ANSI 405-2018

AMERICAN NATIONAL STANDARD

Standard for Adhesives for Use in Structural Glued Laminated Timber

Approved American National Standard

ANSI

APA

AMERICAN NATIONAL STANDARD

Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution. The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

Caution Notice: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036
www.ansi.org

Published by
APA – The Engineered Wood Association
7011 South 19th Street
Tacoma, WA 98466

ANSI 405-2018

AMERICAN NATIONAL STANDARD

Standard for Adhesives for Use in Structural Glued Laminated Timber

APA – The Engineered Wood Association

Approved December 12, 2017
American National Standards Institute

ABSTRACT

This Standard provides minimum requirements to evaluate adhesives for use in structural glued laminated timber.

FOREWORD (This Foreword is not a part of American National Standard ANSI 405-2018)

This Standard is a revision of ANSI 405-2013. It contains minimum requirements to evaluate adhesives for the use in structural glued laminated timber.

Development of consensus for this Standard was accomplished by the *Operating Procedures for Development of Consensus Standards* of *APA – The Engineered Wood Association,* approved by the American National Standards Institute (ANSI).

Inquiries or suggestions for improvement of this standard are welcome and should be directed to *APA – The Engineered Wood Association* at 7011 South 19th Street, Tacoma, WA 98466, www.apawood.org.

CONTENTS

STANDARD FOR ADHESIVES FOR USE IN STRUCTURAL GLUED LAMINATED TIMBER

This Standard has been developed under the provision of the American National Standards Institute (ANSI) as a new consensus standard and a revision of ANSI 405-2013.

1. SCOPE

This Standard provides minimum requirements to evaluate adhesives for use in structural glued laminated timber. Adequacy of the adhesive is established by meeting or exceeding the criteria outlined in Section 3. Alternative tests shall not be permitted to substitute for the tests prescribed in this Standard.

Although the test methods specified in this Standard are primarily intended for evaluation of face bond adhesive, the minimum test requirements noted shall be used for evaluation of end joint adhesives by adapting the required face bond specimens to conform to required end joint adhesive curing conditions.

Adhesives approved for use in structural glued laminated timber under AITC 405-92 or ANSI/AITC A190.1-2002 prior to the release of this Standard are beyond its scope. It is the responsibility of the accredited inspection agencies, as defined in ANSI A190.1-2017, to establish policies regarding the continued use of adhesives previously approved for use under those standards.

1.1 Minor Changes in Formulation

Previously approved adhesives with minor changes in formulation shall meet the requirements of ASTM D2559 and shall pass the in-plant qualification. The remaining requirements of this Standard shall be permitted to be waived if the following documentation is signed by an authorized agent and provided to the laminator's accredited inspection agency by the adhesive manufacturer:

(1) Request for approval of the modified adhesive

(2) Description of reason for the changes in formulation

(3) Statement that changes to the adhesive are minor and will not change the performance as measured by the screening tests in this Standard.

1.2 Validating Test Results

All testing shall be performed or witnessed by a laboratory accredited as a competent testing laboratory in accordance with ISO/IEC 17025 general requirements. Test results shall be submitted by the adhesive manufacturer to the accredited inspection agency.

1.3 Mixing and Curing Conditions

The mixing and curing conditions for samples made with the proposed adhesive shall be representative of the conditions recommended by the adhesive manufacturer for in-plant use. Where a variety of conditions will be recommended, the adhesive manufacturer shall provide evidence, in the form of test data or rational analysis, to attest that the adhesive will perform acceptably under all recommended mixing and curing conditions.

2. REQUIRED TESTS

The screening tests described herein shall be performed and the results submitted to the accredited inspection agency for approval prior to the in-plant qualification.

