

P_w = wind siphoning pressure (Pa)

ϱ = air density at ambient temperature (kg/m^3)

C_f = flow coefficient, calculated in accordance with Appendix E

V_t = assumed wind velocity (m/s)

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3.3.2 Airflow

The airflow due to the wind siphoning pressure shall be calculated in accordance with the following equation:

$$Q_w = F \times \left(\frac{2\,P_w}{\varrho} \right)^{1/2} \qquad \ldots 3(4)$$

where

Q_W = wind volume flowrate (m^3/s)

F = effective aerodynamic area of the ventilator calculated in accordance with Appendix D

P_W = wind siphoning pressure (Pa)

ϱ = air density (kg/m^3)

3.4 COMBINED EFFECT

The airflow due to the combined effect of stack and wind siphoning pressures shall be calculated in accordance with the following equation:

$$Q_c = F(2\,\Sigma\,P_c / \varrho)^{1/2} \qquad \ldots 3(5)$$

where

Q_C = combined volume flow rate (m^3/s)

F = effective aerodynamic area of the ventilator calculated in accordance with Appendix D

ΣP_C = $P_w + P_s$ (Pa)

ϱ = air density (kg/m^3)

3.5 NOMINAL PERFORMANCE

All ventilators shall have their performance calculated at the following three nominal conditions:

ϱ = 1.2 kg/m^3

g = 9.81 m/s^2

h = 6 m

ΔT = 14 K

T = 20°C

V_t = 0m/s, 3.0 m/s and 6.0 m/s

The effective aerodynamic area (F) and the flow coefficient (C_f), determined in accordance with this Standard, shall be used in the calculations.

NOTE: It is **not** intended that the criteria listed in this Clause be used for design purposes. Design of natural ventilation systems should be in accordance with the requirements of building regulation which may preclude the use of an incident wind speed in some jurisidictions, i.e. $V_t = 0$ m/s.

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SECTION 4 INFORMATION AND MARKING

4.1 PRODUCT INFORMATION

The supplier shall provide appropriate product information which shall include the following:

(a) Type of ventilator and model number.

(b) Performance classification.

(c) Effective aerodynamic area (in m^2).

(d) Maximum and minimum pitch as nominated by the manufacturer.

(e) Nominal performance of the ventilator calculated in accordance with Section 3.

(f) Fixing information.

(g) Installation instructions.

(h) Recommended inspection and maintenance procedure.

(i) The number of this Standard, i.e. AS/NZS 4740.

4.2 MARKING

Each ventilator shall be marked so that the following information is visible after installation:

(a) Manufacturer's name or registered trademark.

(b) Type of ventilator and model number.

Marking shall be indicated by one or more of the following:

(i) Adhesive label.

(ii) Die stamp.

(iii) Waterproof ink.

Miniature ventilators of less than 0.01 m^2 effective aerodynamic area shall be exempted from the marking requirements.

NOTES:

1 Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging, or promotional material related to that product, are advised to ensure that such compliance is capable of being verified.

2 Alternative means of demonstrating compliance with this Standard are given in Appendix I.

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SECTION 5 TEST REPORTS

5.1 GENERAL

Test reports shall include the preliminary information required by Clause 5.2 and the appropriate test information as required by Clause 5.3.

5.2 PRELIMINARY INFORMATION

All test reports shall include the following information:

(a) Name of laboratory.

(b) Name of the client.

(c) Date of tests.

(d) Name of supplier and trade name of the product.

(a) The reference to the test methods used, i.e. Appendix B, C, D E, F, G or H, as appropriate, AS/NZS 4740.

(e) Product name, classification and catalogue number.

(f) Product dimensions, face area and throat area.

(g) Fixing method used in test.

5.3 TEST INFORMATION

5.3.1 Rain leakage test

The following shall be reported:

(a) The maximum roof slope at which the ventilator was tested.

(b) The maximum test wind velocity.

(c) The water spray application rate.

(d) Ventilator rain penetration classification.

(e) The value of v_r, (if applicable).

(f) Other pertinent observations.

5.3.2 Effective aerodynamic area test

The following shall be reported:

(a) Test information in a format similar to that in Table 5.1.

(b) Discharge coefficient of the ventilator.

(c) Throat area of the ventilator.

(d) Effective aerodynamic area of the ventilator.

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TABLE 5.1

EFFECTIVE AERODYNAMIC AREA TEST DATA

Parameter	Symbol	Unit	Test run				
			1	2	3	4	5
Tunnel velocity	V_t	m/s					
Pressure drop across ventilator	Δp_v	Pa					
Volumetric flow rate of air	q_v	m^3/s					
Discharge coefficient	C_i	—					

5.3.3 Flow coefficient test

The following shall be reported:

(a) Test information in a format similar to that in Table 5.2.

(b) The calculated flow coefficient of the ventilator.

TABLE 5.2

FLOW COEFFICIENT TEST DATA

Parameter	Symbol	Unit	Test run				
			1	2	3	4	5
Tunnel velocity	V_t	m/s					
Ventilator velocity	V_v	m/s					
Flow coefficient	C_f	—					

5.3.4 Wind load resistance tests

The following shall be reported:

(a) Final upper limit load applied, i.e. air pressure, static load or wind speed.

(b) Any evidence of failure.

5.4 DEVIATIONS FROM STANDARD TEST PROCEDURE

Any deviations from the standard test procedure and requirements, as outlined in this Standard, shall be noted in the appropriate test report.

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APPENDIX A

PURCHASING GUIDELINES

(Informative)

A1 GENERAL

Australian Standards are intended to include the technical provisions necessary for the supply of the product referred to in the particular Standard, but do not purport to comprise all the necessary provisions of a contract. In a number of cases the purchaser is either asked to state his requirements or given a choice of optional requirements, and these are contractual matters to be agreed upon between the buyer and the seller.

The performance levels set within this Standard for the purposes of product classification are nominal values made available to the purchaser for the comparison of various products and systems. These nominal values are not intended to be used as defacto design criteria and each design and installation needs to be considered on an individual basis

This Appendix contains detailed explanation, advice and recommendations on the information to be supplied by the purchaser at the time of enquiry or order. It aims at avoiding misunderstanding of the product requirements and should result in the buyer receiving satisfactory material and service.

A2 INFORMATION TO BE SUPPLIED BY THE BUYER

The buyer should supply the following information at the time of enquiry or order:

(a) Ventilator type (see Clause 1.5.1).

(b) Required rain resistance level (see Clause 1.5.2 and Appendices B or C).

(c) Required discharge coefficient or effective aerodynamic area (see Clause 1.5.2 and Appendix D).

(d) Required flow coefficient (see Clause 1.5.2 and Appendix E).

(e) Required wind loading level (see Clause 1.5.2 and Appendices F, G or H).

(f) Required anti-corrosion treatment (see Clause 1.5.4).

(g) Installation details.

