UL 1897

STANDARD FOR SAFETY

Uplift Tests for Roof Covering Systems

UL Standard for Safety for Uplift Tests for Roof Covering Systems, UL 1897

Seventh Edition, Dated September 23, 2015

Summary of Topics

This revision of ANSI/UL 1897 dated September 30, 2020 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made..

The requirements are substantially in accordance with Proposal(s) on this subject dated July 17, 2020.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

No Text on This Page

SEPTEMBER 23, 2015
(Title Page Reprinted: September 30, 2020)

ANSI/UL 1897-2015 (R2020)

UL 1897

Standard for Uplift Tests for Roof Covering Systems

The First edition was titled Roof Covering Systems.

First Edition – November, 1992
Second Edition – April, 1993
Third Edition – March, 1995
Fourth Edition – April, 1998
Fifth Edition – March, 2004
Sixth Edition – September, 2012

Seventh Edition

September 23, 2015

This ANSI/UL Standard for Safety consists of the Seventh Edition including revisions through September 30, 2020.

The most recent designation of ANSI/UL 1897 as a Reaffirmed American National Standard (ANS) occurred on September 30, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

No Text on This Page

INTRODUCTION

1 Scope

1.1 The test method specified in this Standard is intended to provide uplift resistance data for the evaluation of the attachment of roof covering systems to roof decks by using differential air pressures. It is applicable to any type of roofing system which is adaptable to the test equipment.

1.2 The test evaluates the roof covering systems method of attachment, including all components such as base sheets, ply sheets, slip sheets, membranes, etc. and insulation, if used. Supporting roof decks are evaluated only with respect to span conditions and physical properties such as gauge, yield strength, grade, size and/or species of lumber and related factors which affect fastener attachment or bond strength.

1.3 This test method provides a comparative measure of the uplift resistance for roofing systems by means of static differential pressure. The method does not necessarily simulate the actual dynamic uplift pressures encountered by roofing systems. Uplift pressures on a roofing system are dependent upon many factors such as wind gusts, building shape, edge configuration, and the terrain surrounding the building. A method to calculate the uplift pressures on roof assemblies is contained in the Standard for Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, ANSI/ASCE 7.

1.4 The purpose of this test method is to provide data regarding the securement of the roofing system to the roof deck based upon a short-term static load. When needed the option to include the roof deck attachment to supports shall be described in the test Report. A test method for evaluating uplift resistance of complete roof deck assemblies including the roof deck and its attachment to supports may also be available in Reports for Standard for Tests for Uplift Resistance of Roof Assemblies, UL 580.

2 Units of Measurement

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

PART I – UPLIFT RESISTANCE TEST

PERFORMANCE

3 Test Apparatus – General

3.1 The test apparatus, in general, consist of a top and/or bottom chamber to create and maintain a uniform steady static pressure. The top chamber when used shall be of sufficient dimensions to cover the specified area of roofing system and of sufficient volume so as not to interfere with upward deflections of the roofing system. At least one static pressure tap shall be provided to measure the chamber pressure and shall be so located that the reading is unaffected by the velocity of the air supply to or from the chamber, or any other air movement.

3.2 The air system is to consist of a controllable blower, or a constant volume blower, or both, with an adjustable pressure relief damper capable of providing constant static air pressure differential across the roofing system for the test duration.

3.3 When underside positive pressure is utilized, the apparatus shall incorporate a bottom chamber capable of applying a steady positive pressure to the underside of the test assembly. The air supply opening into the bottom chamber shall be arranged so that the air does not impinge directly on the test specimen.

3.4 When underside uniform static positive pressure is utilized in combination with topside uniform static negative pressure the total differential pressure across the assembly is to be measured as well as the corresponding pressures developed within the bottom and the top chambers.

3.5 Recording equipment is to be used to make a permanent record of the pressure levels developed in the test.

4 Test Assembly – Minimum 10 × 10 ft

4.1 The roof system test assembly is to be representative as to materials, workmanship, and details such as dimensions of parts of the roof deck construction for the rating desired. It shall be built in accordance with the system installation specifications under conditions representative of those in building construction under normal field conditions of use. Properties of the materials and ingredients used in the test assembly, together with their location and method of attachment, are to be determined and recorded.