2.1 Screening Tests

For the purposes of the screening tests under Sections 2.1.1, 2.1.2, and 2.1.5, species within the groupings defined in ANSI A190.1 need not be approved separately. Treated lumber shall be considered separately under Sections 2.1.1, 2.1.2, and 2.1.5. For the screening tests under Sections 2.1.3, 2.1.4 and 2.1.6, either Douglas fir-Larch or Southern Pine shall be used. The wood used to make all test specimens shall be as required by ASTM D2559 or as required in the specific test standard.

2.1.1 ASTM D2559

This test shall be performed in its entirety under all conditions described therein.

2.1.2 ASTM D1151

For the purposes of this test, a sample shall consist of ten (10) specimens. Two (2) samples (20 specimens) of the adhesive and two (2) samples (20 specimens) of a solid wood control shall be used. The wood for the control shall be of the same species and density as that used to test the adhesive.

All specimens are permitted to be the size and shape described in ASTM D905; however, modified specimens are permitted to be used. Total specimen thickness is permitted to be reduced to 1.25 in. (32 mm). If the modified specimen size is used, all specimens (solid and bonded) shall have the thinner dimension. The specimens shall be tested in shear according to the procedures outlined in ASTM D905 or AITC Test T107. A minimum of one (1) sample (10 specimens) of each of the bonded and solid wood specimens shall be conditioned to each of the exposures listed below.

One (1) sample of each of the adhesive-bonded and the solid wood control specimens shall be tested immediately following preconditioning. The other samples shall be conditioned to Test Exposure Number 3 (see Table 1 of ASTM D1151). For the purposes of this Standard the following exception shall be permitted: temperatures shall be held ± 9°F (5°C) for one (1) hour and tested immediately.

The results shall be compared directly to the solid wood control.

2.1.3 ASTM D7247

For the purposes of this test, a sample shall consist of ten (10) specimens. One (1) sample (10 specimens) of the bonded and one (1) sample of matched solid wood control shall be used. The test temperature and heat exposure duration for specimens tested at elevated temperature (Section 7.2 of ASTM D7247) shall meet the requirements of Items 1, 2, 3, and 4 below.

(1) The solid wood control specimen and both pieces of the bonded specimen shall be prepared from the same commercial species group of Douglas fir-Larch or Southern Pine. The adhesive formulation used in the test shall be the same as the adhesive formulation used in the production process.

(2) For the bonded specimens, the minimum target bondline temperature shall be 428°F (220°C). For the matched solid wood control specimens, the minimum target temperature at the shear plane shall be 428°F (220°C).

(3) The minimum target temperatures of Item 2 shall be maintained for a minimum of 10 minutes or until achieving a residual strength ratio for the solid wood control specimens of 30% ± 10%, whichever is longer.

(4) Block shear testing shall be conducted immediately after removal from the oven such that the specimen bondline or shear plane temperature does not drop more than 9°F (5°C) after leaving the oven and prior to failure. This provision is satisfied when the time interval from the removal of the specimen from the oven to the failure of the block shear specimen does not exceed 60 seconds for each specimen tested and the room temperature of the test laboratory at the time of testing is not less than 60°F (15.5°C).

For adhesives tested in accordance with the conditions listed above, the residual shear strength ratio for the bonded specimens, as calculated in accordance with ASTM D7247, shall be equal to or higher than the lower 95% confidence interval on the mean residual shear strength ratio for the solid wood control specimens.

2.1.4 CSA O112.9 – Section 4.10.2 Creep Resistance

This test shall be performed in its entirety for exposure B_2 only.

Note: In accordance with Section 2.1, the specimens are limited to either Douglas fir-Larch or Southern Pine for the completion of this test, which may or may not coincide with the species outlined in CSA O112.9.

2.1.5 ASTM D1183

For the purposes of this test, a sample shall consist of ten (10) specimens. One (1) sample (10 specimens) of the bonded specimens and one (1) sample (10 specimens) of a solid wood control shall be used. The wood for the control shall be of the same species and density as that used to test the adhesive.

All specimens are permitted to be the size and shape described in ASTM D905, however modified specimens are permitted to be used. Total specimen thickness is permitted to be reduced to 1.25 in. (32 mm). If the modified specimen size is used, all specimens shall have the thinner dimension.

