ANSI/AMCA Standard 550-15

Test Method for High Velocity Wind Driven Rain Resistant Louvers

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AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL INC.

The International Authority on Air System Components

ANSI/AMCA Standard 550-15

Test Method for High Velocity Wind Driven Rain Resistant Louvers

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Related AMCA Documents

Related Publications	AMCA Publication 501	*Application Manual for Louvers*
	AMCA Publication 511	*Certified Ratings Program - Product Rating Manual for Air Control Devices*
	AMCA Publication 512	*AMCA Listing Label Program*
Related Standards	ANSI/AMCA Standard 500-L	*Laboratory Methods of Testing Louvers for Rating*
	ANSI/AMCA Standard 540	*Test Method for Louvers Impacted by Wind Borne Debris*

Contents

Test Method for High Velocity Wind Driven Rain Resistant Louvers

1. Purpose

This standard establishes uniform laboratory test methods and minimum performance ratings for water rejection capabilities of louvers intended to be used in high velocity wind conditions.

2. Scope

Tests conducted in accordance with the requirements of this standard are intended to demonstrate the acceptability of the louver in which water infiltration must be kept to manageable amounts during a high velocity wind driven rain event. The test specimen can be approved in either an open or closed position as stated in Section 5.

3. Units of Measurement

3.1 System of units

SI units (The International System of Units, *Le Systéme International d'Unités*) are the primary units employed in this standard, with I-P units (inch-pound) given as the secondary reference. SI units are based on the fundamental values of the International Bureau of Weights and Measures, and I-P values are based on the values of the National Institute of Standards and Technology which are, in turn, based on the values of the International Bureau.

3.2 Basic units

The SI unit of length is the meter (m) or millimeter (mm); the I-P unit of length is the foot (ft) or the inch (in.). The SI unit of mass is the kilogram (kg); the I-P unit of mass is the pound mass (lbm). The unit of time is either the minute (min) or the second (s). The SI unit of temperature is either the degree Celsius (°C) or kelvin (K); The I-P unit of temperature is either the degree Fahrenheit (°F) or the degree Rankine (°R).

3.3 Airflow rate and velocity

3.3.1 Airflow rate

The SI unit of volumetric airflow rate is the cubic meter per second (m^3/s); the I-P unit of volumetric flow rate is the cubic foot per minute (cfm).

3.3.2 Airflow velocity

The SI unit of airflow velocity is the meter per second (m/s); the I-P unit of airflow velocity is the foot per minute (fpm).

3.4 Water flow rate

The SI unit of liquid volume is the liter (L); the I-P unit of liquid volume is the gallon (gal). The SI unit of liquid flow rate is the liter per second (L/s); the I-P unit is the gallon per minute (gpm).

3.5 Dimensionless groups

Various dimensionless quantities appear in the text. Any consistent system of units may be employed to evaluate these quantities unless a numerical factor is included, in which case units must be as specified.

3.6 Physical constants

The density of distilled water at saturation pressure shall be taken as 998.278 kg/m^3 (62.3205 lbm/ft^3) at 20 °C (68 °F). The density of mercury at saturation pressure shall be taken at 13595.1 kg/m^3 (848.714 lbm/ft^3) at 0 °C (32°F). The specific weights in kg/m^3 (lbm/ft^3) of these fluids under standard gravity in a vacuum are numerically equal to their densities at corresponding temperatures.

4. Definitions

4.1 Louver

A louver is a device comprised of multiple blades. When mounted in an opening, a louver permits the flow of air but inhibits the entrance of other elements.

4.2 Specimen

The test specimen is a representative sample of the louver model design and is intended to evaluate the water rejection capability of the louver model.

4.3 Performance variables

4.3.1 Water infiltration

The amount of water passing through a louver during the test.

4.3.2 Rain fall simulation

As calculated in Section 7.2.3 and Section 7.2.5.

4.3.3 Wind stream velocity

The movement rate of air generated during the test.

