STANDARD

ANSI/AMCA Standard 280-26

Test Methods for Wind Resistance and Impact Resistance for Fans and Ventilators

An American National Standard
Approved by ANSI on February 23, 2026

Air Movement and Control Association International

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Test Methods for Wind Resistance and Impact Resistance for Fans and Ventilators

1. Purpose

To establish uniform methods for laboratory testing of wind resistance and missile debris impact resistance of non-embedded fans and ventilators whose failure would compromise the integrity of the building envelope.

2. Scope

Tests conducted in accordance with this standard are intended to demonstrate the capability of a fan, powered ventilator, or unpowered ventilator mounted externally to a building to withstand wind pressure (lateral and/or uplift), missile impact(s), or both. The test methodology, pass/fail criteria, and functional criteria are defined. The wind pressure test methodology in this standard is intended to demonstrate a fan or ventilator's ability to sufficiently retain its structural integrity, functionality, and maintain integrity of the building envelope. The missile debris impact test methodology in this standard is intended to demonstrate a fan or ventilator's ability to maintain structural integrity of its housing and components attached to it.

3. Normative References

The following documents contain provisions that, through specific reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in this section. Note that codes and standards that reference AMCA 280 may reference different editions of the standards listed in this section.

- ASCE 7-22, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, American Society of Civil Engineers, Reston, VA 2022.
- ASTM E1886-19, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials, American Society of Testing and Materials, West Conshohocken, PA, 2019.
- ASTM E1996-23, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes, American Society of Testing and Materials, West Conshohocken, PA, 2019.

4. Definitions and Symbols

4.1 Definitions

Reference AMCA-99 for terms not defined in this section. For this standard, the definitions in this section apply:

4.1.1 Access door

A door that allows access for inspection, maintenance, or repair.

4.1.2 Access panel
A removable panel that allows access for inspection, maintenance, or repair.

4.1.3 Air
A mixture of various gases forming the earth's atmosphere and commonly used to denote any gaseous medium measured, moved or controlled in an HVAC system.

4.1.4 Barometric pressure
The absolute pressure exerted by the atmosphere at a location of measurement.

4.1.5 Basic protection
An impact rating given to a fan or ventilator by testing to Missile Level 'D.'

4.1.6 Building envelope
Exterior boundary of a building that acts as the physical barrier separating the interior space from the external environment.

4.1.7 Dry-bulb temperature
Air temperature measured by a temperature-sensing device without modifications to compensate for the effects of humidity.

4.1.8 Enhanced protection
An impact rating given to a fan or ventilator by testing to Missile Level 'E'.

4.1.9 Essential facilities
See ASTM E1996-23 section 6.2.1.1.

4.1.10 Fan
A device that utilizes a power-driven rotating impeller for moving air or gases. The internal energy (enthalpy) increase imparted by a fan to a gas does not exceed 25 kJ/kg (10.75 BTU/lbm).

4.1.11 Curb
A raised/extended frame that supports a fan or ventilator.

4.1.12 Fan guard
A screen or other device used to prevent ingestion of objects at the fan inlet or outlet.

4.1.13 Housing
A stationary enclosure of a fan or ventilator having an inlet and an outlet that the fluid being handled flows through.

4.1.14 Lateral loading
Forces acting in a direction parallel to the surface the fan is installed on.

4.1.15 Largest qualified size
The maximum physical size fan or ventilator that can be qualified using this standard.

4.1.16 Outlet nozzle
The converging section on a discharge of a fan, whose purpose is to increase the velocity of the exhaust air.

4.1.17 Shall and should
In AMCA standards, the word "shall" is understood to be normative; the word "should" as advisory.

4.1.18 Smallest qualified size
The minimum physical size fan or ventilator that can be qualified using this standard.

4.1.19 Uplift loading
Forces acting in a direction perpendicular and away from the surface the fan is installed on.

4.1.20 Ventilator
A powered or non-powered device that supplies air or gas to a space or removes air or gas from a space.

4.1.21 Weather hood
A covering intended to protect component(s) from the environment.

4.1.22 Windband
A device at the discharge of a fan that may facilitate induction of ambient air mixing with exhaust air and may protect components at the discharge of the fan from wind.

5. Instrumentation and Measurements

5.1 Equipment calibration
All equipment used to measure load, deflection, velocity, and mass shall be calibrated by a qualified agency at a maximum calibration interval of two years or at the maximum calibration interval recommended by the equipment manufacturer, whichever is shorter. Equipment calibration must be traceable to NIST, or a nationally recognized NIST equivalent.

6. Large Missile Impact Test

6.1 Test specimens
All parts of the test specimen shall be full size, using the same materials, details, methods of construction and methods of attachment as proposed for actual use. The specimen shall consist of the entire assembled unit and shall contain all devices used to make the product resistant to wind forces. The test specimen shall include fasteners and anchorage identical to the actual intended installation as defined by the manufacturer.

All additional devices that are chosen to be employed in the test (e.g., curbs and hardware) will become part of the acceptance.

The test specimen shall be assembled per the manufacturer's instructions.

6.1.1 Minimum number of specimens
A minimum of two specimens, the largest and smallest size to be qualified, shall be impacted. Testing shall also be performed on the design most susceptible to failure of each distinct product design. Any change that affects the structural or material characteristics, or geometric proportionality, excluding features that are invariant across sizes, of the product shall constitute a distinct product design.

6.1.2 Additional specimen due to a test specimen failure
One additional specimen may be submitted for testing should any originally submitted specimen described in Section 6.1 fail any impact portion of the BSR/AMCA Standard 280 testing. Pass/fail and functional criteria are described in Section 8.

6.2 Test methods

6.2.1 Specimens
Unless required differently by BSR/AMCA Standard 280, the specimens and test methods shall comply with sections 3, 4, 6, 7, 9, 11 and 13 of ASTM E1886. Rotation of the test sample is permissible to overcome test laboratory width/height limitations.

6.2.2 Missile
The test requester shall be required to declare a missile level and corresponding protection level from Table 1 for the test specimen prior to impact testing.

Natural rotation of a missile in flight is common. It shall be permitted to position the missile in the propulsion device so the missile has a higher chance of impacting the target location(s) within tolerance. See Figures 6.2A – 6.2E.