(h) Additional product identification requirements.

Others matters which should be clarified include which party is to be responsible for—

(i) shipment;

(ii) on-site storage; and

(iii) installation.

A3 PUBLISHED DATA

Relevant information should be made available to the buyer upon request (see Clause 4.1). This includes dimensions, ratings, nominal performance (see Clause 3.5), instructions for installation, maintenance and precautions.

A4 SPECIFICATION EXAMPLE

Table A1 provides an example of a typical performance specification for a fixed roof ventilator.

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TABLE A1

TYPICAL SPECIFICATION FOR AS 4740 TYPE 2 VENTILATOR

Characteristic	Performance level
Rain resistance	Class B
Effective aerodynamic area	Class 2
Flow coefficient	Class 3
Wind loading	Level 1
Anti-corrosion treatment	Specification supplied

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APPENDIX B

DETERMINATION OF RESISTANCE TO LEAKAGE DURING RAIN—TYPE 1 VENTILATOR

(Normative)

B1 SCOPE

This Appendix sets out the method for determining the resistance of a Type 1 ventilator to leakage during rain.

B2 PRINCIPLE

The ventilator is mounted in a section of wall and subjected to an air stream into which water has been introduced to simulate wind-blow rain. The ventilator is monitored from inside the wall for signs of water penetration. Four levels of performance classifications are included.

B3 APPARATUS

The following apparatus shall be required:

(a) An external fan for directing the air perpendicular to the ventilator test plane, as illustrated in Figure B1. The air outlet of the fan and any silencing or straightening section shall not be less than 1 m in diameter. The fan shall be capable of producing an air velocity of 13 m/s at 1 m in front of the test plane of the ventilator. An air straightener section shall be assembled to the outlet of the fan to avoid swirling air currents.

(b) A weather section complying with the following:

  (i) The ventilator or calibration plate, to be tested, shall be mounted and fixed in the centre of a 3 m × 3 m square wall at the rear of the weather section (see Figure B1).

  (ii) The ventilator or calibration plate, as appropriate, shall be tightly sealed to the wall, in accordance with the installation instructions recommended by the manufacturer.

  (iii) The outside face of the ventilator shall be facing the wind and rain simulation equipment.

(c) Rain simulation equipment consisting of at least four nozzles in an array close to the discharge of the wind effect fan to suit the spread of rain required. A suitable spray may be achieved by using the nozzles and control systems as shown in Figures B1 and B2.

  The overall required effect is to cover the area of the ventilator or calibration plate in a uniform manner. In order to achieve a satisfactory trajectory, water flow rate and droplet size from the nozzles it is necessary to spray water from the nozzles in short bursts with only one of the four nozzles spraying at any instant. This is achieved by connecting each nozzle array to an electrically or mechanically operated timer valve. The total flow rate to the nozzle array shall be maintained constant and the flow sufficient to ensure that the droplet size is significant. The nozzles used shall be of the wide spray type featuring a solid cone-shaped spray pattern with a square impact area, and a spray angle of 95° to 115° with a capacity of 3.7 L per minute at 0.3 Bar pressure.

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The rain simulation equipment shall satisfy the following with the calibration plate mounted in the test opening:

(i) Capable of producing a simulated rain penetration through the calibration plate of 75 L/h (+10% −0%) per square metre of opening.

(ii) The simulated rainfall rate measured using the rain gauge shall not deviate from the mean value by more than 15%.

(iii) The water penetration through the calibration plate measured in the collection section shall be at least 80% of the water supply rate from the nozzles.

(d) The collection duct shall comply with the following:

(i) The collection duct shall be sealed against the back of the weather section.

(ii) The collection duct shall have a water droplet elimination section at the downstream end to prevent carry over of airborne water droplets from the collection duct.

(iii) The collection duct shall have an airtight connection to the airflow measuring plenum.

(e) The mechanical ventilation section shall consist of a ventilation fan that shall be capable of producing an airflow rate through the ventilator under test over the range of 0.5 m^3/s to 3.5 m^3/s.

B4 MEASUREMENTS

B4.1 Water collection

Water shall be collected as follows:

(a) *At the collection duct* Water shall be collected at the drain from the collection duct so that the water penetration for the test period can be measured.

(b) *In front of the ventilator* Water shall be collected in the weather section at the base in front of the ventilator or calibration plate so that the water rejection during the period of the test can be measured.

B4.2 Airflow rate measurement

The airflow rate shall be measured by means of a conical inlet positioned at 600 mm from the discharge end of the section. To achieve a uniform flow approaching the conical inlet, resistance screens should be fitted.

The required uniformity is considered to be achieved if the maximum air velocity in plane A nowhere exceeds 1.25 times the average velocity in plane A.

NOTE: Three uniform wire mesh or perforated plate screens adequately supported and sealed to the chamber spaced 100 mm apart and with 60%, 50% and 45% free area successively in the direction of flow may be expected to secure the required flow uniformity.

B4.3 Pressure loss

The pressure loss across the ventilator shall be measured using static pressure measurement points positioned 100 mm behind the ventilator on the sides of the aerodynamic test section. There shall be no obstructions within 2 m of the face of the ventilator.

B4.4 Water eliminator performance test

B4.4.1 *General*

The following installation and procedures shall be used to check the effectiveness of the water eliminators in the water collection duct as shown in Figure B1.

The test shall be carried out for the extremes of the ventilator test conditions, as follows:.

(a) Simulated wind = 13 m/s .... ventilation rate = 3.5 m^3/s.

(b) Simulated wind = 13 m/s .... no ventilation rate.

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B4.4.2 *Installation*

The nozzles shall be supplied with water by means of a pump drawing water from a small sump tank, the sump tank shall have a sight glass for gauging the water content. The drain from the collection duct shall feed to the sump tank (see Figure B2).

B4.4.3 *Procedure*

The procedure shall be as follows:

(a) Install the array of spray nozzles in the collection duct.

(b) Fill the sump tank with water and start the pump and set the water flow rate to 75 L/h (+10%, −0%).

(c) Allow sufficient time for the surfaces of the collection tank to become wetted (approximately 1 h).

(d) After the surfaces of the collection duct have been wetted, the sump tank shall be filled to a mark on the sight glass.

(e) As the water level in the sump drops due to water loss, refill the tank with measured amounts.

(f) Continue the test for a period of 2 h.

(g) Calculate the total amount of water used to refill the tank.

The rate of water loss, amount of water used to refill the tank, shall be less than 3% of the hourly water flow rate through the nozzle.

B5 TEST SPECIMEN AND CALIBRATION PLATE

B5.1 Test specimen

The ventilator to be tested shall be as near as possible to, but not exceeding, the nominal dimensions of 1000 × 1000 mm using standard blade pitches and without the use of cover plate or infills. If the manufacturer's range does not extend up to 1000 × 1000 mm, then the maximum size unit shall be tested.

