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Committee F17 on Plastic Piping Systems
Subcommittee F17.40 on Test Methods

Research Report: F17-1053

Interlaboratory Study to Establish Precision Statements for ASTM F2634-15, Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method

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1. Introduction:

Interlaboratory Study 1110 was conducted to establish a precision statement for F2634, Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method.

2. Test Method:

The Test Method used for this ILS is F2634-15. To obtain a copy of F2634, 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:

Engineering Mechanics Corporation of Columbus
3518 Riverside Drive, Suite 202
Columbus, Ohio 43221-1735
USA
Prabhat Krishnaswamy
kswamy@emc-sq.com

Microbac Laboratories, Inc. - Hauser Division
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Boulder, Colorado 80301
USA
Steve Ferry
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McElroy Manufacturing
833 N Fulton Ave
TULSA, Oklahoma 74115
USA
Jason Lawrence
JLAWRENCE@MCELROY.COM

4. **Description of Samples:**

There were 2 samples of varying targeted results used for this study. Each sample was supplied, prepared and distributed by Jason Lawrence of McElroy Manufacturing. Below is a list of the samples:

Material A-Yellow MDPE Joint Test Specimen

Material B-Black HDPE Joint Test Specimen

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.

[1] The equipment listed was used to develop a precision statement for F2634-15. This listing is not an endorsement or certification by ASTM International.

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 D.

9. Precision and Bias Statement:

13.1 The precision of this test method is based on an interlaboratory study of ASTM F2634, Standard Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method, conducted in 2014. Three laboratories participated in this study. Each of the labs reported eight replicate test results for two different PE butt fusion joints. Every "test result" reported represents an individual determination. Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. F17-1053.[i]

NOTE #: All testing resulted in rupture of the test specimens outside of the joining interface. Therefore the tables provided below illustrate the performance of the pipe material in the test specimen rather than directly reflecting the performance of the unfailed joint.

13.1.1 Repeatability (r) - The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

13.1.1.1 Repeatability can be interpreted as the maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

13.1.1.2 Repeatability limits are listed in Tables 1 and 2 below.

13.1.2 Reproducibility (R) - The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

13.1.2.1 Reproducibility can be interpreted as the maximum difference between two results, obtained under reproducibility conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

13.1.2.2 Reproducibility limits are listed in Tables 1 and 2 below.

13.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E 177.

13.1.4 Any judgment in accordance with statements 13.1.1 and 13.1.2 would normally have an approximate 95% probability of being correct, however the precision statistics obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The limited number of materials tested and laboratories reporting results guarantees that there will be times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95% probability limit would imply. The repeatability limit and the reproducibility limit should be considered as general guides, and the associated probability of 95% as only a rough indicator of what can be expected.

Table 1. Minimum Width Measured (inches)

Material	Average[ii] $\bar{x}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation s_R	Repeatability Limit r	Reproducibility Limit R
Material A	0.399	0.001	0.002	0.002	0.004
Material B	0.401	0.002	0.004	0.005	0.010

Table 2. Average Velocity (inches per second)

Material	Average[iii] $\bar{x}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation s_R	Repeatability Limit r	Reproducibility Limit R
Material A	5.862	0.031	0.117	0.086	0.329
Material B	5.843	0.005	0.212	0.013	0.593

Table 3. Yeild Stress (psi)

Material	Average[iv] $\bar{x}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation s_R	Repeatability Limit r	Reproducibility Limit R
Material A	4148	28	249	80	697
Material B	4534	35	47	99	133