



Designation: **D6521 – 13** **D6521 – 18**

Standard Practice for Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)¹

This standard is issued under the fixed designation D6521; 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 This practice covers the ~~accelerated aging (oxidation) conditioning~~ of asphalt binders to simulate accelerated aging (oxidation) by means of pressurized air and elevated temperature. This is intended to simulate the changes in rheology which occur in asphalt binders during in-service oxidative aging, but may not accurately simulate the relative rates of aging. It is normally intended for use with residue from Test Method **D2872** (RTFOT), which is designed to simulate plant aging.

~~NOTE 1—Modified asphalt binders may phase separate or form skins during oven conditioning in Test Method **D2872** (RTFOT); the results from subsequent testing of this residue may not be representative of modified asphalts short-term aged under field conditions. Phase separation, or formation of skins, or both can also occur during PAV conditioning. Therefore, the practice may not be suitable for some modified asphalts.~~

~~NOTE 1—PAV conditioning has not been validated for materials containing particulate materials.~~

1.2 The aging of asphalt binders during service is affected by ambient temperature and by mixture-associated variables, such as the volumetric proportions of the mix, the permeability of the mix, properties of the aggregates, and possibly other factors. This conditioning process is intended to provide an evaluation of the relative resistance of different asphalt binders to oxidative aging at selected elevated aging temperatures and pressures, but cannot account for mixture variables or provide the relative resistance to aging at in-service conditions.

1.3 The values stated in SI units are to be regarded as ~~the standard~~. ~~Values in parentheses in inch-pound units are provided for informational purposes only.~~ standard. No other units of measurement are included in this standard.

1.4 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard

~~NOTE 2—The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification **D3666** are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification **D3666** alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification **D3666** or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.~~

1.5 *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~~ safety, health, and health environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D8 Terminology Relating to Materials for Roads and Pavements

D2872 Test Method for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

¹ This practice is under the jurisdiction of ASTM Committee **D04** on Road and Paving Materials and is the direct responsibility of Subcommittee **D04.46** on Durability and Distillation Tests.

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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.

[D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing](#)

[D6373 Specification for Performance Graded Asphalt Binder](#)

[E1137/E1137M Specification for Industrial Platinum Resistance Thermometers](#)

2.2 ~~AASHTO Standards:Standard:~~³

[M 320 Specification for Performance-Graded Asphalt Binder](#)

2.3 ~~CGA Standards:Standard:~~⁴

[CGA G-7.1–1997 Commodity Specification for Air, Fourth Edition](#)

3. Terminology

3.1 Definitions:

3.1.1 Definitions of terms used in this practice may be found in Terminology [D8](#), determined from common English usage, or combinations of both.

4. Summary of Practice

4.1 Asphalt binder is normally first conditioned using Test Method [D2872](#) (RTFOT). Residue from the RTFOT is then placed in standard stainless steel pans and aged at the specified conditioning temperature for 20 h in a vessel pressurized with air to 2.10 MPa. The conditioning temperature is selected according to the grade of asphalt binder. The residue is then vacuum degassed.

5. Significance and Use

5.1 This practice is designed to simulate the in-service oxidative aging that occurs in asphalt binders during pavement service. Residue from this conditioning practice may be used to estimate the physical or chemical properties of asphalt binders after several years of in-service aging in the field.

5.2 Binders conditioned using this practice are normally used to determine specification properties in accordance with Specification [D6373](#) or AASHTO M 320.

5.3 For asphalt binders of different grades or from different sources, there is no unique correlation between the time and temperature in this conditioning practice and in-service pavement age and temperature. Therefore, for a given set of in-service climatic conditions, it is not possible to select a single PAV conditioning time, temperature, and pressure that will predict the properties or the relative rankings of the properties of asphalt binders after a specific set of in-service exposure conditions.

5.4 The relative degree of hardening of different asphalt binders varies with conditioning temperatures and pressures in the PAV. Therefore, two asphalt binders may age at a similar rate at one condition of temperature and pressure, but age differently at another condition. Hence, the relative rates of aging for a set of asphalts at PAV conditions may differ significantly from the actual in-service relative rates at lower pavement temperatures and ambient pressures.

<https://standards.iteh.ai/catalog/standards/sist/2f43d9ec-a189-4ef4-b369-7acd1ab4e64d/astm-d6521-18>

6. Apparatus

6.1 An equipment system consisting of a pressure vessel, ovens, ~~pressure-controlling devices, temperature-controlling pressure controlling devices, temperature controlling~~ devices, pressure and temperature measuring devices, and a temperature and pressure recording system (see [Fig. 1](#)).

