ANSI/MCA FTS-1-2019

Test Method for Wind Load Resistance of Flashings Used with Metal Roof Systems

Approved 6/25/19

1.0 Scope

1.1 This test method evaluates the wind load resistance of flashings to be installed at the roof perimeter and roof plan transitions of metal roof systems by testing the flashing and its attachment to the supporting structure using line loads.

1.2 The provisions of this test method apply to exposed flashings with a face 4 inches or greater that are direct-fastened, and hem-and-cleat connections, or other attachment methods with a face 2 inches or greater.

1.3 This test method provides a standard procedure to demonstrate wind load resistance under uniform line load. This procedure is intended to represent the effects of uniform loading on exposed elements on a building surface. Two methods of testing are provided: 1) Face Load and 2) Face Load and Top Load.

3.0 Terminology

Where the following terms appear in this standard they are in italics and shall have the meaning defined herein. Terms not defined in Section 3 of this standard shall have the ordinary accepted meaning for the context in which they are used.

Anticipated ultimate load – the estimated maximum load that the *specimen* is expected to resist.

Cleat – a continuous metal strip to which a flashing with an open hem is engaged.

Clip – a non-continuous metal component used to secure two or more metal components together.

Coping – the covering piece on top of a parapet wall exposed to the weather, usually made of metal and sloped to carry off water.

Direct-fastened – an attachment method that involves a *fastener* passing through the attached member rather than attaching with a *cleat* or other similar method.

Drip edge – the outward projecting lower edge of a flashing used to control the direction of dripping water and to protect underlying building components.

Face—the exposed surface or surfaces of a flashing to which one load is applied

Failure – fracture, disengagement or unrestrained deformation of components, including *fasteners*, such that the *specimen* is not capable of resisting additional load.

Fastener – any of a wide variety of mechanical devices and assemblies, including nails, staples, screws, rivets and bolts for securing components to a building.

Load case – one orientation of load or loads that is applied for a *test cycle*.

Specimen – the entire assembled unit submitted for testing.

Sustained load – a load resisted for specified time.

Test cycle – a series of increasing, *sustained loads*.

Ultimate load – the maximum *sustained load* resisted by the *specimen*.

4.0 Units and Terms

Any compatible system of measurement units is acceptable to be used in this standard, except where explicitly stated otherwise. The unit systems in this standard shall include U.S. customary units (force in kips and length in inches) and SI units (force in newtons and length in millimeters).

5.0 Summary of Test Method

5.1 This test method shall include all of the following: (1) attachment of the stiffening plate or other test apparatus components to the flashing *specimen* as needed, (2) attachment of the flashing *specimen* to the bed of the test apparatus, (3) application of a series of uniform line loads to the test *specimen* and (4) observation and recording of the loads resisted and mode or modes of *failure* of the test *specimen*.

5.2 The increments of load application shall be chosen so that results from a minimum of four *sustained loads* are recorded. If *failure* occurs before a minimum of four loads have been sustained, the test shall be deemed invalid.

6.0 Apparatus

6.1 Description of Apparatus

The apparatus for single load tests shall include the major components shown in Figure 1. The apparatus for two load tests shall include the major components shown in Figure 2 and Figure 3. The Optional Stiffening Plate shown in these figures, if used, shall be no wider than 2” (51 mm) and no thicker than 1/8” (3.2 mm). Figures 1, 2 and 3 indicate how loads are applied to various generic flashing configurations. Actual flashing and configuration connection shall be per the design and manufacture of the flashing to be tested.