Table 1 — Missiles

Missile Level	Protection Level	Missile	Impact Speed
D	Basic	4100 g ± 100 g (9.0 lb ± 0.25 lb) 2x4 in. 2.4 m ± 100 mm (8 ft ± 4 in.) lumber	15.25 m/s (50 ft/s) ± 2%
E	Enhanced	4100 g ± 100 g (9.0 lb ± 0.25 lb) 2x4 in. 2.4 m ± 100 mm (8 ft ± 4 in.) lumber	24.38 m/s (80 ft/s) ± 1%

6.2.3 Locations of impact
Each test specimen requires a minimum of two impacts: a center and corner impact.

The initial contact between the missile and the test specimen shall be in such a way that the entire leading face of the missile shall impact within a 254 mm (10 in.) diameter tolerance circle, perpendicular to the missile flight path.

Once the leading face of the missile impacts the test specimen within the tolerance circle, it is permissible for the missile to contact parts of the test specimen located outside of the tolerance circle.

For impacts on curved and/or sloped surfaces the tolerance circle shall be projected onto the curved and/or sloped surface. See Figures 6.1A – 6.1C.

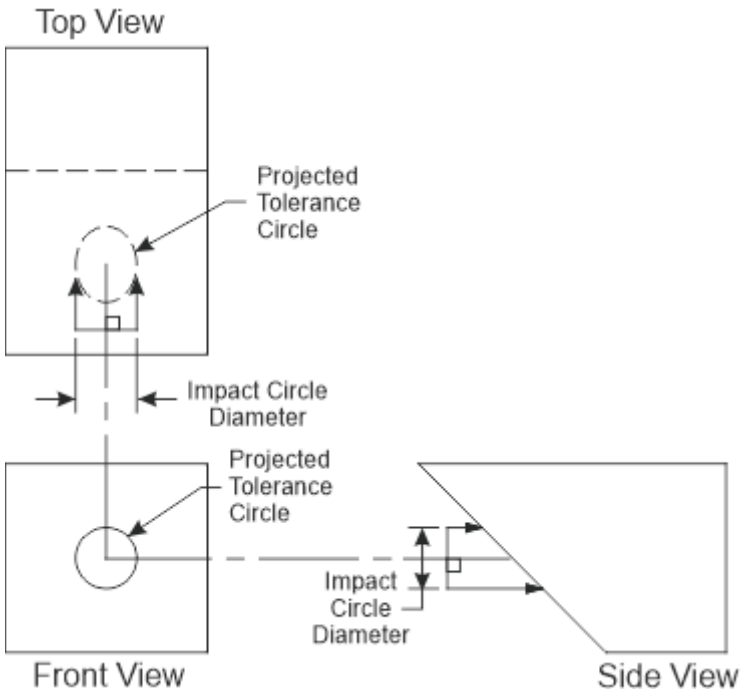

Figure 6.1A – Tolerance Circle on Sloped Surface

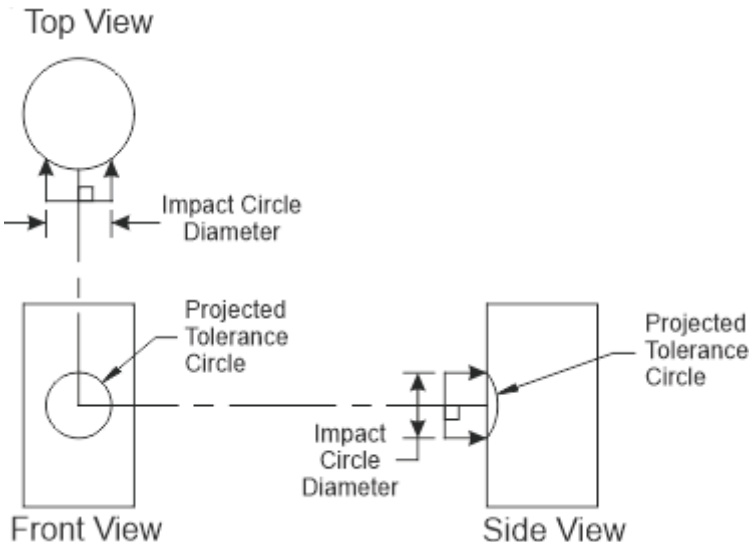

Figure 6.1B – Tolerance Circle on Curved Surface

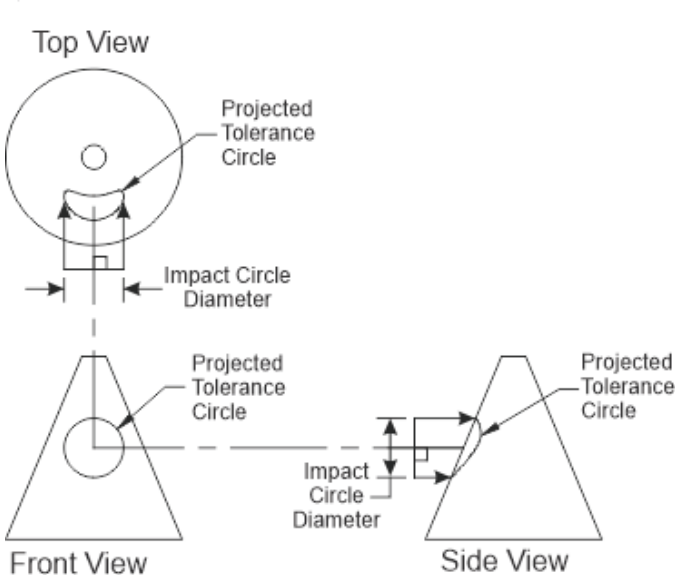

Figure 6.1C – Tolerance Circle on Conical (Curved and Sloped) Surface

A center impact is required and shall be within a 254 mm (10 in.) diameter tolerance circle with the center of the circle located at the geometric center of the test specimen's housing.

A corner impact is required and shall be within a 254 mm 10 in. diameter tolerance circle with the center of the circle located 150 mm (6 in.) vertically and horizontally from the corner of the test specimen's housing. The offsets shall be made from the innermost edge of any vertical and horizontal corner support members.

The missile shall impact +/- 5 degrees from horizontal to the entire test specimen, even if the impacted surface is sloped.