One (1) sample (10 specimens) from each of the bonded and solid wood samples shall be conditioned through one cycle of Test Condition Designation "D" in Table 1 of ASTM D1183 including all four (4) of the conditions described therein. The specimens shall be tested in shear according to the procedures outlined in ASTM D905 (or AITC Test T107).

The results shall be compared directly to the solid wood control.

2.1.6 Durability

Either test identified in this Section shall be permitted to be used for durability testing.

2.1.6.1 ASTM D3434

This test shall be performed in its entirety with the exception that the test shall not be required to run for more than 800 cycles. No phenol-resorcinol-formaldehyde control specimens shall be required.

2.1.6.2 CSA O112.9 – Section 5.5 Block Shear Test and Percent Wood Failure Assessment (Boil-Dry-Freeze Test)

This test shall be performed in its entirety with the exception that treatments outlined in Sections 5.5.3.2 and 5.5.3.3 of that standard need not be tested.

Note: In accordance with Section 2.1, the specimens are limited to either Douglas fir-Larch or Southern Pine for the completion of this test.

2.1.7 *CSA O177 – Section A.2 Small-Scale Flame Test*

This test shall be performed in its entirety.

Note: In accordance with Section 2.1, the specimens are limited to either Douglas fir-Larch or Southern Pine for the completion of this test.

2.2 In-Plant Qualification

Once the required screening tests have been passed and the data submitted and approved, the adhesive shall pass an in-plant qualification as described in ANSI A190.1 prior to being used in the manufacture of structural glued laminated timber.

3. PASS/FAIL CRITERIA

3.1 ASTM D2559

Pass/fail criteria shall be as outlined within that specification.

3.2 ASTM D1151

The average strength of bonded specimens shall equal or exceed 90% of the average strength of the solid wood control at every condition.

The average wood failure of bonded specimens according to ASTM D5266 shall equal or exceed 75% at every condition.

3.3 ASTM D7247

The residual shear strength ratio for the bonded specimens, as calculated in accordance with ASTM D7247, shall be equal to or higher than the lower 95% confidence interval on the mean residual shear strength ratio for the solid wood control specimens.

3.4 CSA O112.9 – Creep Resistance

Pass/fail criteria shall be as outlined within that specification.

3.5 ASTM D1183

The average strength of bonded specimens shall equal or exceed 90% of the average strength of the solid wood control.

The average wood failure of bonded specimens according to ASTM D5266 shall equal or exceed 75%.

3.6 Durability

3.6.1 *ASTM D3434*

Dry average strength shall equal or exceed the values listed in Table 1 or ASTM D2559.

TABLE 1

REQUIRED AVERAGE SHEAR STRENGTH OF ADHESIVE JOINTS IN LAMINATED CONSTRUCTIONS OF DIFFERENT SPECIES AT VARIOUS MOISTURE CONTENTS

	Required Average Shear Strength (psi) at Moisture Content of		
Species	**12% or less**	**Up to 14%**	**Up to 16%**
Douglas fir	1,020	980	940
Larch, Western	1,220	1,160	1,100
Pine, Southern	1,250	1,150	1,040

Strength retention and wood failure shall be recorded at each stage of the test. The retained strength shall be plotted on a graph as a function of the number of cycles. The shape of the curve shall exhibit a logarithmic degradation trend. The strength of the adhesive after 800 cycles shall equal or exceed 500 psi (3.45 MPa) and shall not be less than 2/3 of the strength retained after 200 cycles.

Exception: the strength retention requirement after 800 cycles shall be permitted to be reduced to 400 psi (2.76 MPa) if the average wood failure of the specimens exceeds 75%. In no case, however, shall the strength after 800 cycles be less than 2/3 of the strength retained after 200 cycles.

3.6.2 *CSA O112.9 – Boil-Dry-Freeze Test*

Pass/fail criteria shall be as outlined within that specification.