6.1.1 *Pressure Vessel*—A stainless steel pressure vessel designed to operate at 2.1 ± 0.1 MPa between 90 and ~~110~~ 110 ± 10 °C, with interior dimensions adequate to hold ten PAV pans and a pan holder. The pan holder shall be capable of holding ten PAV stainless steel pans in a horizontal (level) position, such that the asphalt binder film thickness is reasonably uniform. The holder shall be designed for easy insertion and removal from the vessel when the holder, pans, and asphalt binder are at the conditioning temperature. A schematic showing a possible configuration of the vessel, pan holder and pans, and specifying dimensional requirements is shown in [Fig. 2](#).

NOTE 3—The vessel may be a separate unit to be placed in a ~~forced draft~~ forced-draft oven for conditioning the asphalt binders or an integral part of the temperature control system (for example, by direct heating of the vessel or by surrounding the vessel with a permanently affixed heating unit, forced air oven, or liquid bath). For practical purposes, it is recommended that the vessel have the dimensions of 250 mm in diameter and 265 mm in height.

6.1.2 *Pressure and Temperature Controlling Devices:*

6.1.2.1 A pressure relief valve that prevents pressure in the vessel from exceeding the design pressure of the vessel, but in no case exceeding 2.5 MPa during the conditioning procedure.

6.1.2.2 A pressure regulator or regulating system capable of controlling the pressure within the vessel to ± 0.02 MPa, and with a capacity adequate to reduce the pressure from the source of compressed air, so that the pressure within the loaded pressure vessel is maintained at 2.1 ± 0.1 MPa gauge (relative) pressure during the conditioning process.

³ Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

⁴ Available from Compressed Gas Association (CGA), 4221 Walney Rd., 5th Floor, Chantilly, VA 20151-2923, <http://www.cganet.com>.