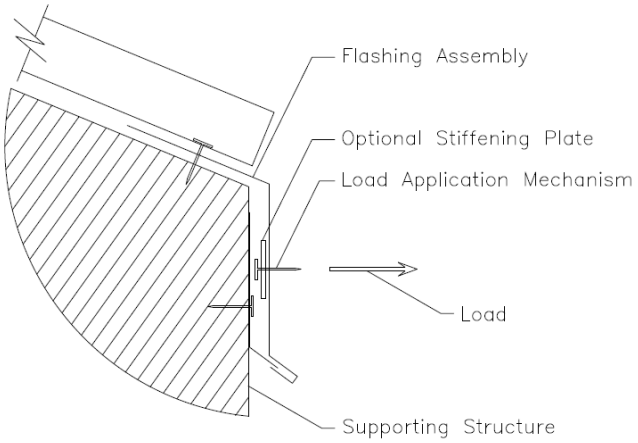

Figure 1 – Single Load Test Apparatus

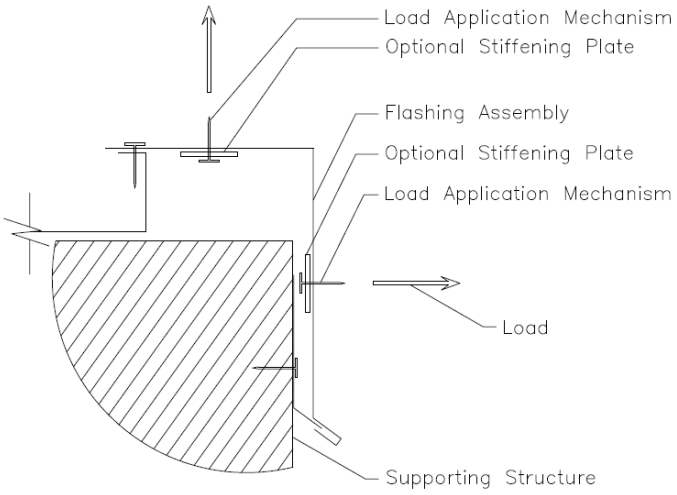

Figure 2 – Two Load Test Apparatus

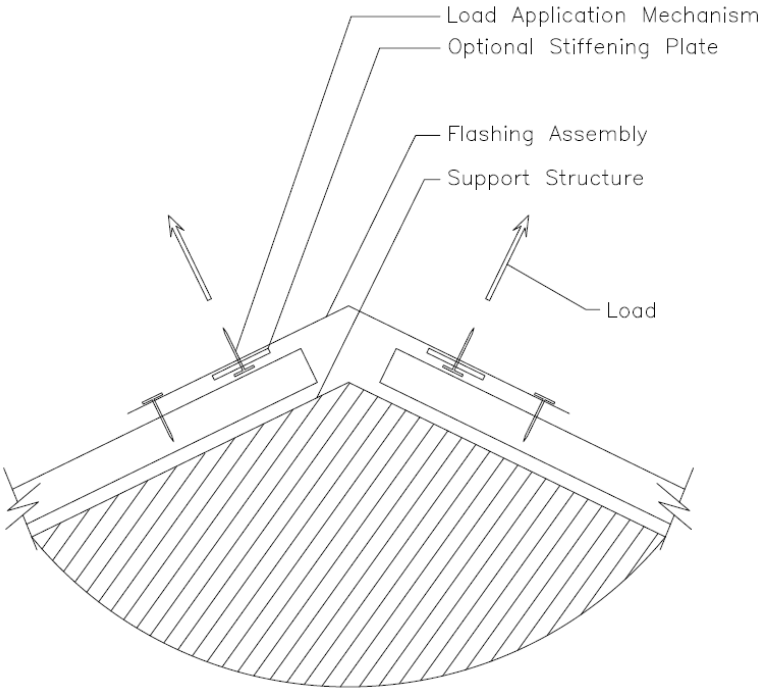

Figure 3 – Two Load Test Apparatus

6.2 Supporting Structure

The supporting structure shall be representative of field conditions and sized to allow the secure attachment of the *specimen*. Anchorage shall be required to hold the supporting structure in place while load is applied during the test. The supporting structure shall be representative of field conditions.

6.3 Load Application System

6.3.1 The load application system shall consist of a tensile tester or other device capable of providing concentrated load and fitted with a load cell capable of indicating loads of at least the *anticipated ultimate load*.

6.3.2 The load application system shall be attached to the *specimen* in the center of the tested face and shall be capable of uniformly distributing the load to the *specimen*. The spacing of the *specimen* attachment to the load application system shall be no greater than 12 inches (300 mm) on center. The load application system shall be attached to the face centered on its width.

6.3.3 The precision of the load application system shall be +/- 10 pounds (4.5 kg) based on calibration within 12 months of the test date. The maximum calibration load shall not be exceeded in testing.

7.0 Test Specimen

7.1 The *specimen* shall consist of all parts relevant to the assembly. Field-application conditions of the *specimen* shall be simulated. The *specimen* shall be full size. Supporting structure shall be of a length no less than the length of the test *specimen*s.

The ends of the *specimen* shall not be restrained, but free to deflect under load. End and edge restraint shall be representative of field conditions and shall be documented in the test report.