The following additional impact locations are required if applicable and impact location target point is not within 127 mm (5 in.) of the center or corner impact location target points:

- An additional impact shall be required if the center of the location's target circle is also located on a support member. Center and corner impacts may each require an additional impact. The additional impact shall be as described below:
  - An additional center impact shall be within a 10 in. (254 mm) diameter tolerance circle, with the center of the circle located at mid-span between the two supporting members (vertical and horizontal inclusively) which are separated the greatest distance from each other. The edges/corner of the test specimen shall be considered supporting members even if no additional support is located at the corner/edge.
  - An additional corner impact shall be within a 10 in. (254 mm) diameter tolerance circle, with the center of the circle shifted 6 in. (150 mm) inward from the inner edge the supporting/frame member.

- The thinnest location of each material type on the exterior of the test specimen shall be impacted. The impact location should be the farthest point possible of any stiffening features and/or supports on that component.
- The largest access door of each material thickness, material type, and mounting method (e.g., welded, bolted, hinged) must be impacted at the center.
- Enclosure components like access panels, covers, weather hoods, louvers, and breather tubes, that are sufficiently large to fully contain the entire tolerance circle within their boundaries, shall

be impacted. The largest panel of each material thickness, each material type, and each mounting method (e.g., welded, bolted, hinged) must be impacted both at the center and corner.

- Fan housings that are not symmetric about two planes perpendicular to one another (e.g., scrolled centrifugal fans) require the center impact and corner impact and an additional impact on the center of the adjacent side of the test specimen.
- If an outlet nozzle and/or windband is included with the test specimen, the geometric center of each of these components must be impacted.
- If a curb is included with the test specimen, the curb must be impacted at the center of the largest side and top corner of any side. If the center impact location contains a stiffening feature or support, the impact location shall be repositioned as far as possible from any stiffening features and/or supports.

6.2.4 Examples of impact locations

Depending on the type and construction of the test specimen, impact locations and the number of required impacts may vary. Figures 6.2A – 6.2E provide some example impact locations. Some impact locations may not be included in the images shown. In these examples:

A: Center impact on fan housing
B: Corner impact on fan housing
C: Impact on enclosure component, weather hood, or windband
D: Center impact on curb
E: Corner impact on curb

Figure 6.2A -- Upblast fans with and without curb

Figure 6.2A -- Upblast fans with and without curb (cont'd)

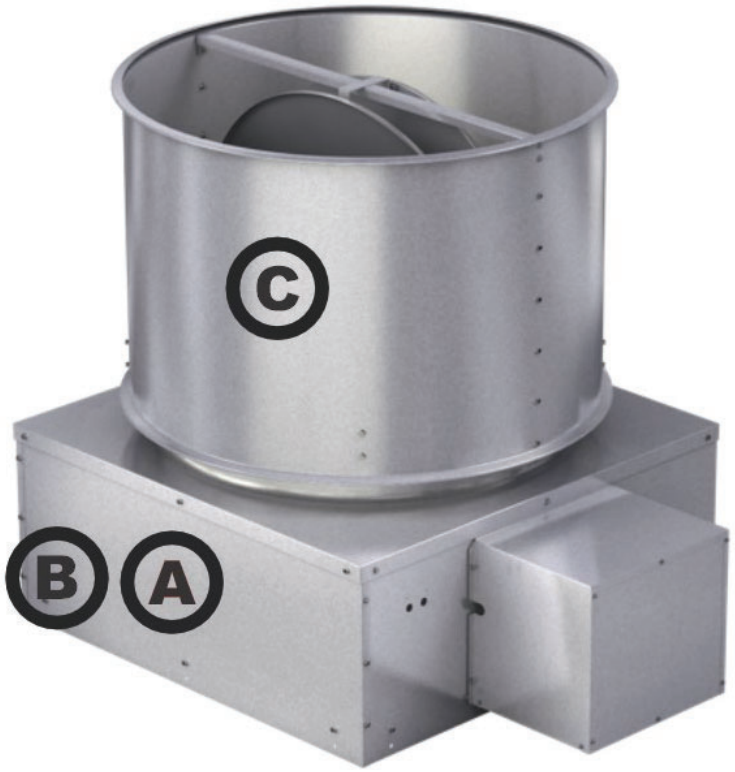

Figure 6.2B -- Roof mounted (powered or non-powered) ventilators

Figure 6.2B -- Roof mounted (powered or non-powered) ventilators (cont'd)

Figure 6.2B -- Roof mounted (powered or non-powered) ventilators (cont'd)

Figure 6.2C – Utility Vent Sets

Figure 6.2C – Utility Vent Sets (cont'd)