4.2 The dimensions of the test assembly are to be a minimum of 10 by 10 ft (3.05 by 3.05 m). The test assembly shall contain side and end joints if such occur in field installation, which represent the most vulnerable exposure to uplift due to wind conditions. Test assemblies that utilize mechanically-attached membranes are to be of sufficient size to incorporate a minimum of three batten or fastener rows plus an additional 1-ft (0.305-m) minimum outside the outlying batten or fastener rows. The test assembly shall consist of secondary bearing members, such as purlins and joists, to which the roof decking is fastened. The assembly components, including secondary members, are to be located to best simulate field conditions, such as maximum span and maximum attachment spacing.

4.3 The periphery of the roofing system test assembly is to be sealed so as to permit the development of a sustained static pressure differential.

4.4 Polyethylene film shall be permitted to seal joints or other air-permeable portions within roof systems when necessary to attain test pressures. The film shall be applied loosely with longitudinal pleats that are positioned up into ribs and/or with extra folds such that the film follows the contour of the assemblies under test. Use of the plastic film shall not prohibit transfer of the full load to the assembly, shall not prevent full movement, or otherwise adversely impact test results.

4.5 The test assembly is to be cured at room temperature until the field strength, humidity, and temperature as specified by the manufacturer are achieved. Hot-mopped or torch applied bitumen roof coverings are to be tested after reaching an ambient room temperature.

4.6 The test specimen frame, containing the installed roof assembly, is placed on the pressure vessel and is sealed by a gasket located between the top of the pressure vessel and the bottom of the test specimen frame. Contact between the pressure vessel and the test sample frame is made at the perimeter.

5 Test Assembly – 5 × 9 ft

5.1 The 5 × 9 Wind Uplift Test Procedure shall be permitted to be used to evaluate various types of roof assemblies in accordance with (a) – (f). The Simulated Wind Uplift Resistance Rating obtained using this procedure shall be limited to a maximum of 90 lbs/ft^2 (4.3 kPa):

a) Mechanically-attached and spot welded membranes are to be of sufficient size to incorporate a minimum of three batten or fastener rows The batten or fastener row spacing shall not be in excess of 4-ft (1.2-m) on center. The batten or fastener rows shall be oriented parallel to the 5-ft (1.5-m) width of the chamber. The batten or fastener rows shall incorporate a minimum of three fasteners per row and shall not be in excess of 2-ft (0.6-m) on center.

b) Assemblies with adhered membranes to fastened board layers (spot or grid affixed) shall be spaced a maximum 2 × 4-ft (0.64 ×1.2-m) on center with the 4-ft (1.2-m) dimension oriented along the length of the chamber. At least one full size board shall be incorporated into the assembly. The board shall be centered in the specimen and not in direct contact with the chamber seal along the perimeter of the assembly.

c) Assemblies shall not be permitted to incorporate an air barrier.

d) Assemblies shall not contain structural concrete or other air impermeable or monolithic substrates as the roof deck.

e) Standing/lap seam metal roof systems shall not be permitted.

f) Air permeable roof systems, e.g. those require polyethylene film to seal the roof covering to attain test pressure, shall not be permitted.

6 Test Procedure – 10 × 10 ft

6.1 A roof system test assembly shall comply with the following requirements during and at the conclusion of the test procedure described in 6.1 – 6.5 and Conditions of Acceptance 5 x 9 and 10 x 10 Test, Section 8. All roof system components and the roof deck shall maintain their structural and weather resistant integrity throughout the test.

6.2 The test is terminated when the roof system test assembly does not comply with 6.1, or at the completion of:

a) A designated static pressure difference held for 1 min where no failure has occurred; or

b) The maximum static pressure difference which was sustained by the equipment for 1 min.

6.3 The test is regulated by raising the uplift static pressure difference from the topside and underside of the roofing system test assembly. Start the test by raising the pressure difference to 15 lbs/ft^2 (0.72 kPa) and holding for 1 min. Thereafter, raise the pressure in increments not greater than 15 lbs/ft^2 (0.72 kPa) and hold the pressure at each increment for 1 min.

6.4 Repairs or modifications, except to stop air leakage along the periphery, are not to be made to the assembly during the test.