B5.2 Calibration plate

For the purpose of calibration tests, a calibration plate shall be fabricated which will fit over the test plane and have an opening of the same dimensions as the core area of the ventilator to be tested. This plate is used in the determination of the rain penetration insertion loss of the ventilator.

B6 PROCEDURE

The procedure shall be as follows:

(a) The Type 1 ventilator to be tested shall be mounted and sealed to the 3 m × 3 m wall at the rear of the weather section as recommended by the manufacturer, to prevent any ingress of water other than through the blades.

(b) The ventilator shall be tested at a minimum of 8 different core velocities ranging from 0 to 3.5 m/s in increments of 0.5 m/s. The set values shall not deviate from the nominal values by more than ±0.1 m/s. All tests shall be at a constant simulated heavy rainfall rate of 75 L/h.m^2 (75 L/h). All tests shall be carried out at a simulated wind speed of 13 m/s measured by means of a velocity meter (i.e. vane anemometer or pitot tube) on the centre-line of the fan and 1 m in front of the face of the ventilator. The velocity meter shall be removed before the rain simulation nozzles are turned on.

    The water flow rates shall be measured with a flow meter and set to the desired rates for each test. Water shall be collected from in front of and behind the ventilator.

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(c) For any of the series of tests the following shall be held at a constant, within the given tolerances:

(i) Water supply rate .... ±2%.

(ii) Water collection .... ±10%.

(iii) Ventilation airflow rate .... ±5%.

(iv) Wind velocity .... ±10%.

(d) Test values shall be noted at not more than 10 min intervals and the test period shall be complete when a minimum of four consecutive readings of values within the steady state tolerance have been noted. Minimum test period shall be 30 min.

NOTE: Wind speed is tested before and after testing.

(e) *Calibration plate test* Calibration procedure shall be as follows:

(i) Mount the calibration plate in the test position.

(ii) Mount the spray nozzles as illustrated in Figure B1.

(iii) Adjust the volumetric flow rate of the air (q_V) to zero and set the wind velocity at 13 m/s.

(iv) Set up the rain pattern as described in Paragraph B3(c).

(v) Adjust the water supply rate (q_S) so that the penetration rate (q_{do}) lies between 75 L/h per m^2 (+10%, −0%) of the calibration plate.

(vi) For the test period the following values shall be measured and recorded:

(A) The water supply rate .... q_{so} (L/h)

(B) The water rejection rate .... q_{uo} (L/h)

(C) The water penetration rate .... q_{do} (L/h)

(D) Airflow rate through plate .... q_{vo} (m^3/s) (except for no airflow test)

(E) Wind velocity .... v_W (m/s) (at the start and end of test period)

(vii) Adjust the airflow (q_{vo}) through the plate to the next value in the test schedule given in Paragraph B6(b) and repeat Steps (v) and (vi).

(viii) When tests have been made at all of the values of (q_{vo}) the test results shall be summarized and the penetration rate corrected by calculation if the water supply rate has varied from the nominal value of (q_{so}).

The nominal water supply rate ($q_{s\,nom}$) is the supply rate to the nozzles that will produce a penetration of 75 L/h.m^2 through the calibration plate at the test airflow rate.

$$q_{s\,nom} = 75.q_{so}.q_{do}^{-1}.A$$

(f) *Ventilator test*

(i) Install the ventilator in the test opening.

(ii) Install the spray nozzles as illustrated in Figure B1.

(iii) Adjust the flow rate (q_{vo}) to zero and the wind speed to 13 m/s.

(iv) The rain pattern shall be as established during the testing of the calibration plate.

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(v) Adjust the water supply rate as close as possible to ($q_{s\,nom}$) as established during the testing of the calibration plate.

(vi) During the test period the following values shall be measured and recorded:

(A) The water supply rate .... q_s (L/h)

(B) The water rejection rate .... q_u (L/h)

(C) The water penetration rate .... q_d (L/h)

(D) Airflow rate through ventilator .... q_v (m^3/s) (except for no airflow test)

(vii) Adjust the airflow rate (q_v) through the ventilator to the next value in the test schedule given in Paragraph B6(b) and repeat Steps (v) and (vi).

NOTE: Airflow rates should be as established during calibration plate test ±5%.

(viii) When tests have been made at all of the values of q_v the test results shall be summarized and the penetration rate corrected by calculation if the water supply rate has varied from the nominal value of $q_{s\,nom}$.

The corrected water penetration rate ($q_{d\,corr}$) is the water penetration rate that would be achieved if the water supply rate were to be equal to the nominal water supply rate ($q_{s\,nom}$) at the test ventilation airflow rate.

$$q_{d\,corr} = q_{s\,nom} \cdot q_d \cdot q_s^{-1}$$

B7 TEST RESULTS

The test results shall be analyzed as follow:

(a) Prepare a graph of the test results of the rain penetration through the calibration plate by plotting:

(i) $q_{s\,nom}$ (vs) q_v; and

(ii) q_{do} (vs) q_v

(b) Prepare a graph of the test results of the rain penetration through the ventilator by plotting.

(i) $q_{s\,nom}$ (vs) q_v; and

(ii) $q_{d\,corr}$ (vs) q_v.

(c) Prepare a graph of the effectiveness of the ventilator at different velocities by plotting the velocity calculated from $q_v A^{-1}$ against the effectiveness (E) calculated from the following equation:

$$E = \left[75.A - q_{d\,corr}\right].100\left[75.A\right]^{-1} \quad \text{. . . B1}$$

at each of the test airflow rates.

NOTE: 75.A is the product of the required calibration plate water penetration rate (75 $L/h.m^2$) and the area of the calibration plate hole (A).

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B8 VENTILATOR RAIN PENETRATION CLASSIFICATION

Table B1 shows different classifications based on the maximum simulated rain penetration per square metre of ventilator. The effectiveness is determined in accordance with Paragraph B7.

Water penetration rating at a given ventilator face velocity is determined by the water penetration while the ventilator is subjected to a 13 m/s simulated wind velocity and a simulated rainfall at the nominal rate.

TABLE B1
VENTILATOR RAIN PENETRATION CLASSIFICATION

Class	Effectiveness	Maximum allowed penetration of simulated rain $L/h.m^2$
A	1 to 0.99	0.75
B	0.989 to 0.95	3.75
C	0.949 to 0.80	15.0
D	Below 0.8	Greater than 15.0

NOTE: The above classifications apply at various core velocities.