5. Test Specimen

One 1000 mm x 1000 mm (39.37 in. x 39.37 in.) core area louver test specimen (as defined in ANSI/AMCA Standard 500-L) shall be submitted for this high velocity wind driven rain test. The same test specimen, or an identical test specimen, shall be tested in the full open position in accordance with the wind driven rain test detailed in ANSI/AMCA Standard 500-L and run at 22 m/s (50 mph) and 203.2 mm/hr (8 in./hr) of rainfall. Operable louvers intended to be shut during a high velocity wind driven rain test can be closed for that test but must be open for the AMCA 500-L wind driven rain test. Louvers such as this will need to be clearly identified on its test report, submittal and installation instructions for this qualification.

Test specimens shall be as built, unpainted, clean, degreased and without additional factory-applied coating on the specimens' surfaces that would enhance water shedding capability. All devices tested shall be without a screen across the air passages of the louver.

The test specimen is any fixed, operable, or combination (fixed and operable) blade louver. The test specimen may also have the following devices attached directly or indirectly to the louver during testing and all are considered part of the test specimen: additional louver(s), damper(s), and sleeves. Sill pan(s)/flashing(s) may be used during testing and are considered part of the test specimen. All types of seals on items, such as blades, jambs, head/sill, blade stops, and caulking, are considered part of the test specimen, excluding sealing between the test specimen and test wall.

Items such as an actuator, lever arm, manual operating lever and/or turnbuckle used to keep operable louver/damper blades in the open/closed position are allowed during testing, but these items shall not be considered as part of the test specimen.

When all blades are in the full open position, the horizontal distance between blades of any device and adjacent louver/device shall not exceed 76.2 mm (3 in.). The back of the test specimen's frame/sleeve shall be at least 610 mm (24 in.) from the back of the test chamber.

5.1 Compliance of other sizes and variations

Manufacturing of sizes other than that which was tested shall utilize the same assembly methods of construction as it pertains to fasteners (e.g., types, sizes and spacing). The distances between components/devices shall be the same as the test specimen.

Testing of the louver specimen per this standard does not guarantee an equivalent test result for other sizes.

The pass/fail compliance of a louver model only applies to the specific test specimen setup tested. Therefore, alternate designs, components, devices, etc. to a previously tested louver model will require an additional complete test to this standard. Additions to the specific test specimen setup (such as bird or insect screens, blank-offs, or security bars) do not void the compliance of a louver model.

6. Apparatus

6.1 Test frame

6.1.1
The test frame shall be constructed of CMU blocks with a minimum size of 2.45 m x 2.45 m (8 ft x 8 ft) and a hole as shown in Figure 1 to allow the insertion of the louver.

A catch basin shall be constructed behind the louver, as shown in Figure 1, to catch the water that penetrates the louver.

6.1.2
The test frame shall be painted to prevent water from penetrating the test apparatus.

6.1.3
The test frame shall be rigidly supported during the test period.

6.2 Wind generator

6.2.1
The wind generator shall provide a constant wind profile over the entire face of the louver for the specified time period to a maximum wind stream velocity of 49 m/s (110 mph).

6.2.2
If the wind generator is unable to provide the required constant profile as determined by wind stream calibration (Section 7.1), air flow from the wind generator shall be directed and smoothed by suitably shaped baffles (see Figure 2).

6.3 Water supply

6.3.1
Water shall be supplied to the wind stream using a sprinkle pipe system mounted on a movable frame capable of simulating a uniform 223.5 mm/hr (8.8 in./hr) of rainfall over the test specimen. The simulated rainfall and flow meters shall be calibrated, and the water distribution shall be checked as noted in Section 7.2 and 7.3.

7. Calibration

7.1 Wind stream calibration

7.1.1
The wind stream velocity shall be measured on a vertical plane grid having dimensions of 2.44 m wide x 1.22 m high (8 ft wide x 4 ft high) and grid dimensions of 610 mm x 610 mm (24 in. x 24 in.), located 610 mm (24 in.) in front of the test frame (without the test specimen in place) with the lower 2.44 m (8 ft) dimension in line with the bottom edge of the test frame opening. (See Figure 3.)

7.1.2
The measured wind stream velocity at the center of each grid square shall be within ±10% of the required axial velocity for each wind speed.

7.1.3
Upon completion of the wind stream calibration, the distance from the test frame to the outlet of the wind generator and any necessary baffle configurations shall be noted and maintained while conducting the test as described in Section 8. These dimensions should be noted in the test report under calibration data and calculations.

