Designation: D711 – 10 (Reapproved 2015)

Standard Test Method for No-Pick-Up Time of Traffic Paint[1]

This standard is issued under the fixed designation D711; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers a laboratory procedure for determining the no-pick-up time of a traffic paint. The method uses a wheel consisting of a metal cylinder with rubber O-rings. The wheel is rolled down a ramp over a freshly applied traffic paint film repeatedly until there is no transfer of paint to the rubber rings. The elapsed time from paint film application to point of no paint transfer is the no-pick-up time. Key variables to be controlled during testing are film thickness, temperature, humidity, and air flow.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels

D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings

D1414 Test Methods for Rubber O-Rings

D2000 Classification System for Rubber Products in Automotive Applications

D4414 Practice for Measurement of Wet Film Thickness by Notch Gages

D5741 Practice for Characterizing Surface Wind Using a Wind Vane and Rotating Anemometer

3. Significance and Use

3.1 This test method serves as a laboratory control test. Types of traffic paints that can be tested with this method are waterborne, solventborne, and some 100 % solids liquid traffic paints. This test is most commonly used with fast-dry waterborne traffic paints. If wet film thickness, temperature, and humidity are controlled within the tolerances specified herein, this method can be useful for relative testing of traffic paints and potentially for qualification of traffic paints for field application in approved specifications. For improved repeatability and meaningful comparison of paint samples being tested, consistent air flow over the paint films during testing is important. Although a no-air-flow (static) test environment is standard, the buyer and seller should agree upon the air flow conditions, whether it be static or carefully regulated air flow (see 4.6.1 and 4.6.2). No-pick-up times for fast-dry waterborne traffic paints are typically less than 10 min in a static air flow condition. Because of the many variables operative in the field application of traffic paint (for example, film thickness, air temperature, humidity, wind speed, pavement type (asphalt or concrete), film profile over pavement, pavement temperature, pavement porosity, pavement moisture content, and the presence or absence of direct sunlight during striping), a direct correlation between the results of this test and field applications is difficult to obtain. However, relative field performance can be predicted using this method if the testing protocol is adhered to.

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.44 on Traffic Coatings.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

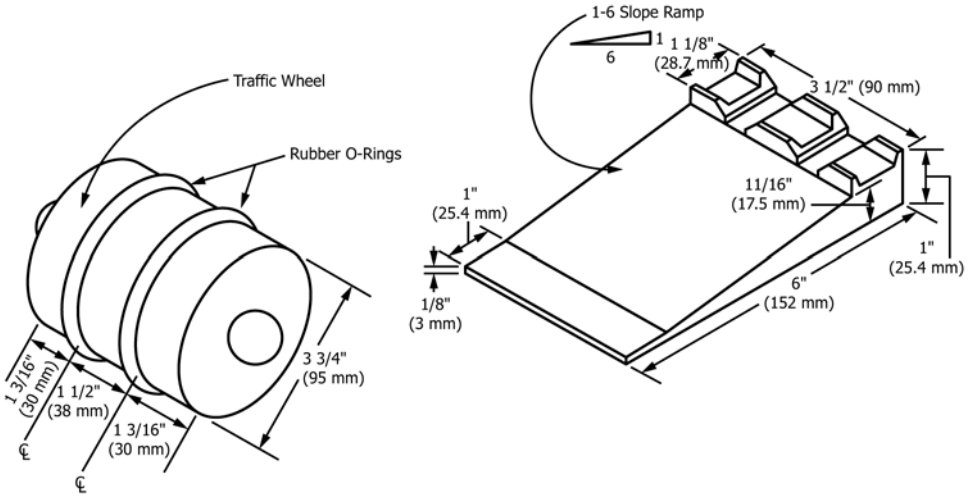
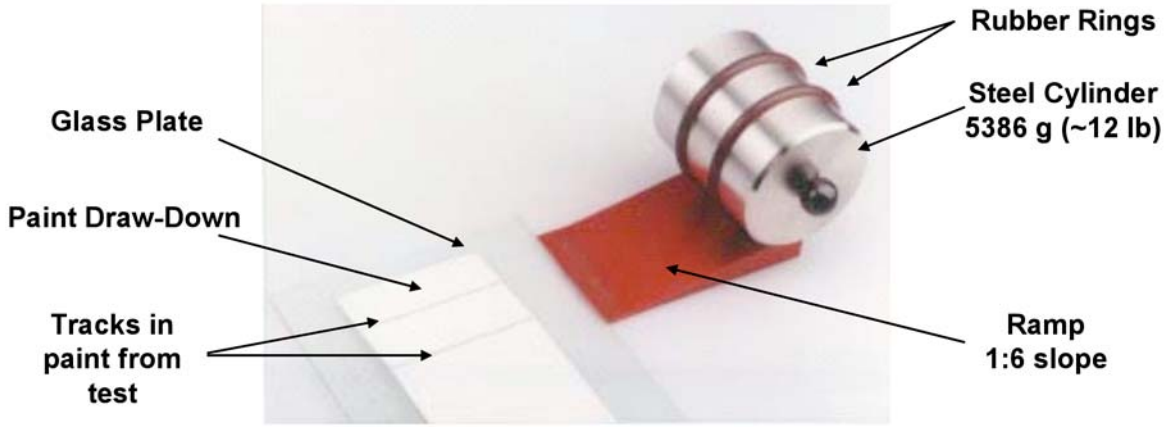