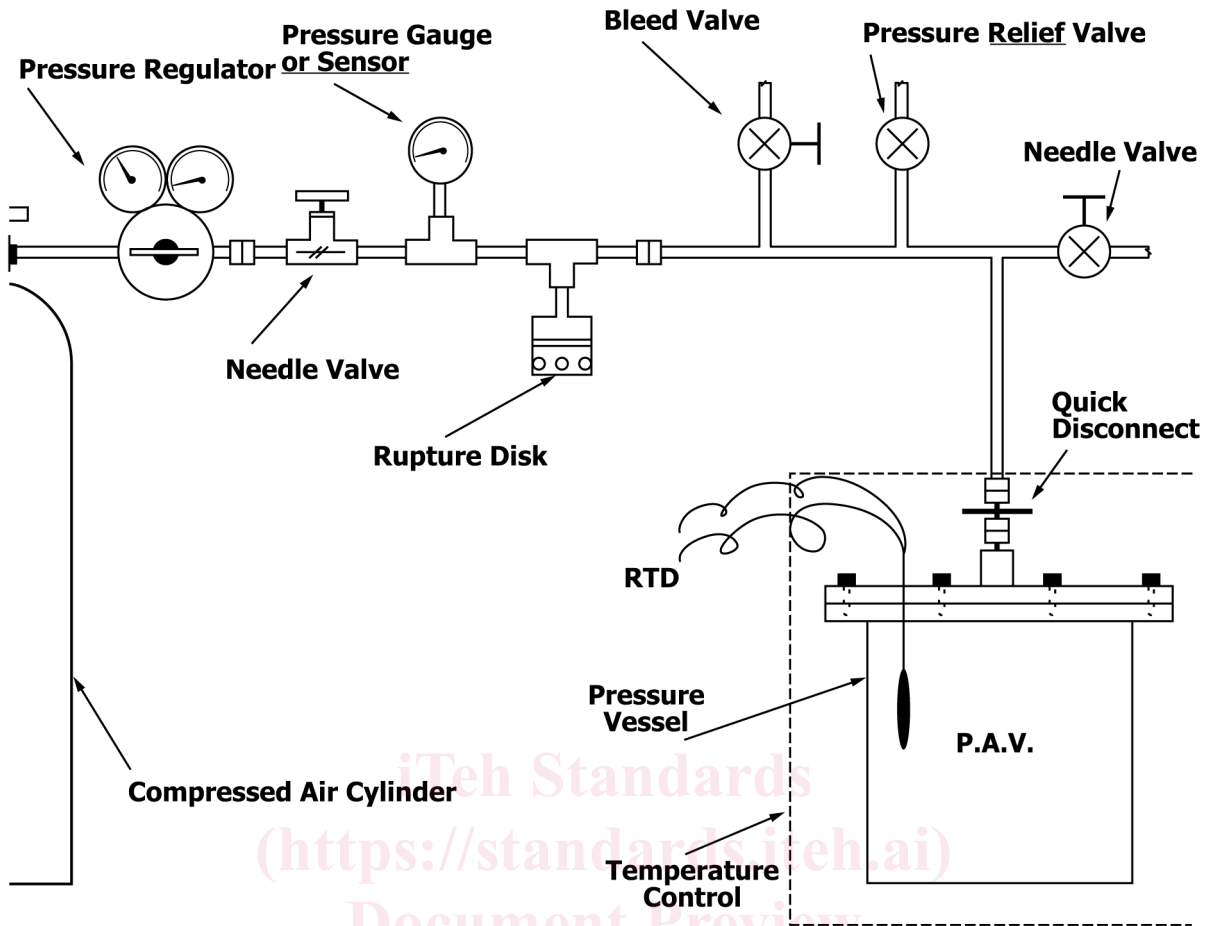
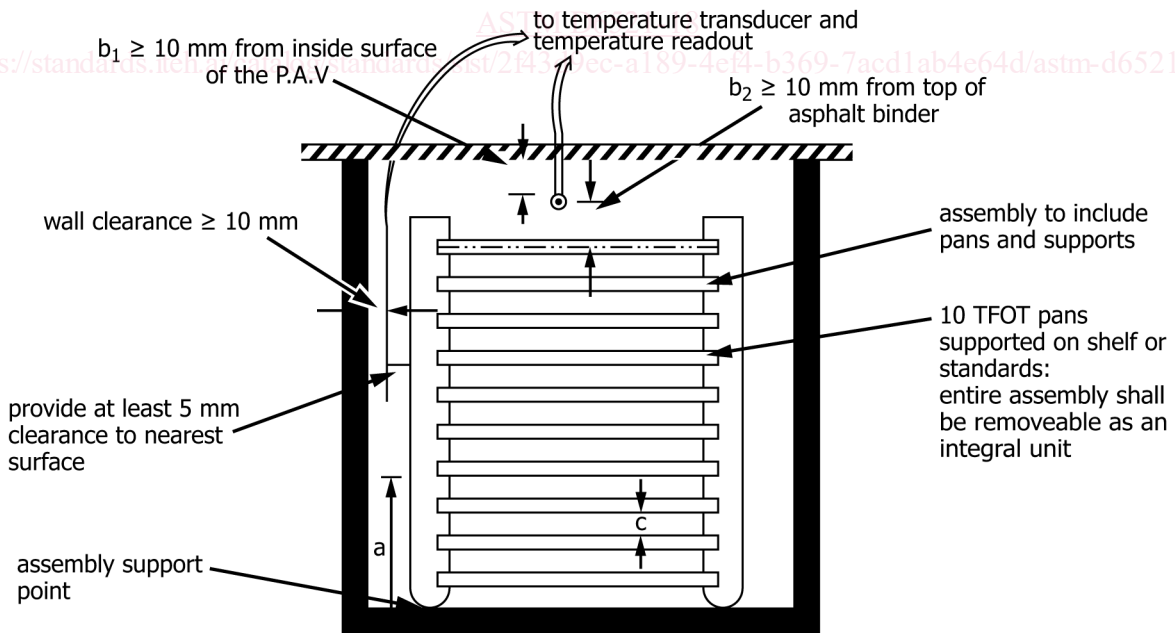


FIG. 1 Schematic of PAV Test System



NOTE 1—Distance “a” controls the levelness of the pan. The assembly shall be supported at three or more support points. The distance “a,” measured from each assembly support point to the bottom of the pan (top of shelf or pan support point), shall be controlled to ± 0.05 mm.

NOTE 2—Distances b_1 and b_2 shall be such that any active portion of the temperature transducer is ≥ 10 mm from any adjacent surface.

NOTE 3—Distance “c” shall be ≥ 12 mm.

FIG. 2 Schematic Showing Location of Pans and RTD Within PAV