Designation: D7539 – 10 (Reapproved 2015)

# Standard Practice for Using a Test Chamber for Humidity Conditioning of Test Panels of Pavement Marking Paints[1]

This standard is issued under the fixed designation D7539; 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.

## 1. Scope

1.1 Specification D3924 defines a standard environment of 23 ± 2°C and 50 ± 5 % relative humidity and free from drafts for normal conditioning and testing of paint, varnish, lacquer, and related materials. This practice describes a test chamber that allows for control of relative humidity above the ambient relative humidity and minimization of air flow for conditioning of test panels at elevated relative humidity and room temperatures.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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]

D711 Test Method for No-Pick-Up Time of Traffic Paint

D1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings

D3924 Specification for Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials

D7377 Practice for Evaluating the Water Wash-Off Resistance of Traffic Paints using a Water Faucet

D7538 Practice for Evaluating the Water Wash-Off Resistance of Traffic Paints Using an Atomizing Spray Device

2.2 *Other Standard:*[3]

TT-P-1952E Federal Specification for Paint, Traffic and Airfield Marking, Waterborne (10 July 2007)

## 3. Terminology

3.1 *Definitions:*

3.1.1 *test chamber, n*—a cabinet or box, preferably made of transparent, waterproof material, such as clear acrylic plastic, with panel supports and holes (ports) that can be partially to fully opened to mix outside ambient air with humidified air in the chamber or some other means to provide humidified air with minimal air flow.

3.1.1.1 *Discussion*—Also commonly referred to as a humidity box or humidity chamber, as in Federal Specification TT-P-1952E.

3.1.2 *waterborne pavement marking (traffic) paint, n*—an aqueous paint used for marking pavements.

## 4. Summary of Practice

4.1 A test chamber is described that allows for the control of relative humidity above ambient relative humidity and the minimization of air flow variability at ambient room temperatures.

## 5. Significance and Use

5.1 The drying rate of organic coatings varies with changes in temperature, air flow, and relative humidity. In particular, the drying rate of waterborne paints depends on the evaporation of water and thus is much more dependent on relative humidity than are solvent based paints or paints that are 100 % solids. Measurement of the rate of drying of waterborne paints under ambient conditions in laboratories cannot be adequately replicated without some control of the drying conditions. A test chamber will be described that provides a means of controlling relative humidity above ambient humidity and minimizing the effects of air flow variability at ambient room temperatures. If desired, the test chamber without water in it and with vents wide open can be placed in a temperature and humidity

[1] This practice 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.

Current edition approved June 1, 2015. Published June 2015. Originally approved in 2010. Last previous edition approved in 2010 as D7539 – 10. DOI: 10.1520/D7539–10R15.

[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.

[3] Available from General Services Administration, Federal Supply Service, Specification Section, Suite 8100, 470 L'Enfant Plaza, SW, Washington DC 20407, http://www.gsa.gov.

controlled room to test dry speed at various temperatures as well as humidity while using the chamber to minimize the effect of air flow.

5.2 This practice is particularly useful for testing the drying rate of waterborne pavement marking (traffic) paints where fast dry at elevated ambient humidity is an important feature. For waterborne traffic paints, the test chamber can be used to evaluate dry to no-pick-up (Test Method D711) and water wash-off resistance (Practices D7377 and D7538) at elevated ambient humidity.

## 6. Apparatus and Equipment

6.1 *Test Chamber*—The required elements of the test chamber are listed below. (Manufacturing details and a photograph of a suitable test chamber are shown in Appendix X1.)

*(1)* Manufactured from transparent material to allow for visual monitoring of relative humidity and dry time test progress inside of the chamber.

*(2)* Horizontal support for coated test panels within the chamber that is perforated to allow circulation of humidified air.

*(3)* A door in the front of the chamber for taking test panels in and out of the chamber.

*(4)* Control of relative humidity above the ambient relative humidity and minimization of air flow.

6.2 *Hygrometer*—placed in the test chamber in full view of the operator to monitor the relative humidity inside of the chamber. This hygrometer should be accurate within ±3 % relative humidity and provide a range from at least 20 to 100 % relative humidity.

6.3 *Thermometer*—to record air temperature.

6.4 *Anemometer/Wind Meter (optional)*—to confirm air flow inside the chamber is "minimal" (below 0.02 m/s).

6.5 *Other apparatus and equipment* specified in the chosen drying rate test procedure.

## 7. Reagents

7.1 *Water*—to provide humid air for mixing with ambient air in the test chamber.