FIG. 1 Traffic Paint Drying Time Wheel and Ramp—Dual Model



Each pass of wheel over the paint film should be at least 2.5 mm (1 in.) from each end of the paint film.

FIG. 2 Picture of Apparatus and Traffic Paint Film Being Tested

4. Apparatus

4.1 The apparatus[3] as shown in Fig. 1 shall consist of a steel cylinder of the shape and dimensions as indicated, fitted with two replaceable O-rings and a ramp of shape and dimensions as shown.

4.2 The detailed dimensional requirements of the steel cylinder are given in Fig. 1. The total weight of the assembly complete with O-rings shall be 5386 ± 28 g (11 lb 14 oz ± 1 oz).

4.3 The detailed dimensional requirements of the ramp are shown in Fig. 1 and a picture of the apparatus with paint film being tested is shown in Fig. 2.

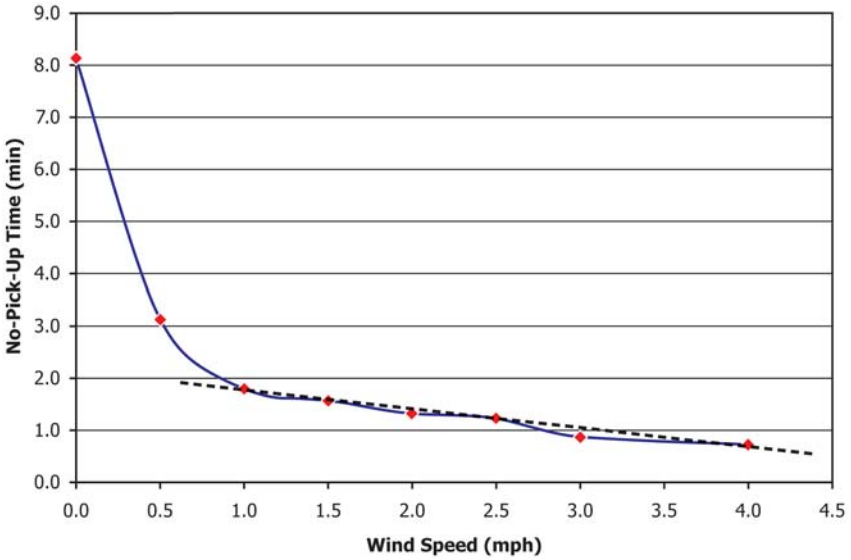
4.4 The replaceable O-rings shall be made of synthetic rubber or rubber-like material meeting the requirements of HK 715 of Classification D2000. Standards for O-rings and rubber products are also found in Test Methods D1414 and Classification D2000.

4.5 The dimensional requirements of the O-ring are as follows:

Outside diameter	104 mm (4⅛ in.)
Inside diameter	85 mm (3⅜ in.)
Cross section	9.5 mm (⅜ in.)