6.5 All vertical movement of the assembly or components of the assembly during the test are to be noted and recorded.

7 Test Procedure – 5 × 9 ft

7.1 A roof system test assembly shall comply with the Conditions of Acceptance 5 x 9 and 10 x 10 Test, Section 8 during and at the conclusion of the 5 × 9 ft test procedure described in 7.2 – 7.8.

7.2 Air is introduced into the pressure vessel until the pressure level reaches 15 lbs/ft^2 (0.7 kPa) with a tolerance of +2 lbs/ft^2, −0 lbs/ft^2 (+0.1 kPa, −0 kPa). The air shall be introduced at a rate that will increase the resulting pressure 1.5 lbs/ft^2/sec ±1 lbs/ft^2/sec (0.07 kPa/sec ±0.05 kPa/sec). Upon reaching 15 lbs/ft^2 (0.7 kPa), the pressure level shall be maintained for a period of 60 sec. The air and clamps shall be permitted to be adjusted as necessary in order to maintain a constant reading. While the sample is being maintained at this pressure level, the sample shall be visually examined to ensure that it continues to meet the conditions of acceptance.

7.3 Upon mutual agreement between the test sponsor and the testing entity, the 15 lbs/ft^2 (0.7 kPa) pressure level noted above may be omitted. This results in the initial pressure level being 30 lbs/ft^2 (1.4 kPa) with a tolerance of +2 lbs/ft^2, −0 lbs/ft^2 (+0.1 kPa, −0 kPa).

7.4 After 60 sec, the pressure level shall be increased in 15 lbs/ft^2 (0.7 kPa) increments by introducing additional air at the rate and within the tolerance described above. Upon reaching the next 15 lbs/ft^2 (0.7 kPa) level, the pressure shall be maintained for a period of 60 sec. The air and clamps shall be permitted to be adjusted as necessary in order to maintain a constant reading. While the sample is being maintained at this pressure level, the sample shall be visually examined to ensure that it continues to meet the conditions of acceptance.

7.5 The procedure described in 7.4 shall be repeated until the sample has maintained a pressure level of 90 lbs/ft^2 (4.3 kPa) [+2 lbs/ft^2, −0 lbs/ft^2 (+0.1 kPa, −0 kPa)] for a period of 60 sec, until failure occurs, until additional pressure levels are unable to be attained or maintained, or at the discretion of the test sponsor. Failure is considered to occur when the conditions of acceptance of this standard are no longer being met or until the pressure level is no longer able to be maintained.

7.6 Repairs or modifications, except to stop air leakage along the periphery, are not to be made to the assembly during the test.

7.7 The test is terminated when the roof system test assembly does not comply with Conditions of Acceptance 5 x 9 and 10 x 10 Test, Section 8, or at the completion of:

a) A designated static pressure difference held for 1 min where no failure has occurred; or

b) The maximum static pressure difference which was sustained by the equipment for 1 min.

7.8 All vertical movement of the assembly or components of the assembly during the test are to be noted and recorded.

8 Conditions of Acceptance 5 x 9 and 10 x 10 Test

8.1 Upon completion of the test, the sample shall be examined and shall comply with all items of the following conditions of acceptance.

8.2 The roof system test assembly shall comply with (a) – (c) during and at the conclusion of the test procedure described in 8.2 through 8.9:

a) Maintain their structural integrity and weather resistant integrity during the entire test period.

b) Not disengage, separate or loosen at any location of securement to the test frame that simulates the building structure.

c) Shall not allow permanent deformation of a component that results in loss of structural resistance (an example of permanent deformation is buckling of a seam in standing seam metal roofing in a 10 × 10 test).

8.3 The uplift resistance rating shall be stated in increments of 15 lbs/ft^2 (0.7 kPa) of uplift resistance and shall be the highest level attained by the assembly that was held for the full 60 sec and continued to meet the conditions of acceptance.

8.4 The results of the 5 × 9 Simulated Uplift Pressure Test shall be stated up to, and including, a maximum of 90 lbs/ft^2 (4.3 kPa).

8.5 In accordance with 8.6 to 8.9 the specific material or component(s), if utilized within the assembly, shall receive a Simulated Uplift Resistance Rating. The rating assigned to the assembly shall be the maximum uplift resistance pressure which the assembly maintained for one min when tested using the appropriate test method referenced above (see 5.1).

