
Standard Method of Test for Penetration of Bituminous Materials

AASHTO Designation: T 49-15 (2019)

Technically Revised: 2015

Reviewed but Not Updated: 2019

Editorially Revised: 2021

Technical Subcommittee: 2b, Liquid Asphalt

ASTM Designation: D5/D5M-13



**American Association of State Highway and Transportation Officials
555 12th Street NW, Suite 1000
Washington, D.C. 20004**

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AASHTO T 49-15 is identical to ASTM D5/D5M-13 except for the following provisions:

1. Replace all references to ASTM D36 with AASHTO T 53.
2. Add the following to Section 2:

2.4 Federal Standard:

- Fed. Std. No. 29, CFR 1910.1200 OSHA Hazard Communication Standard; see also Permissible Exposure Limits—Annotated Tables, available at <https://www.osha.gov/dsg/annotated-pels/>

Replace the last sentence of Section 6.1 with the following:

The weight of the spindle shall be checked.

3. Add the following sentence to the end of Section 7.2:
If air bubbles are visible in the surface of the specimen, briefly flash the top of the specimen with a flame.
4. Replace Section 11 with the following:

11. Precision and Bias

11.1 *Precision*—Criteria for judging the acceptability of penetration of asphalt binder results obtained by this method are given in Table X.

Note: Precision data for penetration on asphalt residue of emulsified asphalt can be found in T 59.

11.1.1 *Single-Operator Precision (Repeatability)*—The figures in Column 2 of Table X are the standard deviations that have been found to be appropriate for the conditions of test described in Column 1. Two results obtained in the same laboratory, by the same operator using the same equipment, in the shortest practical period of time, should not be considered suspect unless the difference in the two results exceeds the values given in Table X, Column 3.

11.1.2 *Multilaboratory Precision (Reproducibility)*—The figures in Column 2 of Table X are the standard deviations that have been found to be appropriate for the conditions of test described in Column 1. Two results submitted by two different operators testing the same material in different laboratories shall not be considered suspect unless the difference in the two results exceeds the values given in Table X, Column 3.

Table X—Precision Estimates of Penetration of Bituminous Materials

Condition of Test and Test Property		Standard Deviation $1s^{a,b}$	Acceptable Range of Two Test Results $d2s^{a,b}$
Single-Operator Precision:			
4°C	Original	$1s = 0.01X + 0.8$	$d2s = (0.01X + 0.8) \times 2.83$
	RTFO	$1s = 0.02X + 0.4$	$d2s = (0.03X + 0.3) \times 2.83$
25°C	Original	$1s = 0.01X + 0.7$	$d2s = (0.01X + 0.6) \times 2.83$
	RTFO	$1s = 0.01X + 0.5$	$d2s = (0.02X + 0.5) \times 2.83$
Multilaboratory Precision:			
4°C	Original	$1s = 0.06X + 1.9$	$d2s = (0.06X + 2.0) \times 2.83$
	RTFO	$1s = 0.06X + 1.5$	$d2s = (0.07X + 1.5) \times 2.83$
25°C	Original	$1s = 0.03X + 1.3$	$d2s = (0.02X + 1.8) \times 2.83$
	RTFO	$1s = 0.04X + 1.2$	$d2s = (0.04X + 1.2) \times 2.83$

^a These values represent the 1s and d2s limits described in ASTM Practice C670.

^b The value of X represents the average value of two test results.

Note: The precision estimates given in Table X are based on the analysis of test results from 21 pairs of AMRL Viscosity Graded Asphalt Cement proficiency samples. The data analyzed consisted of results from 71 to 97 laboratories for each of the pairs of samples. The analysis included original asphalt cements with the average penetration value of 11.7 units to 44 units at 4°C and 33.4 units to 128.9 units at 25°C and RTFO residue with the average penetration value of 7.8 units to 27.2 units at 4°C and 19.8 units to 68.4 units at 25°C.

11.2 *Bias*—No information can be presented on the bias of the procedure because no comparison with a material having an accepted reference value was conducted.