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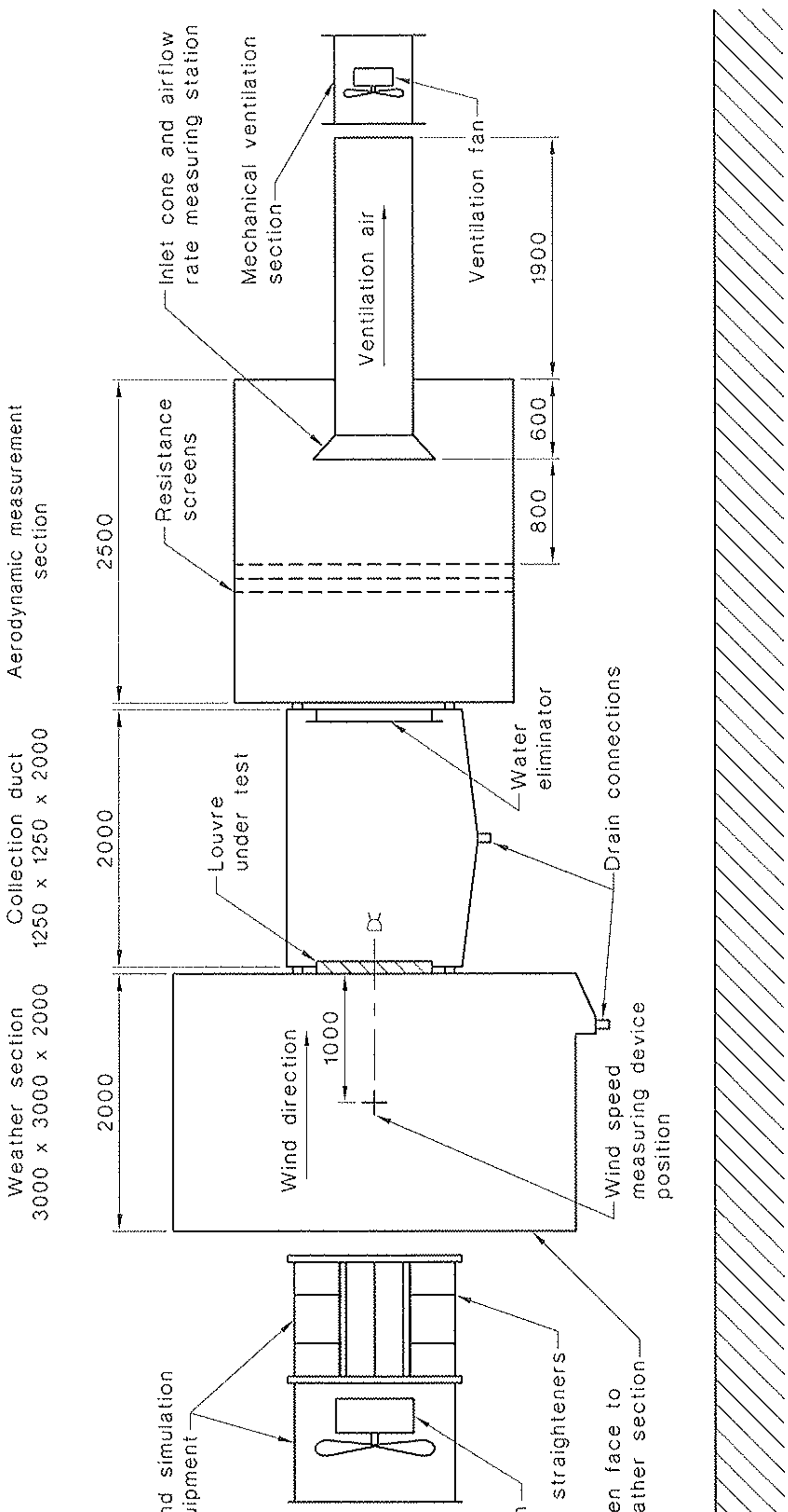

FIGURE B1 AERODYNAMIC WEATHER LOUVRE TEST FACILITY

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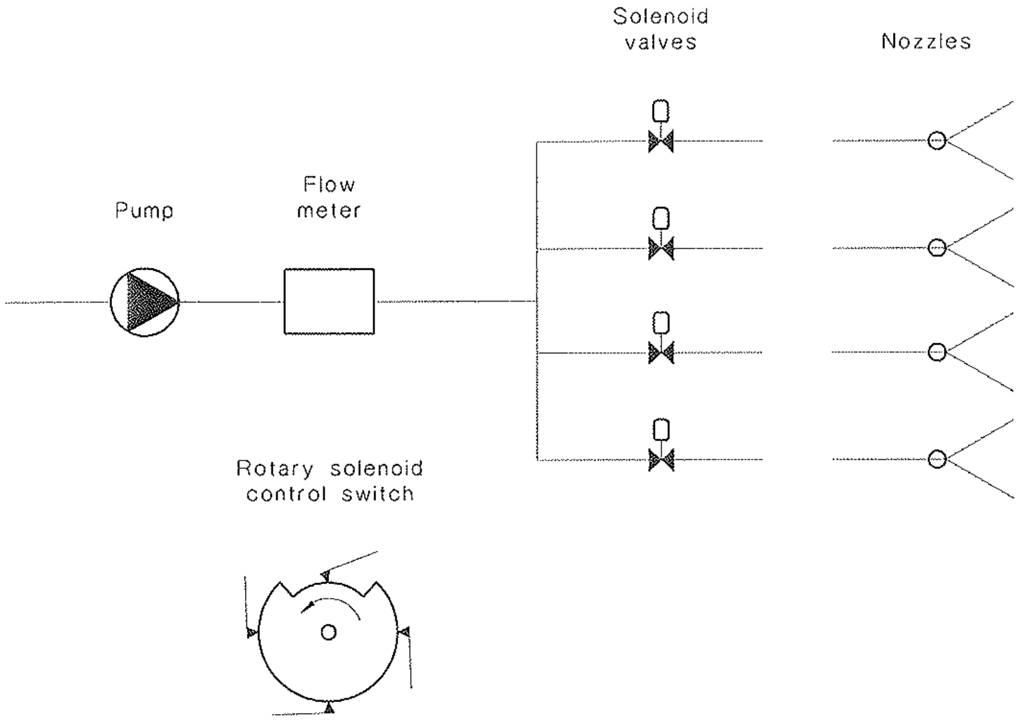

FIGURE B2 SCHEMATIC DIAGRAM OF NOZZLE CONTROL SYSTEM

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APPENDIX C

DETERMINATION OF RESISTANCE TO LEAKAGE DURING RAIN— TYPE 2, 3 OR 4 VENTILATORS

(Normative)

C1 SCOPE

This Appendix sets out the method for determining the resistance to leakage during rain of a Type 2, 3 or 4 ventilator.

C2 PRINCIPLE

The ventilator is mounted in a section of roof and subjected to an airstream into which water has been introduced to simulate wind-blown rain. The ventilator is monitored from inside the roof for signs of water penetration. Four levels of performance classifications are included.

C3 APPARATUS

The following apparatus shall be required:

(a) A wind machine incorporating flow straighteners, for producing an airstream or wind. The wind velocity shall be measured 11 ±1 m upstream from the nearest part of the test specimen.