3.7 CSA O177 – Section A.2 Small-Scale Flame Test

Pass/fail criteria shall be as outlined within that standard.

4. REPORTING

The results of all screening tests shall be summarized in a single report with supporting test data appended for reference.

4.1 Submission of Data

All data for all testing as required in this Standard shall be submitted to the laminator's accredited inspection agency by the adhesive manufacturer at the time of application for certification.

REFERENCES

AITC Test T107. 2007. Shear Test. Included in *AITC Test Methods for Structural Glued Laminated Timber.* American Institute of Timber Construction. Centennial, Colorado.

AITC 405-92. 1992. *Standard for Adhesives for Use in Structural Glued Laminated Timber.* American Institute of Timber Construction. Centennial, Colorado.

ANSI A190.1-2017. 2017. *American National Standard for Wood Products – Structural Glued Laminated Timber. APA – The Engineered Wood Association.* Tacoma, Washington.

ANSI/AITC A190.1-2002. 2002. *American National Standard for Wood Products – Structural Glued Laminated Timber.* American Institute of Timber Construction. Centennial, Colorado.

ASTM D905-08(2013). 2008 (Reapproved 2013)**.** *Standard Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading.* ASTM International. West Conshohocken, Pennsylvania.

ASTM D1151-00(2013). 2000 (Reapproved 2013). *Standard Practice for Effect of Moisture and Temperature on Adhesive Bonds.* ASTM International. West Conshohocken, Pennsylvania.

ASTM D1183-03(2011). 2003 (Reapproved 2011). *Standard Practices for Resistance of Adhesives to Cyclic Laboratory Aging Conditions.* ASTM International. West Conshohocken, Pennsylvania.

ASTM D2559-12ae1. 2012. *Standard Specification for Adhesives for Bonded Structural Wood Products for Use under Exterior Exposure Conditions.* ASTM International. West Conshohocken, Pennsylvania.

ASTM D3434-00(2013). 2000 (Reapproved 2013). *Standard Test Method for Multiple-Cycle Accelerated Aging Test (Automatic Boil Test) for Exterior Wet Use Wood Adhesives.* ASTM International. West Conshohocken, Pennsylvania.

ASTM D5266-13. 2013. *Standard Practice for Estimating the Percentage of Wood Failure in Adhesive Bonded Joints.* ASTM International. West Conshohocken, Pennsylvania.

ASTM D7247-16. 2016. *Standard Test Method for Evaluating the Shear Strength of Adhesive Bonds in Laminated Wood Products at Elevated Temperatures.* ASTM International. West Conshohocken, Pennsylvania.

CSA O112.9-10. 2010 (Reaffirmed 2014). *Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).* Canadian Standards Association. Mississauga, Ontario, Canada.

CSA O177-06. 2006 (Reaffirmed 2015). *Qualification Code for Manufacturers of Structural Glued-Laminated Timber.* Canadian Standards Association. Mississauga, Ontario, Canada.

Forest Products Laboratory, U.S. Department of Agriculture, Forest Service. 2010. *Wood Handbook – Wood as an Engineering Material.* General Technical Report FPL-GTR-190. Madison, Wisconsin.

ISO/IEC 17025. 2005. *General Requirements for the Competence of Testing and Calibration Laboratories.* International Organization for Standardization/International Electrotechnical Commission. Geneva, Switzerland.

APPENDIX A. COMMENTARY (NON-MANDATORY)

C.1 Scope

This standard was developed by the structural glued laminated timber industry to establish a consistent and reasonable performance level for adhesives used in structural glued laminated timber. Historically, satisfactory performance has been maintained by prescriptively limiting the types of adhesives permitted for this use and allowing the marketplace to "weed out" poor performers. Alternative adhesive types were permitted only after extensive testing and comparisons to control specimens bonded with phenol-resorcinol-formaldehyde (PRF) adhesives.