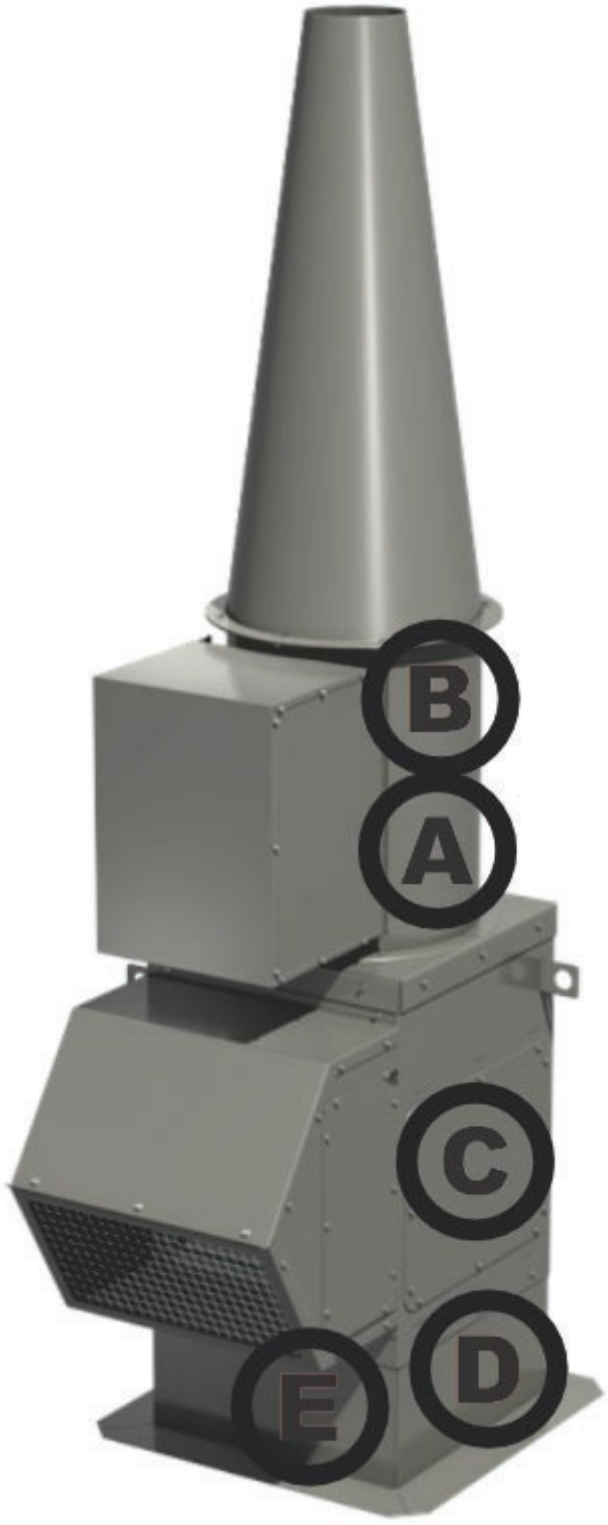

Figure 6.2D -- Laboratory Exhaust Fans

Figure 6.2E -- Wall Mounted Exhaust Fans

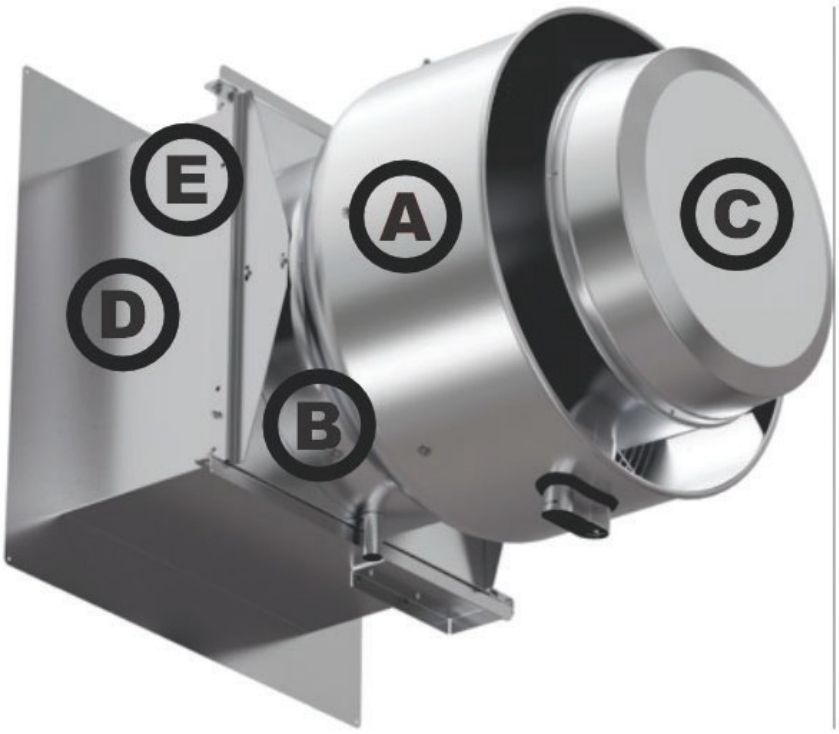

Figure 6.2E -- Wall Mounted Exhaust Fans (continued)

6.2.5 Sequence of impacts
Following the sequence of impact locations as described in this standard during testing is not necessary, which helps facilitate ease of testing, such as by minimizing cannon repositioning and setup.

6.2.6 Out of tolerance impacts
If the missile impact was out of tolerance and an identical condition exists on the same specimen the impact location may be relocated for a substitute impact.

Alternately, an identical additional test specimen can be impact tested if the initial test specimen was subject to an out of tolerance impact. The additional test specimen shall be impact tested to all the required impact locations per Section 6.2.3 and satisfy the applicable criteria in Section 8. The additional test specimen shall then be load tested per Section 7 instead of the initial test specimen.

6.2.7 Missile removal
Once the missile has come to rest after impacting the test sample, additional damage and/or alteration to the test specimen due to the missile's removal by laboratory personnel shall be disregarded when determining the pass/fail status of the impact.

6.3 Missiles

The missile used shall be that as described in Table 1.

6.3.1 Building type requirements
Unless specified otherwise, when a building code or other specification requires a fan or ventilator to be impact protected, the level of required protection shall be as noted per sections 6.3.2 and 6.3.3.

6.3.2 Enhanced protection
Enhanced Protection (Missile Level 'E') shall be required for a fan or ventilator on buildings and other structures designated as Essential Facilities.

6.3.3 Basic protection
Basic Protection (Missile Level 'D') shall be required for a fan or ventilator on any other buildings or structures that are not Essential Facilities.

6.4 Limitations

6.4.1 Maximum representative size of a product line and design construction
The maximum size fan or ventilator that is qualified to BSR/AMCA Standard 280, shall be equal to the size of the largest tested assembly.

6.4.2 Smallest representative size of a product line and design construction
The smallest size fan or ventilator that is qualified to BSR/AMCA Standard 280, shall be equal to the size of the smallest tested assembly.

7. Lateral and Uplift Loading

7.1 Test specimens
The largest size of each unique product design to be qualified must be tested. Any change that affects the structural or material characteristics, or geometric proportionality, excluding features that are invariant across sizes, of the product shall constitute a distinct product design.

A different test specimen than what was used for the large missile impact test may be used for the lateral and uplift load test.

The specimens shall be tested as follows using one of the three methodologies found in Section 7.3, 7.4, or 7.5.

All parts of the test specimen shall be full size, using the same materials, details, methods of construction and methods of attachment as proposed for actual use. The specimen shall consist of the entire assembled unit and shall contain all devices used to make the product resistant to wind forces. The test specimen shall include fasteners and anchorage identical to the actual intended installation as defined by the manufacturer.

All additional devices that are chosen to be employed in the test (e.g., curbs and hardware) will become part of the acceptance.

The test specimen shall be tested in its "as-shipped" condition or, if shipped unassembled, it shall be assembled per the manufacturer's instructions. No other modification shall be applied prior to the test.

The test specimen shall be secured to the test fixture either directly or using mounting accessories such as a curb, equipment supports, and isolators. The equipment attachment points from the mounting accessories to test fixture or test specimen to test fixture may or may not be considered part of the test at the manufacturer's option, but once said methods of securing the equipment are made a part of the test, they shall be included in all results corresponding. If the mounting accessories to test fixture or test specimen to test fixture attachment is not part of the test, the method of attachment shall be designed with an adequate factor of safety to not affect the test.