## 8. Procedure

8.1 *Preparation of Test Chamber Type Described in Appendix X1:*

8.1.1 Cover the bottom of the chamber with water or place water soaked cloth or paper rags below the panel support with water.

8.1.2 Close all ports and the door and allow equilibration to the maximum relative humidity allowed by the tolerances of the chamber.

8.1.3 Establish the desired relative humidity by opening and closing the ports on the sides of the chamber, preferably so that the size of the port openings are about the same on both sides of the chamber to equalize the air circulation in the chamber. The relative humidity in the test chamber will stabilize once the port openings are established. Occasional slight adjustments in the side port openings may be required if the ambient humidity in the room changes significantly during testing.

8.1.4 Target test relative humidity must be above the ambient humidity in the room. It is best to use the chamber in a conditioned room at a controlled temperature (23 ± 2°C) and humidity (50 ± 5 % relative humidity) as described in Specification D3924.

8.2 *Calibration and Standardization*—When using the test chamber to determine drying rates, the initial rate test should include a reference paint of known performance to determine the relative drying rates of test paints and to gauge the effect of ambient room temperature and relative humidity on the drying rates for that test period.

8.3 *Using the Test Chamber for Determining Drying Rates:*

8.3.1 Prepare a test stripe as described in the chosen drying rate procedure at the wet film thickness as specified by that procedure.

8.3.2 Record the time of application or use a timer.

8.3.3 Immediately place the panel with the wet film in the center of the panel support. The ports on the sides of the test chamber must be adjusted promptly and frequently to regain the desired relative humidity within ±5 % relative humidity.

8.3.4 A second panel can be prepared and tested in the chamber at the same time. In order to be able to test the second panel after the same elapsed time as the first panel, it is necessary to allow sufficient time between test panel preparations. Record the time of application of the second panel and immediately place the panel next to the first panel near the center of the panel support. Testing of more than two panels at one time will introduce more variability in results due to poorer control of drying conditions.

8.3.5 At regular intervals, test the dry time of the test films in accordance with the procedures specified in Test Method D711 (no-pick-up) and Practices D7377 and D7538 (water wash-off resistance) or other desired method. All interested parties shall agree on the time intervals at which panels are removed from the chamber for testing.

## 9. Report

9.1 Report the relative humidity and temperature inside the test chamber and relative humidity outside of the test chamber.

## 10. Keywords

10.1 drying rate or drying time; dry through; no-pick-up; relative humidity; test chamber; washout resistance; waterborne traffic paint

# APPENDIXES

**(Nonmandatory Information)**

## X1. TEST CHAMBER CONSTRUCTION ( see Fig. X1.1 for example)

X1.1 The test chamber shall consist of a basic box, a perforated panel support, a waterproof bottom to hold water or some other means to provide saturated air inside the chamber, and holes (ports) that can be opened partially to fully to allow ambient air to mix with the saturated air or some other means to allow the operator to control the relative humidity inside of the chamber.

X1.2 Place the hygrometer in the chamber so that it is in full view of the operator. This hygrometer should be accurate within ±3 % relative humidity and provide a range from at least 20 to 100 % relative humidity.

X1.3 The chamber should be made of a transparent, waterproof material such as clear acrylic plastic. The clear plastic should be ⅜ in. thick. The joints should be water tight.

X1.4 The panel support and any interior parts should be made of corrosion-resistant materials.

