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

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**AASHTO Designation: R 28-12 (2016)**

**Release: Group 3 (August 2016)**



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# Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)

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## 1. SCOPE

- 1.1. This standard practice covers the accelerated aging (oxidation) of asphalt binders by means of pressurized air and elevated temperature. The practice is intended to simulate in-service oxidative aging of asphalt binders and is intended for use with residue from T 240 (RTFOT).
- 1.2. The aging of asphalt binders during service is affected by mixture-associated variables such as the volumetric proportions of the mix, permeability of the mix, properties of the aggregates, and possibly other factors. This practice is intended to provide an evaluation of the relative resistance of different asphalt binders to oxidative aging at selected temperatures and cannot account for mixture variables.
- 1.3. *This standard practice may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

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## 2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 231, Weighing Devices Used in the Testing of Materials
  - M 320, Performance-Graded Asphalt Binder
  - T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)
- 2.2. *ASTM Standard:*
- E220, Standard Test Method for Calibration of Thermocouples By Comparison Techniques
- 2.3. *Deutsche Industrie Norm (DIN) Standard:*
- 43760, Standard for Calibrating Thermocouples

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## 3. TERMINOLOGY

- 3.1. *Definitions:*
- 3.1.1. *asphalt binder*—an asphalt-based cement that is produced from petroleum residue either with or without the addition of nonparticulate organic modifiers.

- 3.1.2. *in-service*—refers to aging of the asphalt binder that occurs in the pavement as a result of the combined effects of time, traffic, and the environment.

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## 4. SUMMARY OF PRACTICE

- 4.1. Asphalt binder is first aged using T 240 (RTFOT). A specified thickness of residue, from the RTFOT, is then placed in stainless steel pans and aged at the specified aging temperature for 20 h in a vessel pressurized with air to 2.10 MPa. The aging temperature is selected according to the grade of the asphalt binder. At the completion of the PAV process, the asphalt binder residue is then vacuum degassed.

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## 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 practice may be used to estimate the physical or chemical properties of asphalt binders after 5 to 10 years of in-service aging in the field.
- 5.2. Asphalt binders aged using R 28 are used to determine specification properties in accordance with M 320. The asphalt binder is aged with the RTFO test prior to this conditioning step. Tank asphalt binders, as well as RTFOT and residue from this practice, are used to determine specification properties in accordance with M 320.
- 5.3. For asphalt binders of different grades or from different sources, there is no unique correlation between the aging time and temperature in this 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 aging time and temperature that will predict the properties of all asphalt binders after a specific set of in-service exposure conditions.
- 5.4. The relative degree of hardening of different asphalt binders varies at different aging temperatures in the PAV. Therefore, two asphalt binders may age similarly at one temperature, but age differently at another temperature.

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## 6. APPARATUS

- 6.1. A test system consists of a pressure vessel, pressure-controlling devices, temperature-controlling devices, pressure- and temperature-measuring devices, and a temperature-recording device (Figure 1).
- 6.1.1. *Pressure Vessel*—A stainless steel pressure vessel designed to operate at  $2.1 \pm 0.1$  MPa between 90 and 110°C with interior dimensions adequate to hold ten stainless steel pans and a pan holder. The pressure vessel shall contain a pan holder capable of holding ten stainless steel pans in a horizontal (level) position such that the asphalt binder film thickness in the bottom of the pans does not vary by more than 0.5 mm across any diameter of the pan. The holder shall be designed for easy insertion and removal from the vessel when the holder, pans, and asphalt binder are at the test temperature. A schematic showing the vessel, pan holder and pans, and specifying the dimensional requirements is shown in Figure 2.
- Note 1**—The vessel may be a separate unit to be placed in a 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).