7.2 The flashing *specimen* shall be a minimum of 120 inches (3000 mm) in length, without laps in the flashing, unless the flashing is only produced in lengths less than 120 inches (3000 mm).

7.3 A face shall consist of a flat segment of a flashing profile plus adjacent segments such as *drip edge* or hem that are within 45 degrees of being inline. Two parallel, flat segments offset by less than 1 inch (25 mm) shall be tested as one face.

7.4 The minimum number of *specimens* shall be based on the number of *load cases* and *test cycles* required for the flashing. Three *test cycles* shall be performed for each *load case*. A new specimen shall be used for each test cycle.

7.4.1 For flashings with only one exposed face, one *load case* shall be required, therefore three *specimens* are required. Loads shall be applied perpendicular to the exposed face. The Single Load Test Apparatus shall be employed for this purpose.

7.4.2 For flashings with two exposed faces, one *load case* shall be required; therefore, three specimens are required. Loads shall be applied to the two faces simultaneously. Loads shall be applied with a ratio of 2 psf (96 Pa) vertical to 1 psf (48 Pa) horizontal. If both faces are expected to receive approximately equal loading in field applications (e.g. ridge cap), then both faces shall be tested with equal load simultaneously. The Two Load Test Apparatus shall be employed for flashings in this category. Load shall be applied perpendicular to the face.

7.4.3 For flashings with three or more exposed faces, the number of required *load cases* shall equal the number of pairs of adjacent faces. In the case of a *coping*, two *load cases* shall be required; therefore, six specimens are required. In the first *load case*, loads shall be applied simultaneously to the top (upward) and to one of the vertical faces (lateral). In the second *load case*, loads shall be applied simultaneously to the top (upward) and

to the other vertical face (lateral). Loads shall be applied with a ratio of 2 psf (96 Pa) upward on the top surface to 1 psf (48 Pa) horizontal on the wall coverage surfaces. The Two Load Test Apparatus shall be employed for flashings in this category. Load shall be applied to each face in a manner that is perpendicular to the roof or wall surface plane covered by that face. For top surfaces sloped less than 10 degrees, the top surface load is permitted to be applied vertically.

8.0 Loading Procedure

8.1 Orientation

The test set up shall be oriented such that gravity shall not have an undue influence on the test other than that experienced by in-place field applications. Only loads resisted by the *specimen* shall be included in the reported loads.

8.2 Procedure

This procedure shall be designed to produce a *test cycle* with a minimum of four *sustained loads*.

8.2.1 The typical loading cycle shall consist of two phases: a load phase and an unload phase.

8.2.2 The load phase shall apply the line loading in increasing magnitudes. The first loading shall be at one third of the *anticipated ultimate load*. Subsequent loadings shall be increased by up to one sixth of the *anticipated ultimate load*. For loads of up to 150 psf (7.2 kPa), the load shall be achieved within 1 minute. For loads greater than 150 psf (7.2 kPa), the load shall be achieved within 2 minutes. Each loading shall be held for at least 1 minute.

Loads shall be recorded to a precision of five percent of the *anticipated ultimate load* during applications of the test loads.

8.2.3 The unload phase shall relax the load to zero. This phase shall last no longer than 5 minutes. This phase shall be followed by the next loading cycle.

8.2.4 For flashings loaded on two separate faces simultaneously, the loading shall progress as described above based upon the *anticipated ultimate* vertical *load* (applied to the more horizontal surface.

8.2.5 The test shall be concluded when any of the following happen, the *specimen* fails, the capacity of the test apparatus is reached, or at the direction of the party conducting

the test. *Failure* in the *specimen* shall be when any of the following conditions occur: 1) *Fastener failure* (ex. pull-out, pull-over or breakage), 2) Unlatching of a panel or flashing, 3) Component *failure* (ex. Rupture, tearing or cracking),

8.2.6 A minimum of four *sustained loads* shall be recorded before a *test cycle* is concluded. If the *specimen* fails before four *sustained loads* are recorded the *test cycle* shall be deemed invalid and shall be repeated with a lower *anticipated ultimate load* that will yield four *sustained loads*.

9.0. Test Report

9.1 Date of test and date of report shall be included in the test report along with the name of the testing organization and location. The observers, their qualifications and affiliation shall be included.

9.2 The test report shall describe the *specimen*, including the manufacturer, location of manufacture and dimensions. The testing equipment including load cell and load application device shall be described.