7.2 Rainfall simulation and flow meter calibration

A maximum of six months prior to conducting the test, the flow meter(s) shall be calibrated using the method described in Section 7.2.1 through Section 7.2.6.

7.2.1
Prepare an apparatus to capture any water which would enter the wind stream during an actual test.

7.2.2
Commence water insertion for a period of one minute and capture the water. Record the flow meter reading (gal/min) during this process.

7.2.3
Convert the flow meter reading to rainfall simulation using the following formula:

$$\left[\frac{\left(\frac{\text{L}}{\text{min}}\right)\times\left(\frac{60\text{ min}}{1\text{ hour}}\right)\times\left(\frac{1{,}000{,}000\text{ mm}^3}{\text{L}}\right)}{4{,}459{,}346\text{ mm}^2}\right]=x\left(\frac{\text{mm}}{\text{hour}}\right)\quad\text{Eq. 7.2.3 SI}$$

$$\left[\frac{\left(\frac{\text{gallons}}{\text{min.}}\right)\times\left(\frac{60\text{ min.}}{1\text{ hour}}\right)\times\left(\frac{231\text{ in.}^3}{1\text{ gallon}}\right)}{6{,}912\text{ in.}^2}\right]=x\left(\frac{\text{in.}}{\text{hour}}\right)\quad\text{Eq. 7.2.3 I-P}$$

Note: For Equation 7.2.3 SI and Equation 7.2.3 I-P, 4,459,346 mm^2 and 6,912 $in.^2$ refer to the expected projection area of the water that hits the wall, respectively.

7.2.4
The quantity of rainfall simulation determined in Section 7.2.3 shall be within ±5% of the desired rainfall simulation of 223.5 mm/hr (8.8 in./hr).

7.2.5
Measure the volume of water (mm^3 [$in.^3$]) captured and convert this to rainfall simulation (mm/hr [in./hr]) using the following formula:

$$\left[\frac{\left(\frac{\text{mm}^3}{4{,}459{,}346\text{ mm}^2}\right)}{1\text{ min}}\right]\times\left(\frac{60\text{ min}}{1\text{ hour}}\right)=y\left(\frac{\text{mm}}{\text{hour}}\right)\quad\text{Eq. 7.2.5 SI}$$

$$\left[\frac{\left(\frac{\text{in.}^3}{6{,}912\text{ in.}^2}\right)}{1\text{ min.}}\right]\times\left(\frac{60\text{ min.}}{1\text{ hour}}\right)=y\left(\frac{\text{in.}}{\text{hour}}\right)\quad\text{Eq. 7.2.5 I-P}$$

Note: For Equation 7.2.5 SI and Equation 7.2.5 I-P, 4,459,346 mm^2 and 6,912 $in.^2$ refer to the expected projection area of the water that hits the wall, respectively.

7.2.6
The rainfall simulation determined in Section 7.2.3 (x) shall be within ±5% of the rainfall simulation determined in Section 7.2.5 (*y*).

7.3 Water distribution check

A maximum of six months prior to conducting the test, the water distribution check over the 2.44 m wide x 1.22 m high [8 ft wide x 4 ft high]) wall surface shall be calibrated using the method outlined herein. The water distribution system must introduce water into the wind stream so that it strikes the wall area.

7.3.1
Prepare eight 610 mm (24 in.) squares of the absorptive material (e.g., roofing felt) and weigh each sample. From this data, determine the average weight of the samples. As an alternative, depending on the consistency of the weight of the absorptive material, each square used for calibration may be weighed individually.

7.3.2
Lay out the eight numbered squares of absorptive material (e.g., roofing felt) as shown in Figure 4. Put the hold-down frame over the squares of absorptive material.

7.3.3
Set the wind speed to 15.65 m/s (35 mph) and add water to

Table 1
Wind Stream Velocity and Water Spray Intervals for High Velocity Wind Driven Rain Resistance Testing

Interval #	Wind Speed m/s (mph)	Time (min)	Water Spray
1	15.6 (35)	15	On
2	0 (0)	5	Off
3	31.3 (70)	15	On
4	0 (0)	5	Off
5	40.2 (90)	15	On
6	0 (0)	5	Off
7	49.2 (110)	5	On
8	0 (0)	5	Off

the windstream at a constant rate, as indicated on the flow meter, until the absorptive material is well wetted but not so that it is saturated, at which time the wind and water flow shall be terminated.