8.6 In reference to 8.5, all fasteners, fastener plates and clips shall:

a) Remain securely embedded into or through roof decks and other structural substrates to which they are being fastened to or through.

b) Not pull through, become dislodged, disconnected or disengaged from plates, battens, seams or substrates.

c) Not fracture, separate or break.

8.7 In reference to 8.5, all insulations shall:

a) Not fracture, break or pull through or over fastener heads, plates or battens or show other evidence of opening of the roofing system.

b) Not delaminate or separate from their facers or adjacent components to which they have been adhered.

c) Be permitted to deflect between points of mechanical securement provided that the insulation boards do not fracture, crack or break.

8.8 In reference to 8.5, all membranes shall:

a) Not tear, puncture, fracture or develop any through openings (tearing of membrane at fastener/distribution plate or batten is allowed up to ultimate failure).

b) Not delaminate or separate from adjacent components.

Exception: Mechanically fastened membranes shall be permitted to separate and deflect from adjacent components at locations where they are not fastened.

8.9 In reference to 8.5, all adhesives shall maintain full contact between all the surfaces of all components to which it has been applied to or comes in contact with without any separation, delamination, fracture, cracking or peeling of the adhesive or its bond.

Exception No. 1: Mechanically fastened membranes shall be permitted to separate and deflect from adjacent components at location where they are not fastened.

Exception No. 2: Partially adhered membranes shall be permitted to separate and deflect from adjacent components at locations where adhesive placement was not intended.

Exception No. 3: Tearing of membrane at fastener plates and batten bars is allowed up to ultimate failure.

Exception No. 4: Minor areas of delamination are allowed provided they do not continue to grow in size by more than 50% during a given pressure level. Minor areas of delamination in wind uplift testing are an area approximately 1% of the test sample. For a 12 × 24 ft (3.6 × 7.3 m) test an area of 3 ft^2 (0.28 m^2), for a 5 × 9 test an area of 0.5 ft^2 (0.05 m^2), whereby two adhered components which are intended to be in contact are not in contact.

REPORT

9 General

9.1 The report is to contain the following information:

a) Assembly and material description.

b) Fastening types/patterns.

c) Deflection measurements, when taken.

d) Maximum uplift pressure obtained on the assembly is to be recorded. When a combination of underside uniform static positive pressure and topside uniform static negative pressure is utilized the corresponding pressure developed within the bottom and the top chambers are also to be recorded.

e) Description of how the assembly failed, if failure occurred, and other post test observations.

f) The test method used shall be shown when reporting the test results.

g) The uplift resistance rating shall be the highest level attained by the assembly that was held for the full 60 sec and continued to the meet the conditions of acceptance.

h) The fastener/plate/batten bar placement must be accurately described or depicted to provide a thorough description on placement as it relates to the insulation or substrate dimensions.

CLASSIFICATION

10 Details

10.1 The rating for the roofing system shall be the maximum static pressure difference uplift load recorded in lbs/ft^2 (kPa) sustained for a 1 min duration without failure. The rating shall include a complete description of pertinent information regarding the components and assembly detail for the roofing system.

PART II – SIMULATED WIND UPLIFT PULL TEST

GENERAL

11 Wind Upift Pull Test – General

11.1 The Wind Uplift Pull Test is intended to be used to evaluate roof assemblies where all components are fully adhered, heat welded or hot mopped with asphalt to each other and to structural or lightweight concrete and for such assemblies where the roof cover or insulation is adhered or mopped with hot asphalt to the roof deck or insulation using ribbons of adhesive or hot asphalt spaced less than or equal to 12 in (305 mm) on center. The Simulated Wind Uplift Pull Test Procedure is designed to evaluate roof assemblies in which all components have been adhered to each other and to structural or lightweight concrete roof decks with adhesive, moppings of hot asphalt or heat welding.

11.2 This method is not intended to evaluate roof assemblies that require or use mechanical securement of any component to the roof deck or assembly in which the roof cover or insulation is adhered or mopped with hot asphalt to the roof deck or insulation by using spot or ribbon application of adhesive or asphalt spaced greater than 12 in (305 mm) on center.