7.2 Loading
7.2.1 General information
The loading used for the test shall be defined by the entity or individual commissioning the test. The test load in this section, if intended to demonstrate compliance with applicable codes, shall be

based upon the basic wind speeds per ASCE 7. For this standard, wind force shall be determined using the load combinations in ASCE 7 for Allowable Stress Design.

7.2.2 Lateral loading

Determine the lateral load based upon the test commissioning parameters. Tests intended to demonstrate compliance with applicable codes shall have the lateral loads based on the provisions established in ASCE 7 for determining the lateral wind loads on equipment mounted on the exterior of a building.

7.2.3 Uplift loading

Determine the uplift load based upon the test commissioning parameters. Tests intended to demonstrate compliance with applicable codes shall have the lateral loads based on the provisions established in ASCE 7 for determining the uplift wind loads on equipment mounted on the exterior of a building.

7.3 Static uniform load

7.3.1 Objective

The objective behind mechanically applied testing is to allow uniform loading to be applied to the test specimen. The testing assembly shall be prepared to allow the mechanical apparatus's test bed and therefore the applied pressure to be varied until the required loading as determined in 7.2.2 and 7.2.3 is applied to the test specimen. The loading shall be applied with the use of a flexible membrane that conforms to the shape of the test specimen and can sustain the required loading as determined in 7.2.2 and 7.2.3, in the required test configuration.

7.3.2 Lateral loading

Lateral loading shall be applied by installing the test specimen in a rigid fixture that replicates the silhouette at the largest projected area of the test specimen with a gap to allow free movement of the specimen without contacting the silhouette. The fixture should be designed and constructed as a rigid structure capable of withstanding the full test load pressure without interference or influencing the specimen while full test load is applied. A non-adhesive flexible membrane shall be secured to the silhouette fixture and shall be installed to cover the surfaces of the test specimen as uniformly as possible. The flexible membrane shall be selected and installed to maintain the required pressures under the proposed test conditions. Refer to Figures 7.1 and 7.2. The assembly shall be instrumented and calibrated to indicate the load applied to the test specimen and fixture. Vacuum pumps/blowers shall be used to apply pressure differentials between the two sides of the test specimen/silhouette assembly. Pressure differential shall be maintained on the test specimen, to simulate wind pressure. The pressure shall be applied gradually until the test loads are reached. Initially, one-half of the test load prescribed by 7.2.2 shall be applied and held for 30 seconds. The test load shall be released and, after a dwell time between one and five minutes, the full load shall be applied and maintained for 30 seconds.

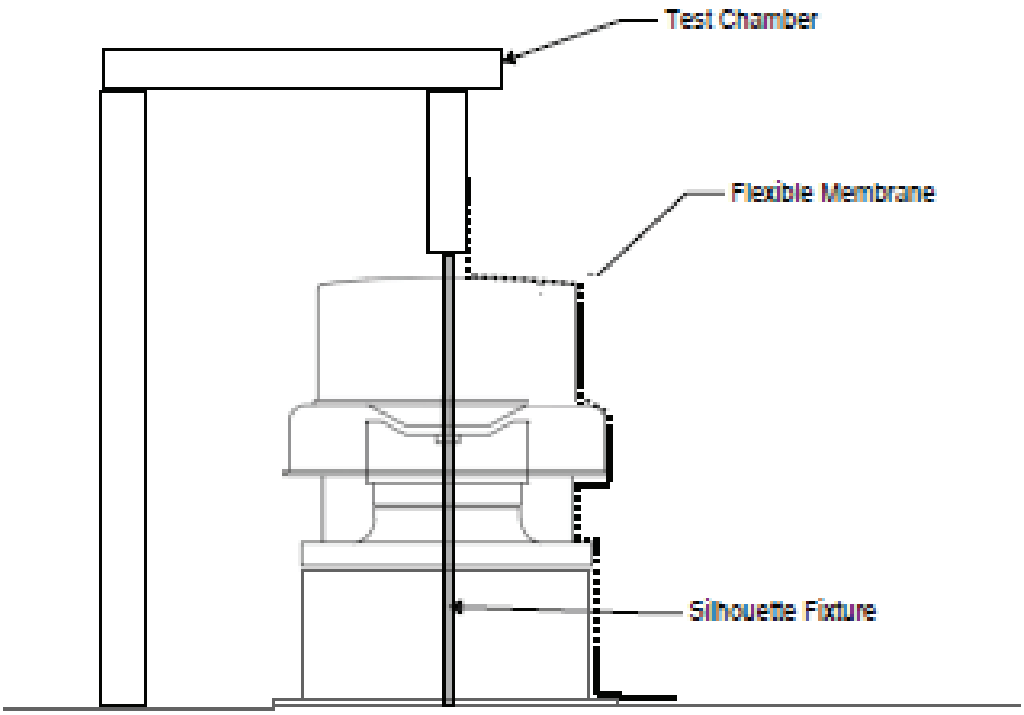

Figure 7.1 – Mechanical Test Apparatus (side view)