4.6 This test method is typically conducted in a laboratory or QC facility. In this method, values and tolerances are specified for wet film thickness, temperature, and relative humidity. Each of these factors can have a strong effect on no-pick-up time if not carefully controlled. Other things being equal, no-pick-up times are reduced (faster) with a thinner film, higher temperature, or lower relative humidity. Although tolerances for air flow are not specified, air flow also has a strong effect on no-pick-up time (See Fig. 3) and is faster at higher flow rate. Even minor variations in air movement at different locations within the same laboratory can affect no-pick-up time results. The conditions and associated apparatus for controlling air flow are described in the following subsections.

[3] The sole source of supply of the apparatus known to the committee at this time that meets the requirements is available from Paul N. Gardner Co., Inc., 316 NE 1st St., Pompano Beach, FL 33060. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.



Testing was conducted on individual drawdowns of the paint at 16 mil wet film thickness, 23°C, and 52 % relative humidity with wind speed varied over the paint films. Wind speed was controlled by box fan, variable transformer to adjust fan speed, and precision air flow meter as shown in Fig. 4.

FIG. 3 Effect of Wind Speed on No-Pick-Up Time for a Fast-dry Traffic Paint

4.6.1 To minimize the effects of air flow, a location for testing in the laboratory should be selected that is free of drafts with no perceptible air movement. An air flow meter (anemometer) may be helpful in detecting drafts. The use of an anemometer is detailed in Practice D5741. If drafts are detected, air flow can be minimized by using an enclosure (open front with solid top, back, and sides) around the test apparatus with approximate dimensions 61 cm wide by 46 cm deep by 46 cm tall (24 by 18 by 18 in.). The enclosure can be made of plastic or other suitable material. If an air conditioning system is used to control room temperature and humidity, the system should be set to "On" rather than "Auto" to maintain constant air movement during testing. Note that test chambers with high air turnover may give much faster no-pick-up times.

4.6.2 Upon mutual agreement by purchaser and seller, another option for regulating air flow during testing is to establish controlled air flow over the applied paint film at some fixed wind speed. One possible apparatus to control wind speed is shown in Fig. 4. This setup includes a 51 cm (20 in.) box fan, a variable transformer (voltage regulator) for fan speed control, and a precision anemometer for measurement and adjustment of the air flow. In a standard format, the glass plate for paint film drawdown is located 61 cm (24 in.) from the fan perpendicular to the air flow. A precision anemometer is located on the opposite side of the glass plate. The variable transformer is adjusted to obtain the desired wind speed over the glass plate. Once the correct wind speed is obtained, the paint film is drawn down on the glass plate and no-pick-up testing is conducted. If this approach is used, a wind speed of 3.2 to 6.4 kph (2 to 4 mph) is recommended where the slope of dry time versus wind speed is lower and in the linear region (see Fig. 3). For most consistent results, the air flow should be controlled to within ±0.16 kph (±0.1 mph).

5. Procedure

5.1 Prepare a test stripe at least 75 mm (3 in.) in width of the paint to be tested by a mechanical spreader, or other suitable means on a clean plate glass panel at a wet film thickness of

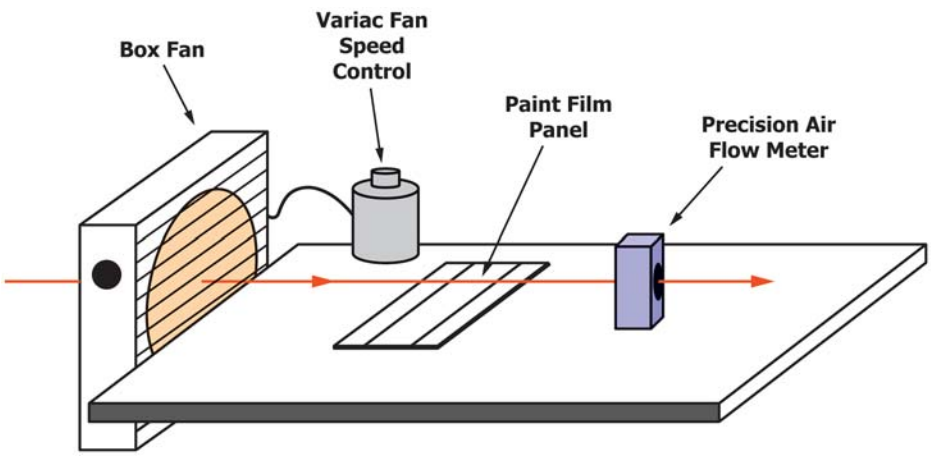


FIG. 4 Apparatus for Controlling Wind Speed Over a Traffic Paint Film During No-Pick-Up Time Testing

