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PRECISION AND BIAS STATEMENT

SLIP-TEST MARK IIIB TRIBOMETER

Updated January 19, 2015

The precision of the attached "F2508 Validation / Calibration / Certification Test Method" dated 1/13/2014 is based on an InterLaboratory Study (hereafter "ILS") of one set of ASTM F2508 Adjunct reference tiles RS-A, RS-B, RS-C, and RS-D. The tiles were purchased from ASTM in April 2011. The Certification Test Method conforms to ASTM F2508-13 *Standard Practice for Validation, Calibration, and Certification of Walkway Tribometers Using Reference Surfaces*[i]. The ILS was conducted on January 15, 2014 in Lake Buena Vista, Florida. The eight different operators used eight different Slip-Test Mark III "B" series tribometers, each equipped with one of eight different testfeet – each unique combination of operator, tribometer, and testfoot comprised a "laboratory". The ILS Coordinator was John Leffler, PE, lead engineering consultant to Slip-Test.

This precision statement is applicable only to Slip-Test Mark IIIB tribometers[ii]. Each of the eight operators tested the four different F2508 Adjunct reference tiles in four nominally perpendicular directions, and recorded three test results in each direction. Ambient test conditions were 72.6ºF and 48% RH. As prescribed for "Certification" within ASTM F2508-2013, ASTM E691 *Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method*[iii] was utilized for analysis of the ILS data. The data and calculations are attached at the end of this Statement.

TERMINOLOGY

A glossary of terminology follows the Precision and Bias statements below.

ILS NOTES

The testfoot starting height requirements of Certification Test Method step 3 were verified through the use of a digital caliper and metal straightedge in addition to the specified go/no-go gauge, and the different testfoot starting heights of the 8 tribometers were found to be within 0.015" of each other.

As has been noted by others involved in tribometer testing on other F2508 reference tiles, the tiles tended to shed water to varying extents. At times, it was necessary to apply a lot of distilled water to the reference tile to ensure that a continuous unbroken film (puddle) of water remained under the testfoot before each test was triggered. Variability in the achievable thickness of the water puddle was more pronounced with RS-C (VCT) and RS-D (ceramic tile). This may have contributed to the generally higher reproducibility standard deviation of the results for RS-C and RS-D, as compared to RS-A and RS-B.

During testing, one droplet of fugitive lubricant/water residue fell from the fine-adjustment quick release nut of one tribometer, onto RS-D. The droplet fell to the side of the tile, outside the area of the tile being tested, and was noticed immediately by the lab personnel. The droplet was promptly soaked up with a paper towel, and though no visible residue remained, RS-D was re-scrubbed with SLS solution (and rinsed) per ASTM F2508 sections 8.2.1.2 through 8.2.1.4. It was then sprayed with 50% alcohol / 50% water mixture and wiped with a clean white terrycloth towel, prior to resuming testing.

Referring to the glossary definition below (from ASTM E177) for "reproducibility conditions", for the subject ILS it was determined that utilizing a common location was acceptable; most entities that own tribometers do not have the sophisticated climate control (temperature/humidity) systems in their laboratory facilities that would be necessary to equalize this aspect of the ILS test conditions. Additionally, several of the tribometer operators were employed by the same entity and (at work) had the same supervisor – but this ILS was supervised by the ILS Coordinator.

PRECISION RESULTS

All data and calculations are attached following this Precision & Bias statement. The calculation worksheet references formulas by number from ASTM E691-11.

		RS-A	*RS-B*	*RS-C*	*RS-D*
average of lab averages	$\bar{X}$	0.136042	0.244167	0.408854	0.677083
repeatability standard deviation	s_r	0.008704	0.011323	0.016620	0.027890
reproducibility standard deviation	s_R	0.011783	0.019433	0.03146	0.042007
repeatability limit	r	0.024371	0.031706	0.046537	0.078091
reproducibility limit	R	0.032992	0.054413	0.088087	0.11762

In accordance with E691, the above repeatability limits and reproducibility limits have an approximately 95% probability of being correct.

BIAS STATEMENT

At this time of this ILS, there was no walkway tile available that provided a "known" accepted reference value for traction; any such determination would be subject to the operational influences of the particular apparatus and method used to measure that traction.

GLOSSARY

The following definitions from ASTM E177 *Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods*[iv] are applicable. See E177 for additional discussion of these terms, which are numbered here as in that standard..

3.1.3 Bias, n—the difference between the expectation of the test results and an accepted reference value.

3.1.10 Precision, n—the closeness of agreement between independent test results obtained under stipulated conditions.

3.1.11 Repeatability, n—precision under repeatability conditions.

3.1.12 Repeatability conditions, n—conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time.

3.1.13 Repeatability limit (r), n—the value below which the absolute difference between two individual test results obtained under repeatability conditions may be expected to occur with a probability of approximately 0.95 (95%).

3.1.13.1 Discussion—The repeatability limit is 2.8 (~1.96√2) times the repeatability standard deviation. This multiplier is independent of the size of the interlaboratory study.

3.1.14 Repeatability standard deviation (s_r), n—the standard deviation of test results obtained under repeatability conditions.

3.1.15 Reproducibility, n—precision under reproducibility conditions.

3.1.16 Reproducibility conditions, n—conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment.

3.1.16.1 {excerpt} Discussion—A different laboratory of necessity means a different operator, different equipment, and different location and under different supervisory control.

3.1.17 Reproducibility limit (R), n—the value below which the absolute difference between two test results obtained under reproducibility conditions may be expected to occur with a probability of approximately 0.95 (95%).

3.1.17.1 Discussion—The reproducibility limit is 2.8 (~1.96√2) times the reproducibility standard deviation. The multiplier is independent of the size of the interlaboratory study (that is, of the number of laboratories participating).

3.1.18 Reproducibility standard deviation (s_R), n—the standard deviation of test results obtained under reproducibility conditions.

Prepared by ILS Coordinator: John Leffler, PE

REFERENCES

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[i] ASTM F2508-13, *Standard Practice for Validation, Calibration, and Certification of Walkway Tribometers Using Reference Surfaces*, ASTM International, West Conshohocken PA, 2013

[ii] Slip-Test Mark IIIB tribometers can be identified as serial numbers 40 and 43-on.

[iii] ASTM E691-11 *Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method,* ASTM International, West Conshohocken PA, 2011

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