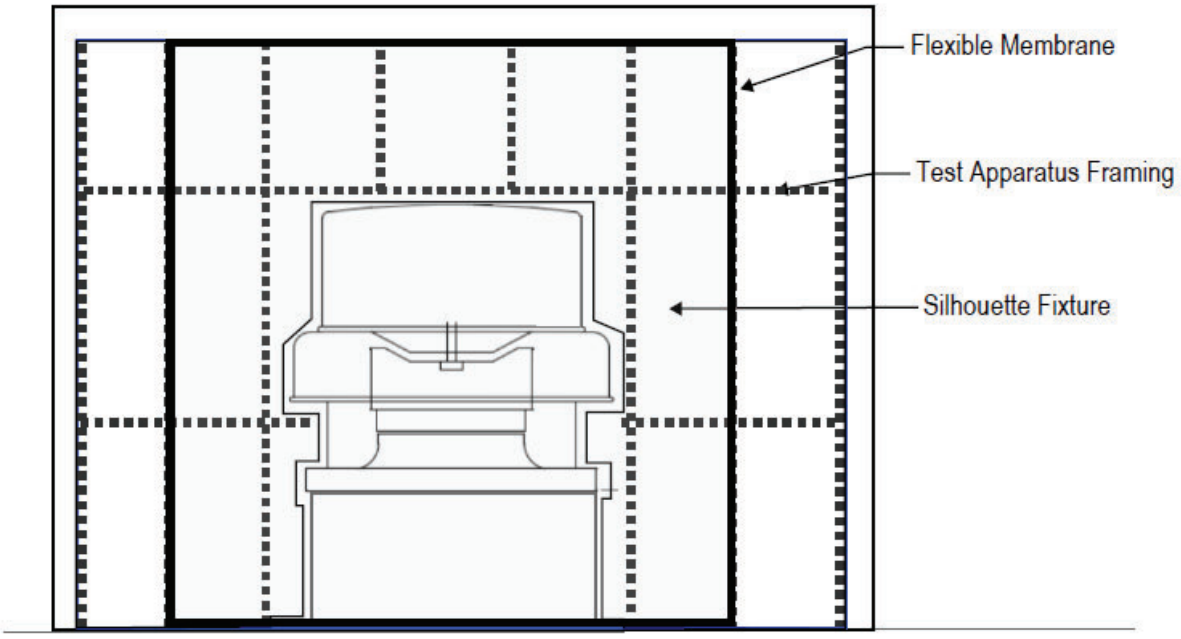

Figure 7.2 – Mechanical Test Apparatus (front view)

7.3.3 Uplift loading

Uplift loading shall be applied in different ways depending on the design of the specimen. Two configurations are offered to illustrate the intention. The test setup shall be configured to apply an uplift load at the largest cross-sectional area of the test specimen. In the first condition, the test specimen shall be installed in a rigid fixture that replicates the silhouette at the largest cross-sectional area of the test specimen with a gap to allow free movement of the specimen without contacting the silhouette. A non-adhesive flexible membrane shall be secured to the silhouette fixture and shall be installed to cover the surfaces of the test specimen including the inside surface of the test specimen hood (if applicable) as uniformly as possible. The membrane bridging the test specimen /silhouette gap must remain in place and intact. The fixture should be designed and constructed as a rigid structure capable of withstanding the full test load pressure without interference or influencing the specimen while full test load is applied. The intent is to replicate the effect of wind acting on the underside of a test specimen. The flexible membrane shall be selected and installed to maintain the required pressures under the proposed test conditions. Refer to Figure 7.3. The figure depicts only one orientation, but orientation is not critical; the pressure differential is.

In the second method, if the test specimen does not include a hood, the test specimen shall be installed in a rigid fixture that replicates the silhouette at the largest projected area of the test specimen with a gap to allow free movement of the specimen without contacting the silhouette. A non-adhesive flexible membrane, if required to obtain the test pressure, shall be secured to silhouette fixture and shall be installed to cover the surfaces of the test specimen as uniformly as possible. The fixture should be designed and constructed as a rigid structure capable of withstanding the full test load pressure without interference or influencing the specimen while full test load is applied. The intent is to replicate the effect of wind acting on a fan that does not have a separable hood or shroud. The flexible membrane shall be selected and installed to maintain the required pressures under the proposed test conditions. Refer to Figure 7.4.

The inlet of the test specimen shall be sealed to replicate a building envelope that has not been breached. The assembly shall be instrumented and calibrated to indicate the load applied to the fan and fixture. Vacuum pumps/blowers shall be used to apply pressure differentials between the two sides of the test specimen/silhouette assembly. Pressure differential shall be maintained on the test specimen to simulate wind pressure. The pressure shall be applied gradually until the test loads are reached. Initially, one-half of the test load prescribed by 7.2.3 shall be applied and held for 30 seconds. The test load shall be released and, after a dwell time between one and five minutes, the full load shall be applied and maintained for 30 seconds.