Changes in adhesive technology and knowledge have created a need to define measurable performance requirements for adhesives used in structural glued laminated timber. Principles of fair and equitable competition dictate that these performance-based requirements be applicable to all adhesives, regardless of type. Therefore, all new adhesives proposed for use in structural glued laminated timber are required to meet the criteria defined in this Standard.

C.1.1 Minor Changes in Formulation

The intent of this provision is to allow the accredited inspection agency to reduce testing requirements when minor changes are made to an approved adhesive. The results of the ASTM D2559 tests and the documentation required for submittal to the accredited inspection agency provide evidence that the adhesive changes are minor.

C.1.2 Validating Test Results

The intent of this Section is to ensure that tests of adhesives are performed in a competent manner producing consistent results.

C.1.3 Mixing and Curing Conditions

Many variables affect the curing and subsequent performance of structural adhesives. One adhesive may perform well when cured at room temperature, but may perform poorly when cured using radio frequency (RF) curing techniques. Another adhesive may be very sensitive to the moisture content of the lumber or some other variable.

While it is impossible to test every possible combination of variables, the adhesive manufacturer should perform sufficient testing to ensure reliable performance of the adhesive under all application and curing conditions recommended by the manufacturer. It is the responsibility of the adhesive manufacturer to demonstrate that the adhesive is suitable for use under the recommended conditions. This may be accomplished by testing multiple sets of specimens to "bracket" the expected performance of the adhesive or by testing specimens cured under the known limiting conditions.

C.2 Required Tests

The screening tests are typically conducted by the adhesive manufacturer, and the in-plant qualification is conducted by the laminator under the supervision of the accredited inspection agency.

C.2.1 Screening Tests

ANSI A190.1 groups species with similar bonding and strength characteristics for in-plant qualification of an adhesive. These same groups are acceptable for the screening tests.

For the tests in Sections 2.1.3, 2.1.4, 2.1.6, and 2.1.7, either Douglas fir-Larch or Southern Pine specimens are permitted to be used. Either of these species is suitable to demonstrate the durability of the adhesive under the accelerated aging tests. Further durability testing on other species is not necessary as the purpose is to test the adhesive, not the substrate nor the durability of the species of wood.

C.2.1.2 ASTM D1151

The modified specimen thickness accommodates the use of one-inch (nominal) thickness lumber planed to a thickness of 5/8 inch (16 mm) for the bonded specimens. Using the modified specimen thickness, side-matched specimens of bonded and solid wood can be obtained from a single piece of 2 x 6 dimension lumber.

C.2.1.3 ASTM D7247

The intent of Section 2.1.3 is that all specimens are held at the target temperature for the same period of time. Subsequently, it is necessary to determine the required time through preliminary testing of samples of solid-sawn specimens.

C.2.1.4 CSA O112.9 – Section 4.10.2 Creep Resistance

For the purposes of this screening test, species used shall conform to the species groupings as outlined in ANSI A190.1, which may or may not coincide with those outlined in CSA O112.9.

The intent of CSA O112.9 condition B_2 creep test was to simulate temperatures that framing members in a fire-protected assembly could be exposed to at some point during a standard fire test to determine the fire resistance rating. Glulam member may be exposed to longer fire events than protected framing members. Despite the basis of the test being different (protected framing members vs. glulam), the ANSI 405 Committee felt the test condition (in addition to the battery of other tests required by ANSI 405) satisfies the high temperature creep requirements for adhesives for use in glulam.

C.2.1.5 ASTM D1183

See Section C.2.1.2.

C.2.1.6 Durability

C.2.1.6.1 ASTM D3434

The automatic boil test in ASTM D3434 has demonstrated its usefulness as a predictor of durability. This test has been a requirement for adhesives qualified under ANSI 405 since its inception. Traditionally, this test has been run for 800 cycles with comparison made to PRF control specimens. Careful inspection of data available from several sources has led to the establishment of performance-based criteria, eliminating the need for a PRF control.