7.3.4
Remove the hold-down frame from the wall and rapidly weigh the squares of wet absorptive material. Determine the weight of water absorbed by each square sample at the particular wind speed and flow meter setting.

7.3.5
No one particular square sample shall exhibit rainfall simulation, measured in weight, greater than or less than 25% of the average wetted weight of all eight squares.

7.3.6
Repeat the steps in Sections 7.3.1–7.3.5 at a wind speed of 31.3 m/s (70 mph).

7.4 Instruments
Instruments used in this test shall be calibrated, by means of the manufacturer's specifications, a maximum of 12 months prior to conducting the test.

8. Test Procedures

8.1
The louver to be tested shall be mounted and sealed as recommended by the manufacturer in the test frame to prevent any ingress of water other than through the louver blades.

The test specimen shall be fully open for the AMCA 500-L 50 mph, 8.0 in/hr test. The test specimen may be closed during the high velocity wind driven rain testing sequence outlined in Table 1.

8.2
The wind stream velocity intervals shall be conducted as noted in Table 1.

8.3
Water shall be added to the wind stream upon commencement of the initial wind stream velocity in an even spray at a rate equal to 223.5 mm/hr (8.8 in./hr) of rainfall over the test specimen. The flow of water shall be measured with a calibrated flow meter during the test procedure to confirm water flow. Water flow shall be stopped and started in conjunction with the air flow intervals noted in Table 1.

8.4
The water penetrating the louver at each wind stream velocity shall be collected and measured.

9. Report and Results of Test

The test report shall be submitted in its entirety and shall include, at a minimum, the following:

1. Date of test, date of report and a unique identification number, with the identification number printed on each page.

2. The name(s) of the author of the report.

3. a. Name and location of the facility performing the test and the name and address of the requester of the test.

   b. Names of the individuals performing the test and any witnesses.

4. Consecutive page numbers, with an indication of the total number of pages.

5. The test standard designation, including the date of issue, and an explanation detailing any derivation from the standard.

6. A signature, including titles, and date from both the professional engineer authorizing the test report and the lab technician.

7. A description of the louver, including:

   a. The model number

   b. Any drawings and photographs of the louver

   c. A detailed report of the method of installation (including fasteners and caulk)

   d. If there is a damper or operable blade louver (if so, the position of operable blades shall be listed as fully open or fully closed)

   e. Any other items, such as a sill pan/flashing, including detailed dimensions and descriptions

   f. If used, a description of the device used to keep operable blades fully closed shall be listed

8. Detailed drawings of the test specimen, showing dimensioned section profiles, blade to frame connection details, frame to frame connection details (corners), fasteners and any other pertinent construction details.

9. Any deviation from the drawings or any modifications made to the test specimen to obtain the reported values, which shall be noted on the drawings and in the report.

For each sample, the following items on the manufacturer-supplied drawing should be checked against the test specimen:

10. Full sample

    a. Louver overall width

    b. Louver overall height

    c. Louver depth

    d. Blade spacing

11. For head frame, jamb frame, sill, blades and other components, verify

    a. Material (aluminum components are aluminum, steel components are steel, etc., not checking chemical composition)

    b. Width of component

    c. Depth of component

    d. Thickness of component (two locations)

    e. Features and shape of component visually matches drawing

    Unverifiable components must be documented in report

12. For connection details, verify

    a. Blade to frame connections

    b. Sill to jamb connections

    c. Head to jamb connections

    (Verification shall consist of visually inspecting weld sizes and lengths)

    (Verification shall consist of inspecting fastener diameters and lengths

    d. Other connections shown on manufacturer's drawings

13. Calibration data and calculations.

14. Detailed observations of any water infiltration. Observations should include the total volume of water which infiltrated the louver at each test speed.

15. The calculated percentage of water which infiltrated the louver based on the total amount of water sprayed at the test apparatus.