9.3 The test report shall include cross-section drawings of the *specimen* including flashing, panels, panel attachment method and supporting structure. The drawings shall identify type, location and spacing of *fasteners* and show how and where the test apparatus is attached to the specimen.

9.5 The test report shall include the measured thickness and yield strength of the *specimen*.

9.6 Tabulation of the loadings and load durations, including the *anticipated ultimate load*, shall be included in the test report.

9.7 The test report shall include visual observations including *failure* mode, the *sustained loads* applied, and the *ultimate loads*. The *ultimate loads* from the performed *test cycles* shall be averaged and recorded as the test result.

9.8 The test report shall include a statement that the test(s) were conducted in accordance with this test method, noting any deviations.

Commentary

This commentary consists of explanatory and supplementary material designed to help in applying the requirements of the preceding Standard.
This commentary is intended to create an understanding of the requirement through brief explanations of the reasoning employed in arriving at these requirements.
The sections of this commentary are numbered to correspond to sections of the Standard to which they refer. Since having comments for every section of the Standard is not necessary, not all section numbers appear in this commentary.

C1.0 Scope

In significant wind events, *failure* frequently begins at the flashing attachment at the roof edge, e.g. eaves and gables, and at roof plane transitions with a reflex angle, e.g. hips and ridges. This test method is intended to determine the capacity of these flashings to withstand the anticipated wind loads.

C1.2 For *direct-fastened* faces less than 4 inches (100 mm) it is anticipated that the mode of *failure* will be *fastener* pull-out; therefore, testing of faces less than 4 inches (100 mm) is not required. *Fasteners* used to *direct-fasten* faces less than 4 inches (100 mm) must have adequate pull-out resistance for the design loads.

For *cleated* faces less than 2 inches (50 mm) the design loads will yield a line load that is too low to allow for a significantly meaningful series of *test cycles*; therefore, testing is not required for flashing with faces less than 2 inches (50 mm).

C2.0 Referenced Documents

The following documents were considered during the development of this document.

1. ASTM E 1592-05(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

2. 2017 Florida Building Code Test Protocols for High Velocity Hurricane Zones:
(TAS) No. 111(B)-95 Test Procedure for Edge Metal Pull-Off Performance
(TAS) No. 111(C)-95 Test Procedure for Coping Cap Pull-Off Performance

3. ANSI/SPRI/FM 4435/ES-1 2017 Test Standard for Edge Systems Used with Low Slope Roofing Systems

C5.0 Summary of Test method

This summary is to outline the general steps that are required for testing. The attachment of test apparatus connections to the test *specimen* may be made before or after the *specimen* is mounted to the apparatus test bed.

C5.2 Metal flashings are subjected to repeated loading from gusting winds; therefore, a critical component of the test is that the test load is applied and relaxed a minimum of four times prior to the application of the *Ultimate Load*. If *failure* occurs before four loads are applied, the *anticipated ultimate load*, and therefore the load increments, must be decreased and the test repeated, until a minimum of four *sustained loads* have been recorded.

C6.0 Apparatus

C6.1 The apparatus is general in nature. Any equipment capable of performing the test procedure within the allowable tolerances described in this section is acceptable.

The purpose of the Optional Stiffening Plate is to reduce complications of fastener(s) in the Load Application Mechanism pulling through the flashing, or the flashing bending along the line of fasteners, by better distributing the load on the loaded face.

C6.2 To simplify and standardize testing, the apparatus does not need to be an exact replication of the substrate expected in field application; however, the apparatus must provide no greater pull-out resistance for the *specimen fasteners* than what will be achieved in field application.

C7.0 Test Specimen

C7.1 The *specimen* includes the supporting structure such as wood or steel, the exterior metal panel(s), panel *clips*, sealant, *fasteners, cleats* and the flashing as applicable.

C7.4.2 and 7.4.3 The ratio between the vertical and horizontal GC_p values used to calculate wind loads vary with building height, roof zone location, and the version of ASCE7 being used. To standardize the testing, and to avoid necessitating that multiple tests be run with several different vertical:horizontal ratios, a simple and conservative ratio of 2:1 was selected.

C9.0 Test Report

C9.5 Both material thickness and yield strength can greatly affect the performance of a flashing system; therefore, the thickness and strength of the tested specimen is needed to confirm that the product produced for use in the field is of equal or greater thickness and yield strength. Yield strength may be determined by methods such as ASTM A 370-17a, ASTM B 557-15, etc. as appropriate for the material being tested.