C.2.1.6.2 CSA O112.9 – Boil-Dry-Freeze Test

While the automatic boil test in ASTM D3434 is considered an excellent test, limited accessibility of test equipment makes an alternative test desirable. Limited data suggest that the CSA O112.9 Boil-Dry-Freeze test provides a useful alternative to ASTM D3434.

For the durability tests outlined in Section 2.1.6, Douglas fir-Larch or Southern Pine are the only two species allowed to be used, though both species need not be used.

C.2.1.7 CSA O177 – Section A.2 Small-Scale Flame Test

The intent of Section 2.1.7 is to qualify the adhesive to avoid delamination due to intensive heat, such as under fire exposure.

C.3.6 Durability

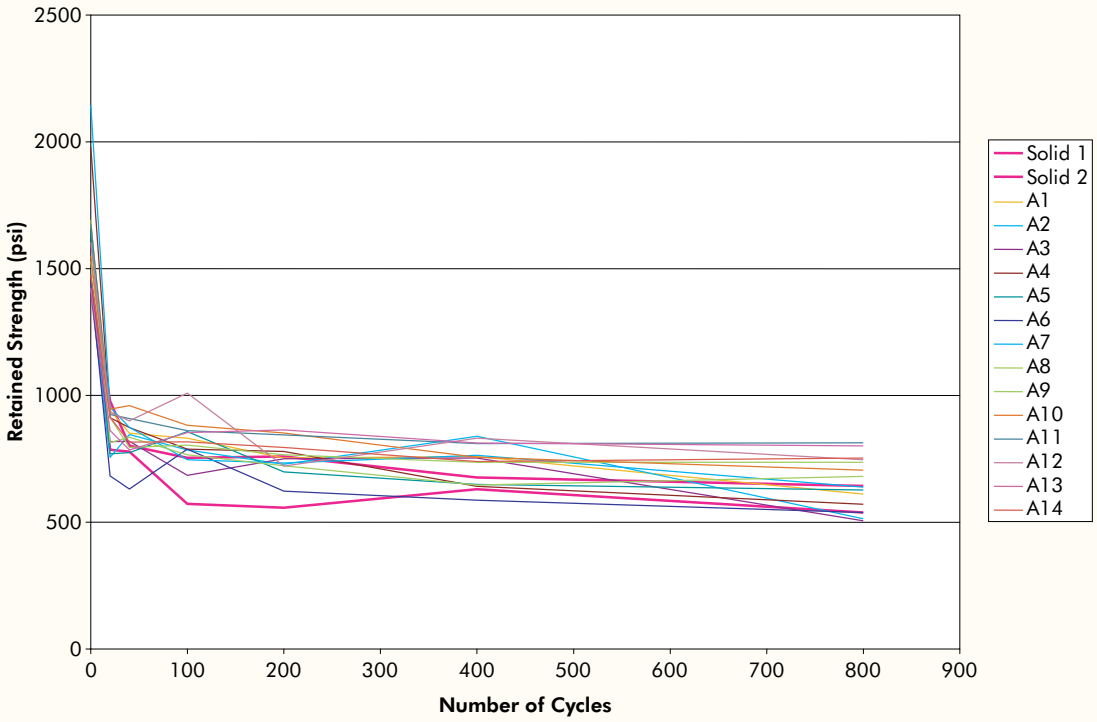
C.3.6.1 ASTM D3434

The strength of solid wood specimens and specimens bonded with durable adhesives follow similar degradation trends when subjected to this test. Both follow a logarithmic degradation trend as cycles increase. Most of the strength loss occurs in the first 100 cycles of exposure, with the retained strength leveling off after about 100–200 cycles. Adhesives with insufficient durability will typically continue to lose strength rapidly, rather than "leveling off" like these adhesives. Figure C1 illustrates this trend using actual performance data for solid wood and several adhesives, including samples of PRF, melamine, polyurethane, and isocyanate adhesives from several manufacturers. Each of the adhesives shown meets the performance requirements of this test.