## X2. TYPES OF CONSTRUCTION

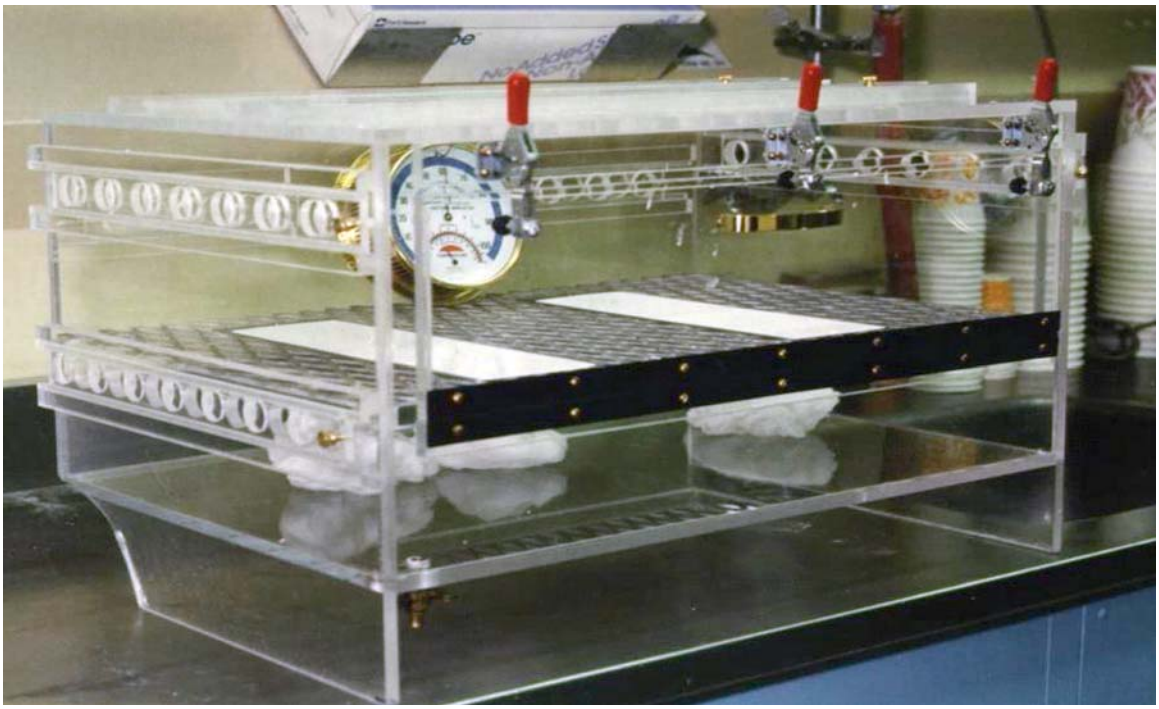

**FIG. X1.1 Test Chamber**

X2.1 Fig. X2.1 (1a and 1b) are typical engineering drawings for front and side views of a suitable test chamber.