(b) A system of 72 spray nozzles fixed in a rectangular grid pattern of—

   (i) 12 horizontal rows, each spaced 450 mm apart; and

   (ii) 6 vertical rows, each spaced 610 mm apart.

   This system shall be located 8.8 m from the wind-speed measuring device with the centre-line of the grid of nozzles on the centre-line of the airstream. The system shall introduce water into the air stream at a rate of 1.6 L/s, whenever required.

(c) A roof panel of variable slope or pitch, capable of rotating horizontally so that the axis of tilting can be set either normal or parallel to the airstream (see Figure C1). The space between the roof panel and the ground or floor below shall be enclosed with a solid construction such that—

   (i) it is sealed to the ground or floor and to the underside of the roof panel to prevent the entry of water;

   (ii) it is sealed at any joint and at the corners to prevent the entry of water;

   (iii) has the leeward side open for access; and

   (iv) has provision for the collection of any penetrated water.

C4 PROCEDURE

The procedure shall be as follows:

(a) With the test specimen at the windward side, set the panel at the maximum pitch nominated by the manufacturer and at right angles to the airstream.

(b) Start the wind machine at the appropriate speed and introduce water into the airstream at a rate of 1.6 L/s. Maintain the required wind velocity for 5 min.

(c) Measure any water penetration.

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(d) Increase the wind velocity to the next setting and repeat Steps (b) and (c).

(e) Set the panel at the maximum pitch nominated by the manufacturer and parallel to the airstream and repeat Steps (b) to (d).

(f) Collect and measure, for each test, any water that penetrates the ventilator (see Appendix B).

(g) Repeat Steps (b) to (f) with the panel set at the minimum pitch nominated by the manufacturer.

C5 TEST RESULTS

C5.1 Determination of rain leakage wind velocity (v_r)

If during the test there is no penetration of water through any part of the test specimen, the maximum wind velocity at which the test specimen was tested shall be deemed to be the rain leakage wind velocity (v_r), i.e. the maximum wind velocity at which the ventilator resists the ingress of wind-driven rain for any ventilator slope between the maximum and minimum slopes tested.

C5.2 Ventilator performance classification

Table C1 shows different classifications based on the maximum wind velocity at which the ventilator will resist simulated rain penetration.

TABLE C1

PERFORMANCE CLASSIFICATION

Class	Performance criteria
A	0 penetration at 50 m/s wind speed
B	0 penetration at 35 m/s wind speed
C	0 penetration at 20 m/s wind speed
D	water penetration at 20 m/s wind speed

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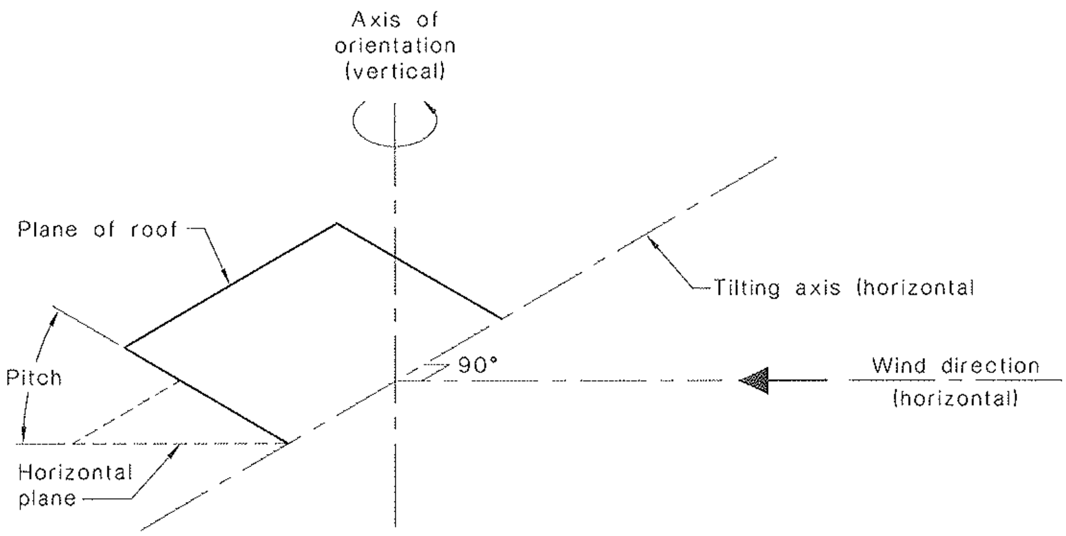
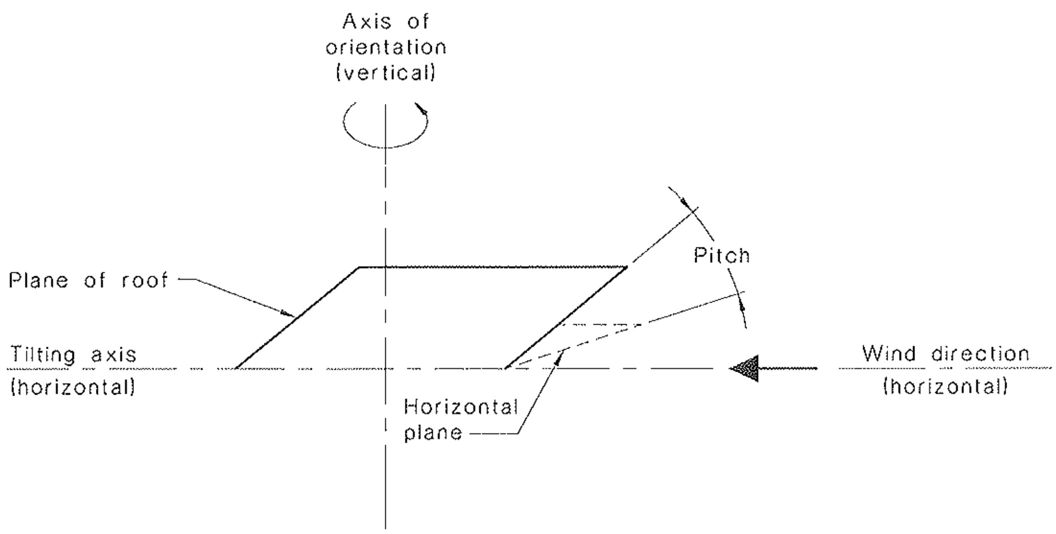


(a) Tilting axis normal to airstream



(b) Tilting axis parallel to airstream

FIGURE C1 SCHEMATIC REPRESENTATION OF THE TEST POSITIONS

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APPENDIX D
DETERMINATION OF DISCHARGE COEFFICIENT AND EFFECTIVE AERODYNAMIC AREA

(Normative)

D1 SCOPE

This Appendix sets out the method for determining the discharge coefficient and the effective aerodynamic area of a ventilator.