The retained strength requirements are permitted to be reduced according to the provisions of the *Exception* clause if accompanied by high percentages of wood failure. This provision was included to avoid penalizing good performing adhesives, because the wood degraded somewhat more than expected.

FIGURE C1

PERFORMANCE CURVES FOR DURABLE ADHESIVES



C.4.1 Submission of Data

The laminator's accredited inspection agency will determine if an adhesive meets the requirements of this Standard and give or deny approval. The accredited inspection agency will inform the adhesive manufacturer of its decision with any reasons for disapproval. Either party may request a ruling of the Technical Review Board to resolve a dispute or disagreement.

APPENDIX B – HISTORY OF STANDARD (NON-MANDATORY)

This Standard was initially published in 2005 by the American Institute of Timber Construction (AITC) as ANSI/AITC 405-2005 and subsequently revised in 2008 as ANSI/AITC 405-2008. On January 1, 2013, the responsibilities of the Secretariat for this standard were transferred to *APA – The Engineered Wood Association* with a revised designation as ANSI 405-2008 after approved by the American National Standards Institute (ANSI). ANSI 405-2008 was revised as ANSI 405-2013 and ANSI 405-2018 subsequently.

The names of the ANSI Committee members when this version of the Standard was published are as shown below. The current list of the committee membership is available from the committee secretariat upon request.

Name	Affiliation	Notes
Deepareddy Akula	McFarland Cascade	
Joshua Bartlett	Franklin International	
Larry Beineke	PFS TECO	
Robert Browder	Southern Pine Inspection Bureau	
Kevin Cheung	Western Wood Products Association	
Don Devisser	West Coast Lumber Inspection Bureau	Vice Chair
Brad Douglas	American Wood Council	
Kerlin Drake	Canfor Southern Pine	
Bill Gareis	Ashland Inc.	
Paul Gilham	Western Wood Structures Inc.	
Ron Goff	ProNet Group Inc.	
Bill Gould	ICC Evaluation Service Inc.	
Bill Grigsby	Glulam/Heavy Timber Detailer	
Jim Griswold	Hexion Inc.	ExSub Member
Jessica Jennings	Georgia-Pacific Chemicals LLC	
Jeet Kumar	U.S. Department of Veterans Affairs	
Mike Lane	QB Corporation	
Patrick Levy	Structural Wood Systems	
Jeff Morrison	Rosboro LLC	Chair
Jeff Olson	Boise Cascade	
Victor Pearson	American Laminators	
Douglas Rammer	USDA Forest Products Laboratory	
Andreas Rhude	Sentinel Structures Inc.	
Glen Robak	Weyerhaeuser Company	
Scott Skinner	Akzo Nobel Coatings Inc.	
Kurt Stochlia	KSPE Inc.	
Leif Van Cott	Unadilla Laminated Products	
Lane Vanek	Alamco Wood Products LLC	
Jim Vogt	Structural Building Components Association	
Chris Whelan	Henkel Corporation	
Tom Williamson	T. Williamson – Timber Engineering LLC	ExSub Member
B.J. Yeh	APA – The Engineered Wood Association	Secretariat
Larry Zhou	Universal Timber Structures	

Inquiries or suggestions for improvement of this Standard should be directed to:
Secretariat, ANSI 405
APA – The Engineered Wood Association
7011 South 19th Street
Tacoma, WA 98466
Internet address: www.apawood.org
e-mail address: help@apawood.org

ANSI 405-2018
Standard for Adhesives for Use in Structural Glued Laminated Timbers

APA HEADQUARTERS
7011 So. 19th St. ▪ Tacoma, Washington 98466 ▪ (253) 565-6600 ▪ Fax: (253) 565-7265

www.apawood.org

PRODUCT SUPPORT HELP DESK
(253) 620-7400 ▪ help@apawood.org

Form No. ANSI 405-2018/Issued December 2017

Approved American National Standard

ANSI

APA