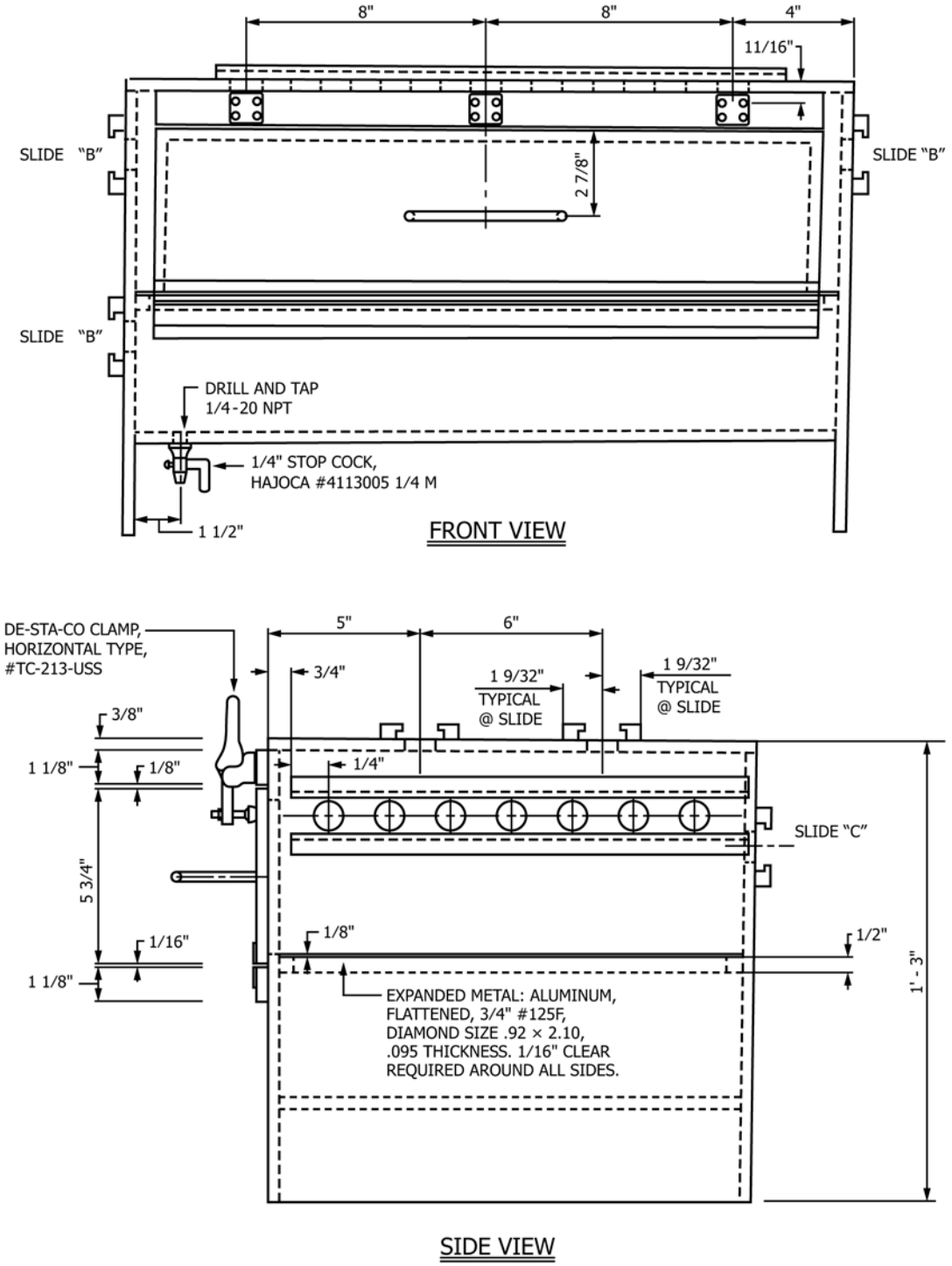


**FIG. X2.1 Testing Chamber Drawing — Figure 1a**

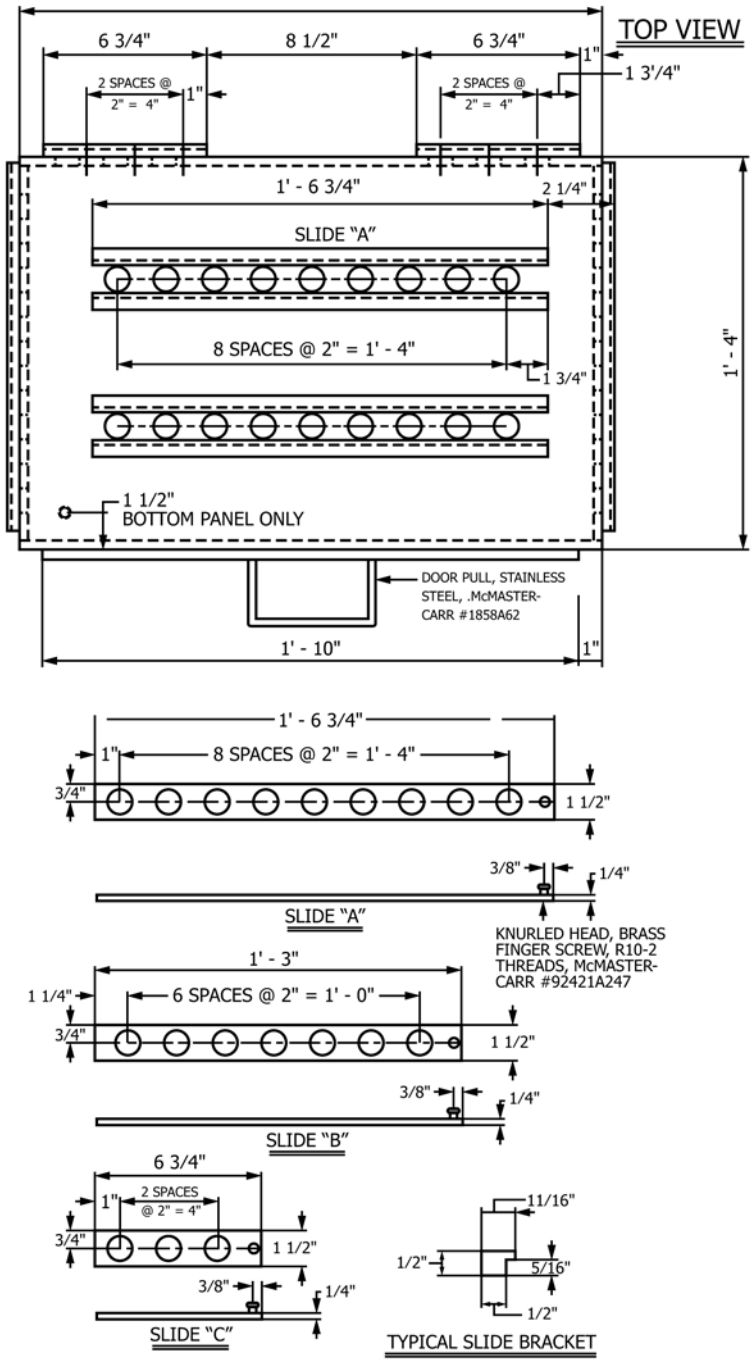


**FIG. X2.1 Testing Chamber Drawing — Figure 1b** *(continued)*