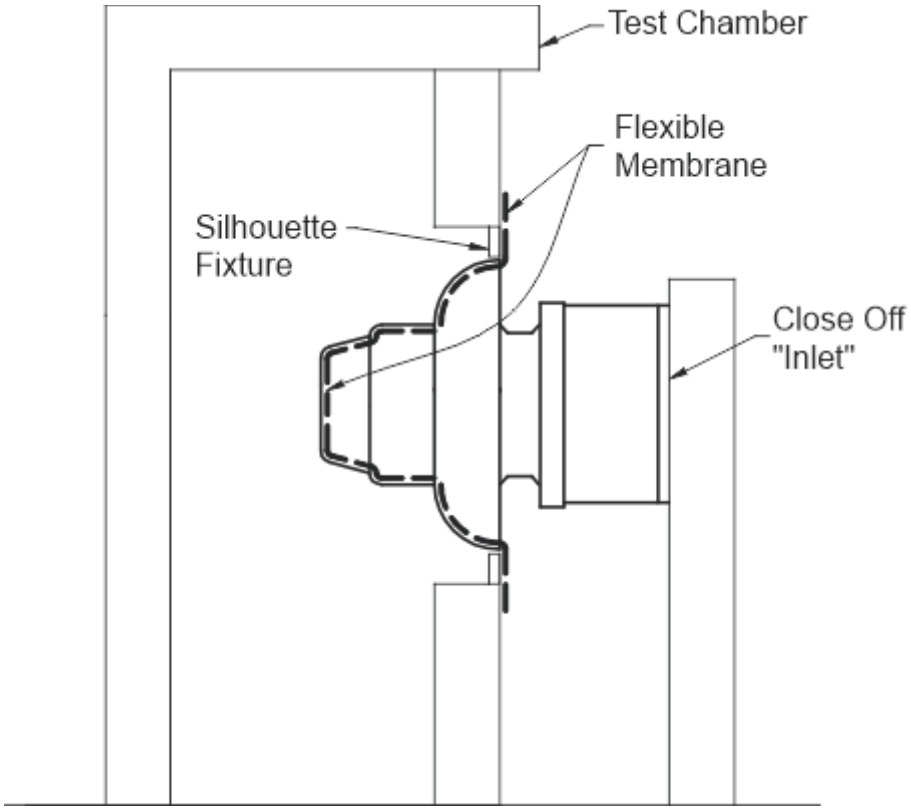

Figure 7.3 – Mechanical Test Apparatus (side view), Uplift Condition 1

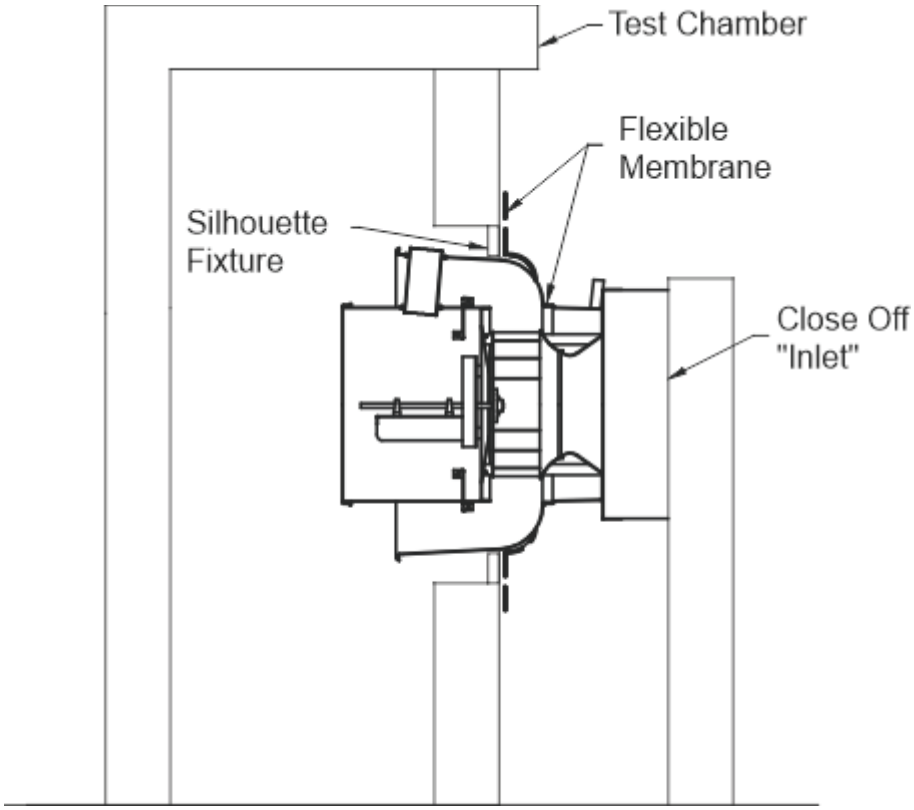

Figure 7.4 -- Mechanical Test Apparatus (side view), Uplift Condition 2

7.3.4 Force tolerance

The force-measuring apparatus shall measure test loads within a tolerance of +/- 2%.

7.4 Wind apparatus testing

7.4.1 Objective

The objective of wind testing is to allow uniform loading to be applied to the test specimen. The test specimen assembly shall be instrumented to allow the wind apparatus's wind velocity to be varied until the required loading as determined in 7.2.2 and 7.2.3 is applied to the test specimen. The wind apparatus is not required to maintain any specific wind velocity; the objective of the wind testing is to maintain a constant force, as applicable, on the test specimen during the test.

7.4.2 Lateral loading

Lateral loading shall be applied by securing the test specimen, with or without mounting accessories such as a curb, equipment supports, or isolators, to a turntable at the base of the apparatus. The turntable shall be instrumented and calibrated to indicate the load applied to the equipment. Instrumented, calibrated apparatus shall be affixed to the turntable, and the turntable shall be constrained to allow the turntable to displace in the axis parallel to the wind direction only, deflecting the instrumented, calibrated apparatus. The wind speed shall be applied gradually at a rate of ten miles per hour per second, until the test loads are reached. Initially, one-half the test load prescribed by 7.2.2 shall be applied and held for 30 seconds. The test load shall be released and, after a dwell time between one and five minutes, the full load shall be applied and maintained

for 30 seconds. The load shall be applied by having the largest profile of the test specimen perpendicular to the oncoming wind.

7.4.3 Uplift loading
Uplift loading shall be applied by securing the test specimen, with or without mounting accessories such as a curb, equipment supports, or isolators, to an open-bottom fixture that matches the base dimensions of the test specimen and presents minimal resistance to flow above and beyond that which is presented by the test specimen alone. The fixture assembly and the test specimen shall be secured to a turntable, and the turntable shall be constrained to allow the turntable to displace in the axis parallel to the wind direction only. The support assembly shall be instrumented and calibrated to indicate the load applied to the test specimen, exclusive of test specimen supports, and shall be affixed to the turntable such that the instrumented, calibrated apparatus captures the load on the test specimen alone, and not the fixture. This may be accomplished by testing the wind load of the fixture supports outboard of the test specimen to determine and account for the wind load attributable to the outboard supports alone. The equipment attachment points from curb to structure, or test specimen to structure, may or may not be part of the test at the manufacturer's option, but once said methods of securing the equipment are made a part of the test, they shall be included in all results correspondingly. If the curb to structure, or test specimen to structure attachment is not part of the test, the method of attachment shall be designed in accordance with applicable code(s) to not affect the test. The wind speed shall be applied gradually at a rate of ten miles per hour per second, until the load established by 7.2.3 is reached. Initially, one-half of the test load prescribed by 7.2.3 shall be applied and held for 30 seconds. The test load shall be released and, after a dwell time between one and five minutes, the full load shall be applied and maintained for 30 seconds.

7.4.4 Force tolerance
The force-measuring apparatus shall measure test loads within a tolerance of +/- 2%.

7.5 Water apparatus testing

7.5.1 Objective
The objective of water testing is to allow uniform loading to be applied to the test specimen. The testing assembly shall be instrumented to allow the water apparatus's test bed and therefore the water velocity to be varied until the required loading as determined in 7.2.2 and 7.2.3 is applied to the test specimen. The water apparatus is not required to maintain any specific water velocity; the objective of the water testing is to maintain a constant force, as applicable, on the test specimen during the test. Water testing may be used provided that the drag coefficient of the test equipment in water is within 5% of the drag coefficient of the test equipment in air.

7.5.2 Lateral loading
Lateral loading shall be applied by securing the test specimen, with or without mounting accessories such as a curb, equipment supports, or isolators, to a turntable at the base of the apparatus. The turntable shall be instrumented and calibrated to indicate the load applied to the fan equipment. Instrumented, calibrated apparatus shall be affixed to the turntable, and the turntable shall be constrained to allow the turntable to displace in the axis parallel to the water flow direction only, deflecting the instrumented, calibrated apparatus. The water speed shall be applied gradually at a rate of one mile per hour per second, until the test loads are reached. Initially, one-half of the test load prescribed by 7.2.2 shall be applied and held for 30 seconds. The test load shall be released and, after a dwell time between one and five minutes, the full load shall be applied and maintained for 30 seconds. The load shall be applied by having the largest profile of the test specimen perpendicular to the oncoming water flow.