0.38 ± 0.01 mm (15 ± 0.5 mils). Use a plate glass panel approximately 100 by 200 by 3 mm (4 by 8 by ⅛ in.). Procedures for producing uniform paint films are found in Practices D823: Practice C, Motor Driven Blade Film Applicators, and Practice E, Hand Held Blade Film Applicators. Be aware that the number (in mils, microns, or mm) printed on many types of film applicator "draw-down" bars is the clearance (gap), and that the thickness of the paint applied using those applicators is often significantly less than the gap (typically 50 to 70 % of the clearance for waterborne traffic paints). Some "Bird" applicators have markings that indicate the approximate wet film thickness expected, while some "bird type" applicators have markings indicating the gap. The applied paint films should be checked for wet film thickness to ensure that they are within 0.381 ± 0.0127 mm (15 ± 0.5 mils). Procedures for measurement of wet film thickness are found in Test Methods D1212 and Practice D4414. Appropriate notched or roller gauges may be used.

5.1.1 Record the time of application. Allow the panel to dry in a horizontal position under the laboratory conditions specified: 23 ± 2°C (73.5 ± 3.5°F) and 50 ± 5 % relative humidity.

5.1.2 Test the paints without drop-on beads unless otherwise specified or agreed upon between the purchaser and the seller.

5.2 Butt the glass plate against the ramp. Position the wheel so that the rubber ring rolls an area of the film at least 2.54 cm (1 in.) from the edge (either end) of the test stripe. At regular intervals remove the wheel from its rest, hold against the rest as a starting point, then free roll the weighted wheel down the inclined ramp and over the paint film with each roll of the wheel over a new wheel path. Position the wheel properly so that a clean surface of the wheel will come into contact with the paint film. As many as three passes of the wheel can be made before the wheel needs to be cleaned. This can be done with a rag saturated with acetone. It is best to set aside the wheel after washing until all the solvent has evaporated.

5.3 Note the end point for no-pick-up time when no paint adheres to the rubber rings of the test wheel when it is rolled over the paint film. As the end point is approached, roll the weighted wheel over the paint film every 30 s.

5.4 Even when all four factors of wet film thickness, temperature, humidity, and air flow are controlled, their additive effect within the specified tolerances can still result in some no-pick-up time variability. A recommended approach for resolving this issue is to establish a control paint that is tested either just before or just after each new paint being tested. The control paint should be mutually agreed upon by buyer and seller and used for all testing conducted over a specified period of time, for example, 6 months. Besides the absolute no-pick-up time values reported for the test paint and control paint, results for each new paint can be expressed as a "% of control" as is done in some other coatings test procedures. A % of control higher than 100 % would be a longer no-pick-up time while less than 100 % would be a shorter no-pick-up time.

6. Report

6.1 Report the time elapsed between application of the paint and the end point as the drying time for no-pick-up of the traffic paint. If a control paint is used, additionally report the no-pick-up time % of control. Other data that should be recorded during testing are the measured wet film thickness, temperature, relative humidity, test location in the laboratory, and air flow conditions at test location, and wind speed over the paint film if controlled.

7. Precision and Bias

7.1 *Precision*—Because of the poor precision of this test method, if it is used in a specification, the maximum deviation from the maximum no-pick-up time specified should be agreed upon between the purchaser and the seller. Supporting precision data for this method are found in 7.3.

7.2 *Bias*—Bias cannot be determined.

7.3 The American Association of State Highway and Transportation Officials (AASHTO) Materials Reference Laboratory (AMRL) was established at the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards, in 1965 under the sponsorship of the AASHTO Highway Subcommittee on Materials. Each year AMRL provides pairs of material samples through the Proficiency Sample Program (PSP) for testing by participating laboratories. AASHTO often specifies ASTM methods and one of the proficiency studies conducted annually is with Test Method D711 on a pair of waterborne traffic paint samples. Each year a batch of waterborne traffic paint is selected by AMRL/PSP for D711 testing. Two paint samples (#1 and #2) are individually taken from the paint batch and then subdivided for distribution to the various testing laboratories. Each laboratory conducts testing on the two paint samples using the D711 protocol. After the testing is complete, the test results are submitted to AMRL for collective single operator and multi-laboratory statistical analyses. AMRL then publishes a report comparing the results of the participating laboratories.