D2 PRINCIPLE

The airflow and pressure drop through a ventilator is measured. From these measurements, the discharge coefficient is determined and the effective aerodynamic area is calculated.

D3 APPARATUS

The following apparatus shall be required (a typical apparatus is described in Figure D1):

(a) A wind tunnel capable of providing at least five different air velocities through the test specimen.

(b) An orifice plate arrangement to AS 2360.1.1 to measure the airflow through the ventilator.

(c) A manometer for measuring the pressure difference through the ventilator.

D4 TEST SPECIMEN

The test specimen shall be mounted so that the test airflow is in the intended direction of the ventilator airflow. The test specimen shall be sealed to the wind tunnel.

D5 PROCEDURE

The procedure shall be as follows:

(a) Determine the penetration area required for normal installation of the ventilator (A) (see Figure D1) and calculate the throat area of the installed ventilator (A).

(b) Determine the air density at ambient conditions (ϱ).

(c) Ensure that the ventilator is in the correct position and operate the wind tunnel.

(d) Select five equally spaced test velocities to suit the test facility. The fifth test velocity shall be at least three times greater than the first.

(e) Determine that the volumetric flow rate of the air (q_V) is in accordance with Item (d) and record the differential pressure across the ventilator (Δp_V) for each test velocity/airflow rate.

D6 CALCULATIONS

D6.1 Discharge coefficient

The discharge coefficient of the test specimen shall be determined as follows:

(a) Discharge coefficient for each air velocity shall be calculated from the following equation:

$$C_i = \frac{q_v}{A} \times \sqrt{\frac{\varrho}{2\Delta\rho_v}} \qquad \ldots \text{D1}$$

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where

C_i = discharge coefficient for each air velocity

q_v = flow rate of air, m³/s

A = throat area of ventilator, m²

ρ = air density, kg/m³

Δp_v = pressure drop across ventilator, Pa

(b) Discharge coefficient of the ventilator

The arithmetic mean $(\overline{C})$ of the values of C_i determined in accordance with Equation D1 shall be evaluated.

The lower limit of the discharge coefficient shall be taken as the discharge coefficient of the specimen and shall be determined from the following equation:

$$C_d = \frac{\overline{C}\,(100 - \varepsilon_{q_v} - \varepsilon_A - \frac{1}{2}\,\varepsilon_\rho - \frac{1}{2}\,\varepsilon_{\Delta p_v})}{100} \qquad \ldots D2$$

where

$$\overline{C} = \sum_{i=1}^{n} C_i/n$$

C_d = discharge coefficient of the ventilator

ε_{q_v} = percentage of error in the determination of q_v

ε_A = percentage of error in the determination of A

ε_ρ = percentage of error in the determination of ρ

$\varepsilon_{\Delta p_v}$ = percentage of error in the determination of Δp_v

D6.2 Effective aerodynamic area

The effective aerodynamic area of the ventilator shall be calculated from the following equation:

$$F = C_d \times A \qquad \ldots D3$$

where

F = effective aerodynamic area, m²

C_d = discharge coefficient of the ventilator

A = throat area of ventilator, m²

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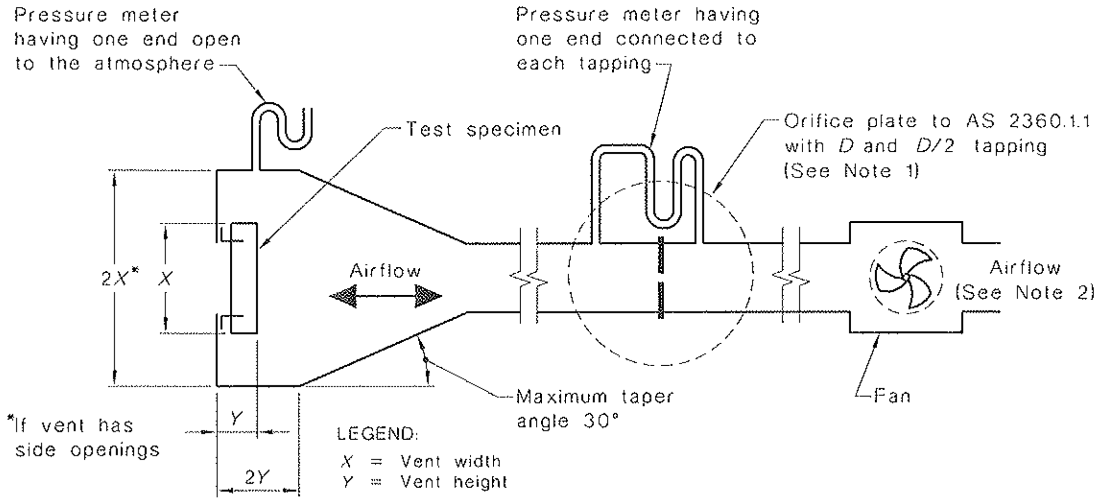
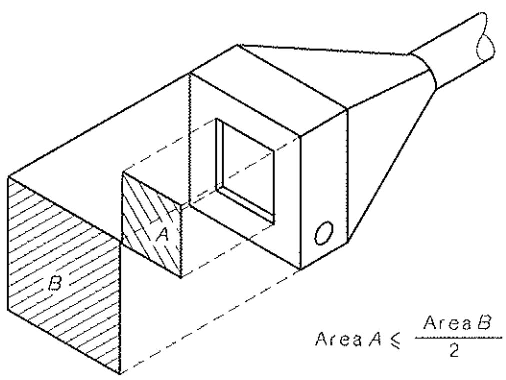


NOTES:

1. The dimensions of the wind tunnel are related to the dimensions of the orifice plate
2. The direction of airflow should be appropriate to the proper operation of the ventilator.

(a) General arrangement



(a) Area relationship

FIGURE D1 TYPICAL APPARATUS

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APPENDIX E
DETERMINATION OF FLOW COEFFICIENT—TYPE 2, 3 OR 4 VENTILATORS
(Normative)

E1 SCOPE

This Appendix sets out the method for determining the flow coefficient (C_f) of a Type 2, 3 or 4 ventilator.

E2 PRINCIPLE

Airflow induced through the ventilator by the action of a known (simulated) prevailing wind speed is measured. From these measurements the flow coefficient is determined.

E3 APPARATUS

The following apparatus shall be required (see Figure E1):

(a) A wind simulator incorporating flow straighteners and capable of producing at least five different air velocities over the test specimen in a free field.

(b) Airflow measurement devices to measure the airflow incident on the ventilator (V_i) and through the ventilator (V_v).

NOTE: An orifice plate arrangement to AS 2360.1.1, or a conical inlet arrangement to ISO 5801, is acceptable for this purpose.

(c) An equilibrium chamber incorporating a supply air fan and pressure measuring device into which the ventilator under test is installed.