16. A determination of "pass – fully open," "pass – fully closed" or "fail" based on whether or not the test specimen exhibits water infiltration in excess of 1% of the total water sprayed.

17. A statement that the laboratory is in possession of a video recording of the test intervals (see Table 1). The video recording shall be retained by the laboratory for a minimum period of five years from the test report date.

18. Photographs of the louver immediately prior to and subsequent to commencement and termination of the test.

19. All data not required herein but useful to a better understanding of the test results, conclusions or recommendations appended to the report.

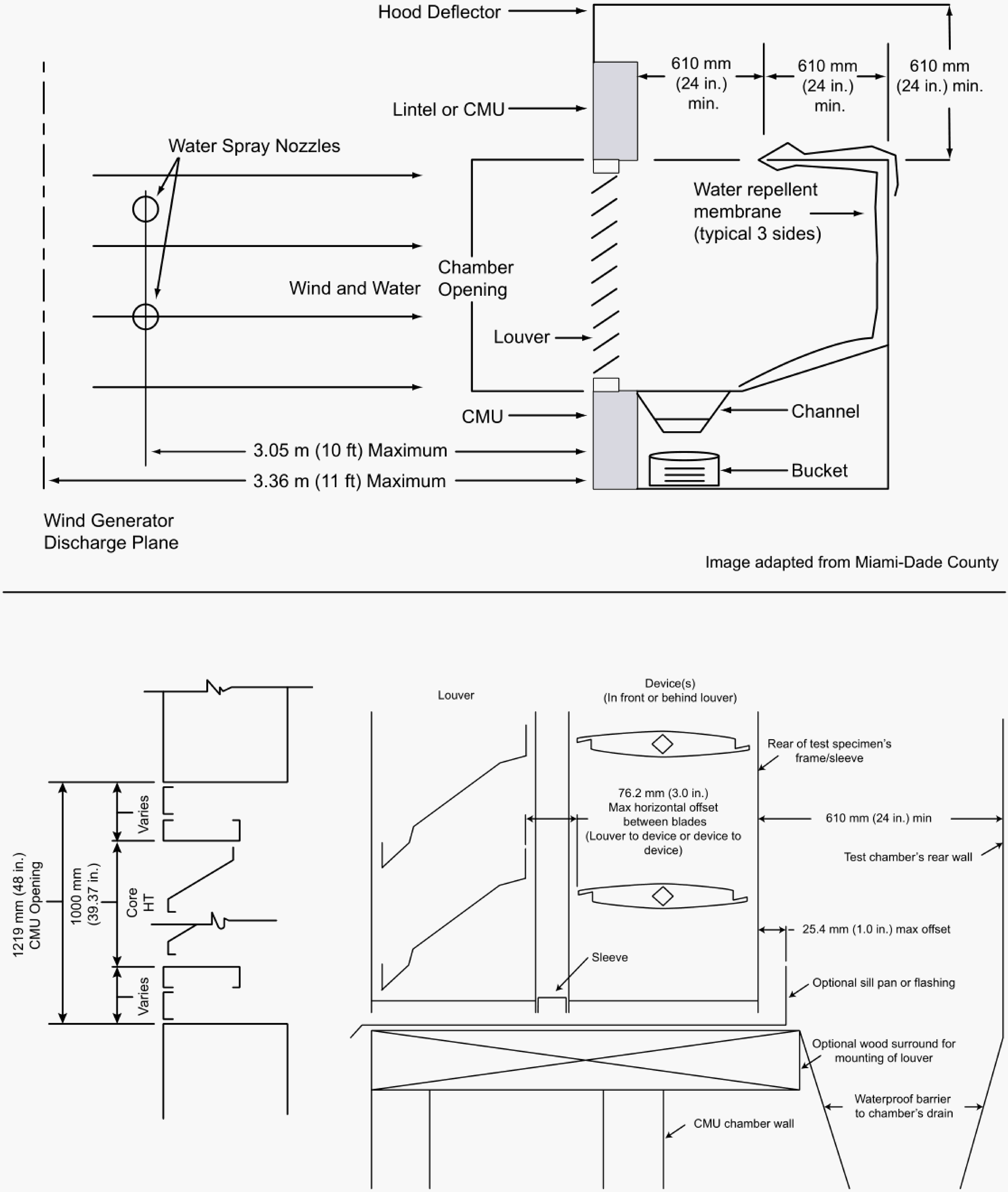

Figure 1
High Velocity Wind Driven Rain Test Setup

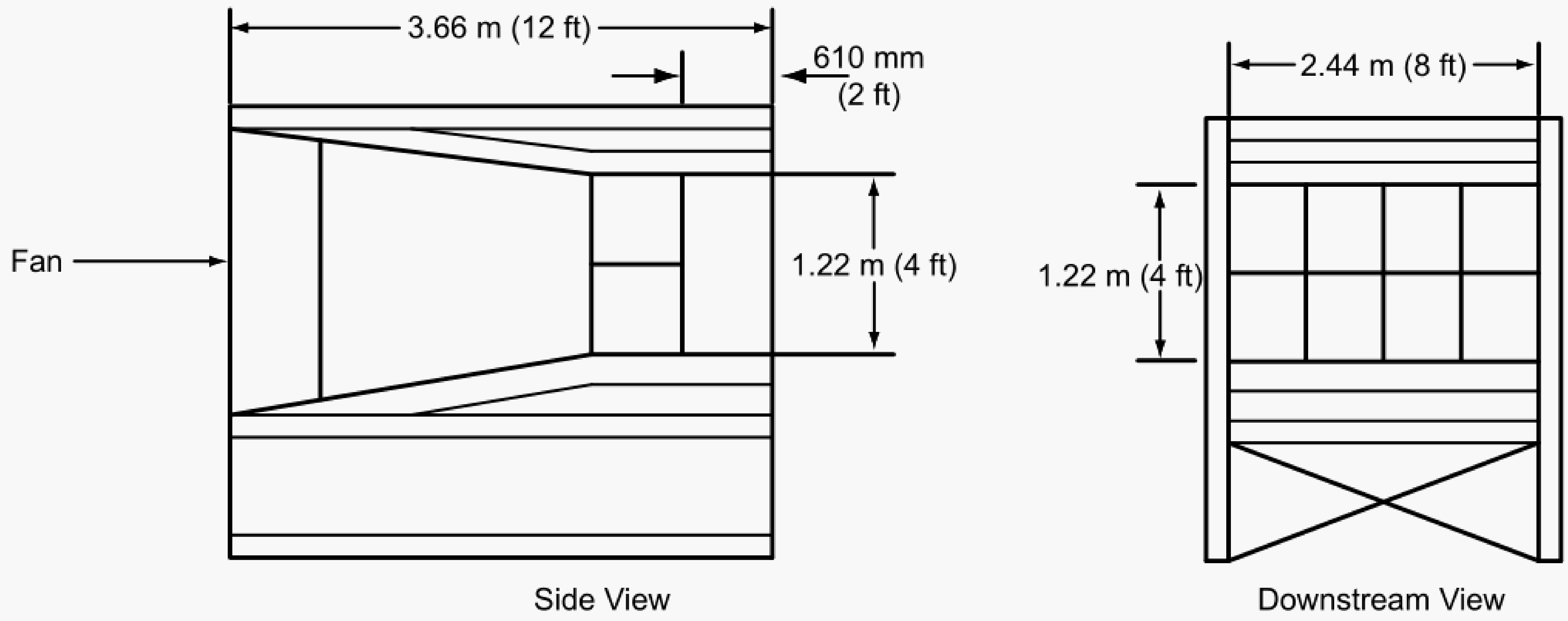

Figure 2
Wind Tunnel with Baffles

Florida Test Protocol TAS No. 100(A)-95

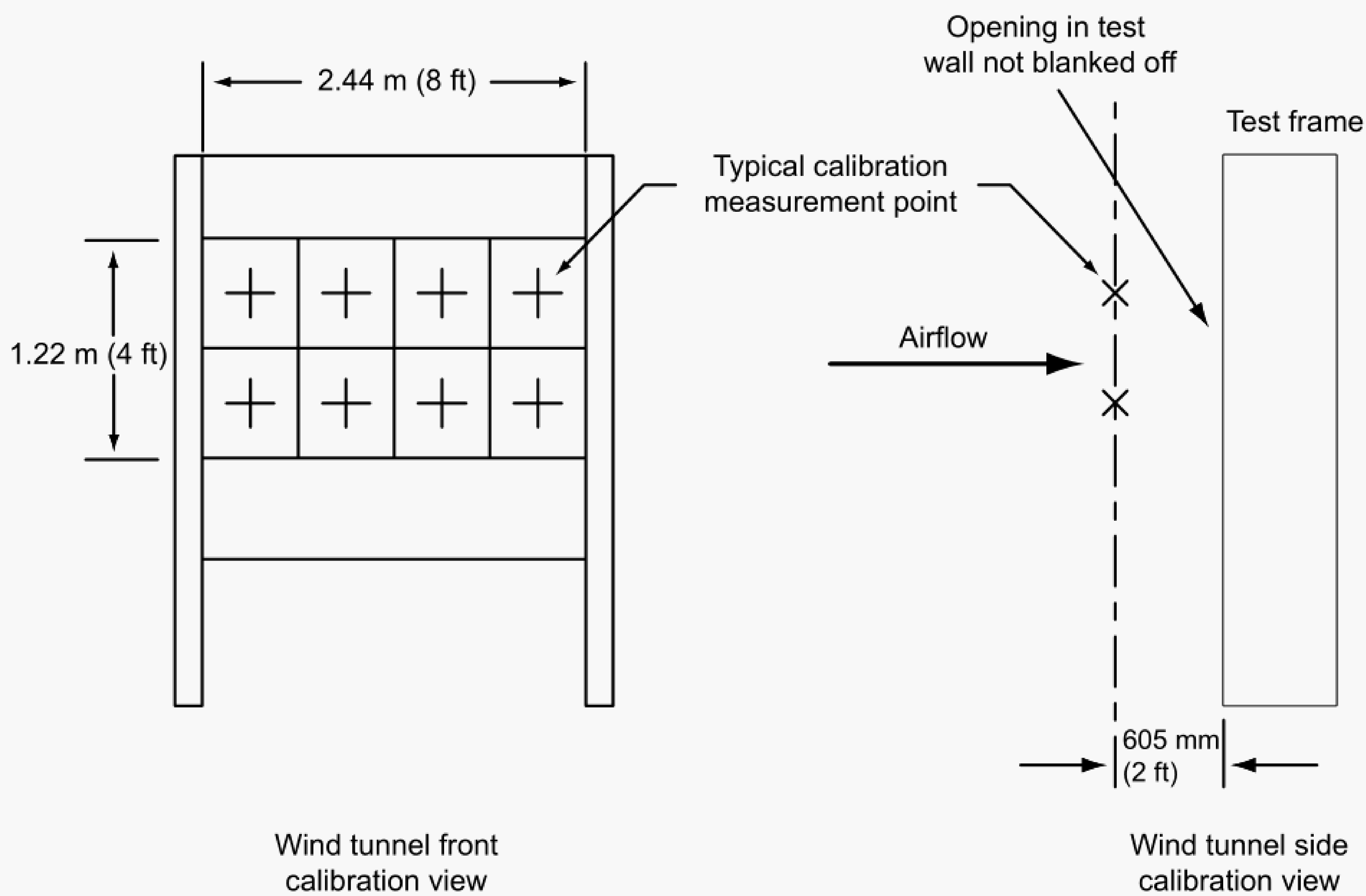

Figure 3
Wind Stream Calibration Setup

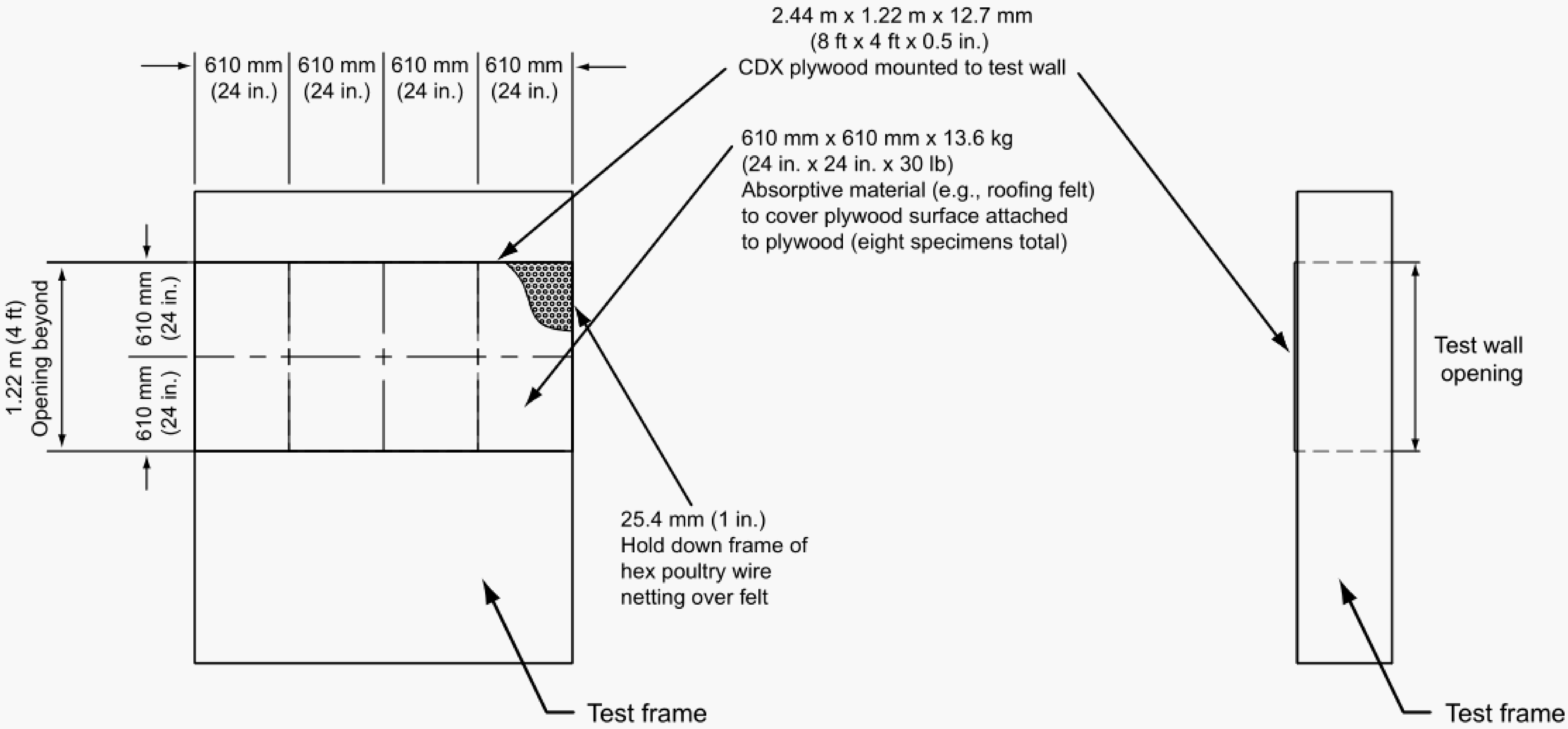

Figure 4
Rainfall Calibration Distribution

Annex A
References (Informative)

Page, C. H. and P. Vigoureux. *The International System of Units (SI): NBS Special Publication 330.* Washington D.C.:National Bureau of Standards,1972.

"Test Procedure for Wind and Wind Driven Rain Resistance and/or Increased Windspeed Resistance of Soffit Ventilation Strip and Continuous or Intermittent Ventilation System Installed at the Ridge Area." *Florida Test Protocol TAS No. 100(A)-95.* Washington, DC: International Code Council, 1995.

ANSI/AMCA Standard 500-L-12, *Laboratory Methods of Testing Louvers for Rating.* Arlington Hts., IL: AMCA Int'l, 2012.

"Checklist #0240 for the Approval of: Louvers (Included Gable End Louvers)." Miami: Miami Dade County, 2012

Annex B
Reason for Two Louver Test Standards (Informative)

The requirement to test the louvers to two test criteria is based upon the need for the louver to perform at two conditions: during normal operation and during a hurricane.

A product could be designed for hurricane or high wind conditions but be unsuitable for normal day to day operation due to its high pressure drop and energy requirements.

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