7.3.1 The precision statement in this method is partially based on the AMRL D711 testing that was conducted annually between 2004 and 2010. In the AMRL testing, the laboratories were expected to follow the D711 protocol which specifies ranges for wet film thickness, temperature, and humidity. No special instructions were provided for air flow. Although there was no specific requirement for control of air flow, this variable is now known to be a significant factor in no-pick-up time testing (see Table X1.1 for method improvement). Based on follow-up AMRL questions to the testing laboratories, there may have been significant variations in film thickness between laboratories and they may also have varied considerably in methods to control humidity and optionally air flow. The variability shown AMRL PSP testing includes this variability.

7.3.2 On average, 37 different laboratories conducted the AMRL PSP D711 testing each year. Some of the paints in certain years were clearly fast-dry traffic paints with average no-pick-up times of less than 10 min. while traffic paints selected for testing in some other years had much longer average no-pick-up times and might be considered standard-dry traffic paints. The following is a 7 year average summary of the D711 AMRL PSP testing for single operator and multi-laboratory testing. Summary details for individual years are found in Table X1.1.

7 Year Average of Annual Single Operator Precision: 1S ± 12 %, D2S ± 35 %
7 Year Average of Annual Multi-laboratory Precision: 1S ± 47 %, D2S ± 134 %

7.3.3 The determination of 1S (one standard deviation) and D2S are as defined within AMRL. The analysis method used in AMRL PSP testing is designed to determine robust estimates of precision that are representative, as much as possible, of testing performed in accordance with the test standards (Test Method D711 in this case). The analysis technique employs a four step process for each year of test data. First, null responses and unpaired data (that is, where laboratories did not submit data for both samples) are removed. Second, invalid data are removed from the remaining population (beyond the equivalent of 4.725 standard deviations from the median value). Third, outliers are removed from the remaining population (beyond the equivalent of 2.7 standard deviations from the median value). Fourth, the remaining core data is then analyzed to determine average and standard deviations for single operator and multi-laboratory precision. Summary data for each year of AMRL PSP D711 testing are shown in Table X1.1.

8. Keywords

8.1 auto no-track time; drying time; no-pick-up time; traffic paint

APPENDIX

(Nonmandatory Information)

X1. METHOD IMPROVEMENT

X1.1 Table X1.1 illustrates AMRL proficiency testing.

TABLE X1.1 AMRL Proficiency Testing of Traffic Paints Using Test Method D711

NOTE 1—Wet film thickness, temperature and humidity are presumed to be within specifications. Air flow conditions likely varied between laboratories.

Test Year	AMRL Posting Date	Traffic Paint Sample Codes	Number of Labs Testing	AVE NPUT (min)	AMRL Single Operator D711 No-Pick-Up Time Results (min)				AMRL Multi-Laboratory D711 No-Pick-Up Time Results (min)			
					1S	1S%	D2S	D2S%	1S	1S%	D2S	D2S%
2004	01/05/04	31 / 32	34	35.9	5.0	13.9	14.1	39	18.7	52.1	52.9	147
2005	01/10/05	33 / 34	36	10.5	1.7	16.7	4.9	47	6.2	59.1	17.5	167
2006	01/05/06	35 / 36	36	7.4	1.2	16.4	3.4	46	2.2	29.3	6.3	84
2007	12/15/06	37 / 38	38	6.8	0.9	13.0	2.5	37	2.5	36.4	7.0	103
2008	12/18/07	39 / 40	36	29.5	2.0	6.6	5.6	19	12.5	42.1	35.2	119
2009	12/17/08	41 / 42	38	14.4	1.5	10.3	4.2	29	9.7	67.2	27.3	190
2010	12/16/09	43 / 44	42	14.8	1.4	9.7	4.1	27	6.7	44.8	18.7	127
Ave			37	17.0	2.0	12.4	5.5	35.0	8.3	47.3	23.5	134