E4 MOUNTING OF TEST SPECIMEN

The test specimen shall be mounted so that the incident airflow is in the intended direction of the prevailing wind. The test specimen shall be sealed to the wind tunnel.

E5 PROCEDURE

The procedure shall be as follows:

(a) Ensure that the test specimen is in the correct position in accordance with Figure E1 and operate the wind simulator.

(b) For each of the incident air velocities given in Table E1 measure the average velocity through the ventilator (V_v).

TABLE E1

MINIMUM REQUIRED INCIDENT AIR VELOCITIES (V_t)

(m/s)

1	2	3	4	5
0.72	1.44	2.16	2.88	3.60

NOTE: 3.6 m/s is equivalent to a wind speed of 12.96 Km/hr.

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E6 CALCULATION

The flow coefficient (C_f) shall be calculated in accordance with the following equation:

$$C_f = V_v / V_i \quad \ldots \text{E1}$$

where

C_f = flow coefficient

V_v = velocity through test specimen, m/s

V_i = velocity in free field incident on the ventilator, m/s

The flow coefficient of the ventilator shall be calculated as the arithmetic mean of the five calculated flow coefficients $(C_f)_i$, where i = 1 to 5.

E7 ALTERNATIVE PROCEDURE

All type tests shall be carried out in accordance with the procedure of Paragraph E6

As an alternative to the procedure indicative performance of a ventilator may be provided by wind tunnel testing. Where wind tunnel testing is undertaken the following limitations shall be observed:

(a) The unit shall be mounted close to the mouth of the tunnel to minimize static pressure.

(b) The cross section of the unit shall be below 15% of the tunnel cross section to reduce blockage effects.

In case of dispute, the procedure of Paragraph E6 shall be the referee procedure.

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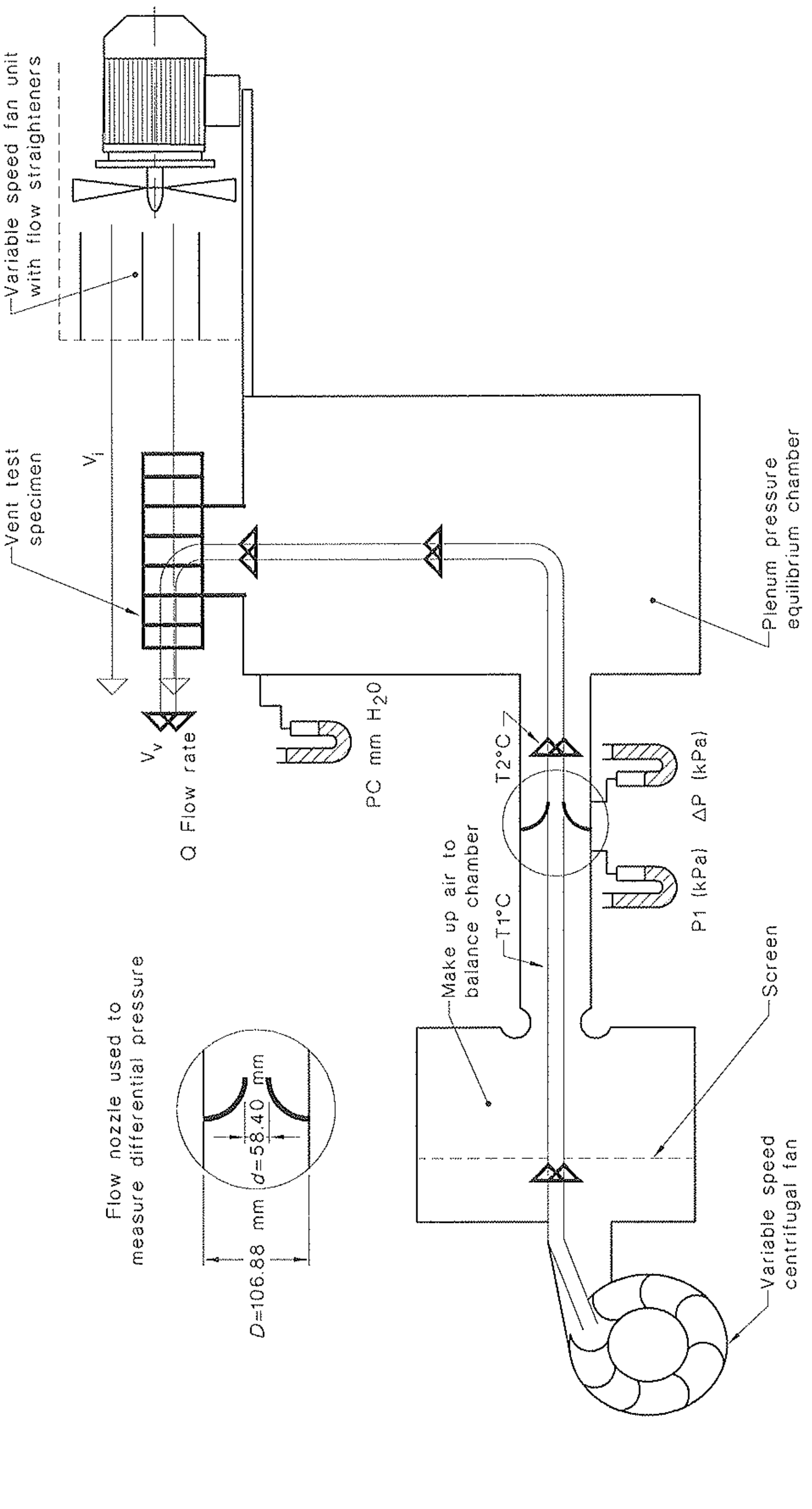

FIGURE E1 FLOW COEFFICIENT TESTING

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APPENDIX F

DETERMINATION OF WIND LOADING RESISTANCE—TYPE 1 VENTILATORS

(Normative)

F1 SCOPE

This Appendix sets out the method for determining the ability of a Type 1 ventilator to maintain structural integrity under anticipated wind loads.

F2 PRINCIPLE

The ventilator is mounted in a frame or on a panel and a uniformly distributed load applied using positive pressure or a static load to simulate the action of wind forces. Four levels of performance requirements are included.

F3 APPARATUS

The following apparatus shall be required:

(a) A air chamber.

(b) A test rig onto which the test specimen can be mounted and subjected to a uniformly distributed load.

(c) A method of applying a load by one of the following methods:

   (i) Air pressure.

   (ii) Air pressure bags.

   (iii) Bags containing not more than 10 kg of solid particle or liquids per bag.

F4 MOUNTING OF TEST SPECIMEN

F4.1 Air pressure test

The test specimen shall be mounted on, or as one face of, an air chamber with the outdoor face oriented to the greater air pressure. The test specimen shall be waterproofed and supported around the outside perimeter in the same manner and by the same fixing as intended for its installation in the building structure. Products intended to be installed with some or all of the free area blanked off shall be tested using static loads.

