Committee D14 on Adhesives
Subcommittee D14.30 on Wood Adhesives

Research Report D14-1015

Interlaboratory Study to Establish Precision Statements for ASTM D905, Strength Properties of Adhesive Bonds in Shear by Compression Loading

Technical contact:
Mr. Richard Cook,
National Casein Of Ca
33425 N 74Th Way
Scottsdale, AZ 85266
United States
racook@nationalcasein.com

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

1. Introduction:

Interlaboratory Study 278 was conducted to establish a precision statement for D0905, Strength Properties of Adhesive Bonds in Shear by Compression Loading.

2. Test Method:

The Test Method used for this ILS is D905. To obtain a copy of D0905, go to ASTM's website, www.astm.org, or contact ASTM Customer Service by phone at 610-832-9585 (8:30 a.m. - 4:30 p.m. Eastern U.S. Standard Time, Monday through Friday) or by email at service@astm.org.

3. Participating Laboratories:

The following laboratories participated in this interlaboratory study

1. Weyerhaeuser
WTC 1B15
32901 - 32nd Drive South
Federal Way, WA 98003
United States
Dick Caster

4. Description of Samples:

There were 6 samples of varying targeted results used for this study. Each sample was prepared and distributed by Dick Caster of Weyerhaeuser. Below is a list of the samples with the corresponding supplier:

1. Casein Glue Adhesive
   Provided by National Casein

2. Chembond for Fir
   Provided by Weyerhaeuser

3. Chembond for Maple
   Provided by Weyerhaeuser

4. Elastomatic
   Provided by DAP

5. PVAc (Hard)
   Provided by National Casein

6. PVAc (Soft)
   Provided by National Casein

5. Interlaboratory Study Instructions

Laboratory participants were emailed the test program instructions. For a copy of the instructions, please see Annex A.

6. Description of Equipment/Apparatus[1]:

For information on the equipment/apparatus used by each laboratory, please see Annex B.

7. Data Report Forms:

Each laboratory was provided with a data report form for the collection of data. A copy of the data is provided in Annex C.

Please note: The laboratories have been randomly coded and cannot be identified herein.

8. Statistical Data Summary:

A summary of the statistics calculated from the data returned by the participating laboratories is provided in Annex C.

9. Precision and Bias Statement:

9.1 *Precision*:
9.1.1 Precision has two components: repeatability at a given test site and reproducibility between test sites. The precision of this test method is affected by many factors including, but not limited to: (*1*) the wood species, (*2*) the boards selected, (*3*) grain direction, (*4*) growth ring orientation, (*5*) the quality of the bonded joint, (*6*) the condition of the shear tool, (*7*) the precision on the testing machine, and (*8*) the operator. When the specimen fails primarily in the wood, the normally variability of the wood strength affects the precision. The coefficient of variation of shear strength parallel to the grain is 14 % for a given species of wood.

9.1.2 *Repeatability at a Given Site*:
9.1.2.1 In a study in which all the above factors were closely controlled and the specimens were bonded with phenolresorcinol formaldehyde adhesive, the coefficient of variation ranged from 2.4 up to 13.0 %, with most values in the range of
3 to 6%.

9.1.2.2 In a study in which all the above factors, except board and growth ring orientation, were controlled, the coefficients of variation ranged from 8 to 11 % for casein bonded specimens, 4 to 12 % for two polyvinyl acetates, 22 to 27 % for an elastomer-based, and 14 to 21 % for phenol-resorcinol formaldehyde adhesive bonded specimens.

9.1.3 *Reproducibility from site to site*:

[1] The equipment listed was used to develop a precision statement for [Standard Designation with date]. This listing is not an endorsement or certification by ASTM International.

9.1.3.1 The reproducibility of this test method has not been established.

9.2 *Bias*—Bias is the difference between the true shear strength of the adhesive bond and the strength measured by a method that is repeatable. Bias arises from the design, method, rate of loading the specimen, and from the strength of the wood.

Annex A:

1. Prepare trial block assemblies on each adhesive first (12 inch assembly will yield 5 blocks). Cut assemblies into blocks and check strengths before proceeding.
2. Set up procedure for bonding the 16 assemblies to send to Caster.

Jan 09, 1986 – a lab technicial review the maple stock and measured to see how many assemblies could be made. Where necessary, poor areas with knots and surface problems will be cut our of the raw lumber. May not be able to make all 16 assemblies as requested.

Jan 12, 1986 – ran a trial bonding using casein glue:
Spread rate: 60 lb/MSGL (single bondline)
Assembly Time: 5 minutes
Press time: 1 hour at 175 psi
Ambient temperature: 75F

Jan 12, 1986 – ran a trial bonding the soft PVAc and the hard PVAc:
Spread rate: 45 lb/MSGL (single bondline)
Assembly Time: 5 minutes
Press time: 1 hour at 250 psi
Ambient temperature: 75F

Annex B:

Apparatus

5.1 The testing machine shall have a capacity of not less than 6810 kg (15 000 lb) in compression and shall be fitted with a shearing tool containing a self-aligning seat to ensure uniform lateral distribution of the load. The machine shall be capable of maintaining a uniform rate of loading such that the load may be applied with a continuous motion of the movable head to maximum load at a rate of 5 mm (0.20 in.)/min with a permissible variation of ±25 %. The shearing tool shown in Fig. 1 has been found satisfactory. The testing machine shall be located in an atmosphere such that the moisture content of the specimens developed under the conditions prescribed in Section 8 is not noticeably altered during testing.