7.5.3 Uplift loading
Uplift loading shall be applied by securing the test specimen, with or without mounting accessories such as a curb, equipment supports, or isolators, to an open-bottom fixture that matches the base dimensions

of the test specimen and presents minimal resistance to flow above and beyond that which is presented by the test specimen alone. The fixture assembly and the test specimen shall be secured to a turntable, and the turntable shall be constrained to allow the turntable to displace in the axis parallel to the water flow direction only. The support assembly shall be instrumented and calibrated to indicate the load applied to the test specimen, exclusive of test specimen supports, and shall be affixed to the turntable fixture. This may be accomplished by testing the water flow load of the fixture supports outboard of the test specimen to determine and account for the water flow load attributable to the outboard supports alone. The equipment attachment points from curb to structure, or test specimen to structure, may or may not be part of the test at the manufacturer's option, but once said methods of securing the equipment are made a part of the test, they shall be included in all results correspondingly. If the curb to structure or test specimen to structure attachment is not part of the test, the method of attachment shall be designed in accordance with applicable code(s) to not affect the test. The water flow speed shall be applied gradually at a rate of one mile per hour per second, until the load established by 7.2.3 is reached. Initially, one-half of the test load prescribed by 7.2.3 shall be applied and held for 30 seconds. The test load shall be released and, after a dwell time between one and five minutes, the full load shall be applied and maintained for 30 seconds.

7.5.3 Force tolerance

The force-measuring apparatus shall measure test loads within a tolerance of +/- 2%.

7.5.4 Test temperature

The test shall be conducted in fresh water at a test temperature range of 18.3 to 32 °C (65 to 90 °F).

8. Pass/fail criteria and functional criteria

The test specimen shall comply with both the pass/fail criteria and the functional requirements for it to be classified for use in Essential Facilities.

8.1 Pass/fail criteria

The complete test specimens shall be observed for these criteria during each test sequence and evaluated for these criteria during and after each test sequence. As per the building classification, the evaluation criteria may vary as stated within this section.

8.1.1 Essential and non-essential buildings

- No openings may be created during the test that allow the passage of a 76 mm (3 in.) diameter sphere to penetrate through the building envelope.
- No parts of the assembly can become fully disengaged from the exterior of the test specimen unless it can fit within a 25 mm x 25 mm x 51 mm (1 in. x 1 in. x 2 in.) envelope and is less than or equal to 25 grams.
- If any components show any sign of weakness or progressive failure the test specimen has failed.
    - Signs of weakness and progressive failure include and are not limited to:
        - Fastener/weld failure cannot progress during the test sequence. If a weld or fastener failure continues during testing, the specimen is considered a failure.
        - Tear in metal: Metal failure cannot progress during the test sequence.
- The test specimen or mounting accessories cannot detach from the test fixture.
- These criteria apply during and at the end of all tests.

8.2 Functional requirements

Each complete test specimen shall be evaluated for these requirements before and after all test sequences. As per the classification of the certification the requirements may vary as stated below.

If water is used as the test media, this standard can only be used for qualifying equipment for non-essential buildings.

8.2.1 Non-essential buildings

- Before the tests:
    - Conduct a visual inspection of the sample before any tests.
    - Rotate test specimen impeller (if applicable) and confirm that the parts are moving freely and there are no interferences, which can be achieved by powering the sample or by manually actuating the rotating parts.
- After the tests:
    - At the conclusion of testing, all moving parts shall be free to move. Interference between components is acceptable as long as parts intended to move can do so. This inspection can be achieved by powering the sample or by manually actuating the rotating parts.

8.2.2 Essential buildings

- Before the tests:
    - Inspect the test specimen by powering the specimen. Observe baseline operation, making sure the test specimen functions as intended.
- After the tests:
    - At the conclusion of testing, conduct a visual inspection of the sample first to determine if there is damage to the test specimen and whether there is interference with moving parts.
    - Power and run the test specimen for performance confirmation:
        - If any components show any sign of weakness or progressive failure within 15 minutes, the test specimen assembly has failed.

9. Presentation of Results

The test report(s) shall be retained for a minimum of ten years and at minimum shall include the following information:

1. Date(s) of test, date of report, and a unique identification number. The identification number shall be on each page
2. The name(s) of the author(s) of the report
3. Name and location of the facility performing the test
4. Names of the individuals performing the test and any witnesses
5. Name and affiliation of the test requester
6. Consecutive page numbers with an indication of the total number of pages
7. Compliance statement indicating tests were conducted in accordance with this test standard, including the date of issue
8. The test report shall be signed and sealed by a registered Professional Engineer employed or contracted by the testing laboratory
9. A description of the test specimen, including:
    a. Manufacturer name
    b. Manufacturer’s model number or other method of identification
    c. Cataloged size of fan or ventilator
10. Test configuration
11. Detailed drawings of the test specimens, including:
    a. Overall dimensions

b. Mounting dimensions
c. Specimen weight
d. Accessories included in testing, (e.g., guards, vibration isolators)
e. Fasteners used for assembly

12. Anchorage details, including attachment of test specimen or mounting accessories, to test bed and details of test bed substrate
13. Description of test equipment, including calibration records
14. For each missile impact, include:
    a. Description of missile(s) including dimensions and mass (weight)
    b. Missile speed and data recorded to determine speed
    c. Impact location and description of any damage resulting from impact
    d. Pass/fail statement for each impact (if applicable)
15. For each lateral and vertical load test include:
    a. Description and pictures of the test setup
    b. Maximum test pressure that was achieved for the required duration
    c. Pass/fail statement for each test (if applicable)
16. Test results
17. Test photographs
18. A statement that the laboratory is in possession of a video recording of the test(s). The video recording shall be retained by the laboratory for a minimum of ten years from the test report date.

RESOURCES

AMCA Membership Information
http://www.amca.org/members/members.php

AMCA International Headquarters and Laboratory
www.amca.org

AMCA White Papers
www.amca.org/whitepapers

Searchable CRP Database of AMCA Certified Products
www.amca.org/certified-listed/cpsearch.php

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