F4.2 Static load test

The test specimen shall be installed horizontally to simulate as near as possible the mounting procedure to be used in the building structure.

F5 TEST LOADS

The test specimen shall be subjected to the loads given in Table F1 as applicable.

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TABLE F1
TEST LOADS

Performance level	Test load	
	m/s	km/hr
1	57	205.2
2	44	158.4
3	31	111.6
4	16	57.6

F6 PROCEDURE

The procedure shall be as follows:

(a) Initially, apply a load using one of the methods given in Paragraph F3 equivalent to 100 Pa for a period of 2 min.

(b) Remove the load and measure and record the deflection of the ends and the midspan of the structural members.

(c) Increase the load from 0 to the appropriate upper limit (see Table F1) in steps equivalent to 100 Pa or multiples thereof.

(d) Maintain this load for 2 ±0.1 min.

(e) Remove the load and check the ventilator and fixing system for loosening of seals and fasteners, distortion of members or structural or functional damage. All observations shall be recorded in the test report.

F7 PASS CRITERIA

At the end of the test period the ventilator and fixing system shall be examined to ensure that functional and structural integrity has been maintained.

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APPENDIX G

DETERMINATION OF WIND LOADING RESISTANCE— TYPE 2 OR 3 VENTILATORS

(Normative)

G1 SCOPE

This Appendix sets out the method for determining the ability of a Type 2 or Type 3 ventilator to maintain integrity under anticipated wind loads.

G2 PRINCIPLE

The ventilator is mounted in a frame or on a panel and a uniformly distributed static load applied to simulate the action of wind forces. Four levels of performance requirements are included.

G3 APPARATUS

The following apparatus shall be required:

(a) A test rig onto which the test specimen can be mounted and subjected to a uniformly distributed load.

(b) A method of applying a load by one of the following methods:

- (i) Air pressure.
- (ii) Air pressure bags.
- (iii) Bags containing not more than 10 kg of solid particle or liquids per bag.

G4 MOUNTING OF TEST SPECIMEN

The test specimen shall be mounted on the test rig as intended for its installation in a building, and shall be waterproofed and supported around the outside perimeter in the same manner and by the same fixings as intended for its installation in the building structure.

G5 TEST LOADS

The test specimen shall be subjected to the loads given in Table G1 as applicable.

TABLE G1

TEST LOADS

Performance level	Test load	
	m/s	km/hr
1	57	205.2
2	44	158.4
3	31	111.6
4	16	57.6

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G6 PROCEDURE

The procedure shall be as follows:

(a) Apply a load using one of the methods given in Paragraph G3.

(b) Increase the load from 0 to the appropriate upper limit (see Table G1).

(c) Maintain this load for 2 ±0.1 min.

(d) Remove the load and check the ventilator and fixing system for permanent deformation and functional and structural integrity.

G7 PASS CRITERIA

At the end of the test period the ventilator and fixing system shall be examined to ensure that functional and structural integrity has been maintained.

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APPENDIX H

DETERMINATION OF WIND LOADING RESISTANCE—TYPE 2, 3, OR 4 VENTILATORS

(Normative)

H1 SCOPE

This Appendix sets out a method for determining the ability of a Type 2, 3 or 4 ventilator to maintain integrity under anticipated wind loads.

H2 PRINCIPLE

The ventilator is mounted in a wind tunnel or in a free field and the action of wind forces simulated. Four levels of performance requirements are included.

H3 APPARATUS

The following apparatus shall be required:

(a) A wind tunnel capable of producing the required air velocity over the test specimen; *or*

A wind generating device capable of producing the required air velocity over the test specimen.

(b) Airflow measurement devices to measure the airflow across the test specimen.

H4 MOUNTING OF THE TEST SPECIMEN

The test specimen shall be mounted in the wind tunnel or in a free field as intended for its installation in a building, and shall be waterproofed and supported around the outside perimeter in the same manner and by the same fixings as intended for its installation in the building structure.

H5 TEST LOADS

The test specimen shall be subjected to the loads given in Table H1, as applicable.

TABLE H1

TEST LOADS

Performance level	Test load	
	m/s	km/hr
1	57	205.2
2	44	158.4
3	31	111.6
4	16	57.6

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H6 PROCEDURE

The procedure shall be as follows:

(a) Apply an airflow increasing from 0 to the appropriate upper limit within 1 ±0.1 min.

(b) Maintain this air speed for 2 ±0.1 min.

(c) Reduce the airflow to 0 within 2 ±0.1 min.

(d) Check the ventilator and fixing system for permanent deformation.

H7 PASS CRITERIA

At the end of the test period the ventilator and fixing system shall be examined to ensure that it has maintained functional and structural integrity.

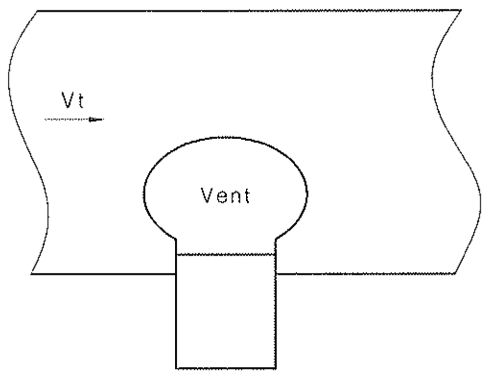

FIGURE H1 TEST SPECIMEN ORIENTATION

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APPENDIX I

MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Informative)

I1 SCOPE

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

(a) Evaluation by means of statistical sampling.

(b) The use of a product certification scheme.

(c) Assurance using the acceptability of the supplier's quality system.

(d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

I2 STATISTICAL SAMPLING

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

(a) The sample shall be drawn randomly from a population of product of known history. The history shall enable verification that the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.

(b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199, guidance to which is given in AS 1399.

I3 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in SAA HB18.28 (SANZ HB18.28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

I4 SUPPLIER'S QUALITY SYSTEM

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for a supplier's quality system or systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

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Guidance in determining the appropriate quality management system is given in AS/NZS ISO 9000.1 and AS/NZS ISO 9004.1.

I5 OTHER MEANS OF ASSESSMENT

If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed from the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform with the full requirements of the Standard.

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Standards Australia

PO Box 1055 Strathfield NSW 2135
Administration
Phone (02) 9746 4700
Fax (02) 9746 8450
Email mail@standards.com.au
Customer Service
Phone 1300 65 46 46
Fax 1300 65 49 49
Email sales@standards.com.au
Internet www.standards.com.au

STANDARDS NEW ZEALAND
Paerewa Aotearoa

Level 10 Radio New Zealand House
155 The Terrace Wellington 6001
(Private Bag 2439 Wellington 6020)
Phone (04) 498 5990
Fax (04) 498 5994
Customer Services (04) 498 5991
Information Service (04) 498 5992
Email snz@standards.co.nz
Internet www.standards.co.nz

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