VISCOSITY TESTING

EN 12595: Bitumen and bituminous binders – Determination of kinematic viscosity

Overview

This test method is used to determine the kinematic viscosity of bitumen by means of a capillary viscometer at 60 °C or 135 °C. Other temperatures are possible if calibration constants are known.

In the test, a fixed volume of bituminous binder is allowed to flow through a capillary tube at a fixed temperature.

The method is not applicable to bituminous emulsions, but can be used for binders recovered and/or stabilized from emulsions.

Experience suggests that the method is not applicable for polymer modified bitumens (PMB); other viscosity test methods, e.g. EN 13302 or EN 13702, are more suitable.

Definition and Terminology

Kinematic viscosity: Measure of a liquid's resistance to flow under gravity, expressed in mm^2/s.

Dynamic viscosity: Measure of the resistance to flow of a liquid, expressed in Pa · s. It is the constant ratio of applied shear stress to the velocity gradient of the liquid.

Newtonian liquid: Liquid with a viscosity that is independent of the rate of shear. If the ratio of applied shear stress to the velocity gradient of the liquid is not constant, the liquid is non-Newtonian.

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At the time of publication of this document, EN 12595:2023 `Bitumen and bituminous binders - Determination of kinematic viscosity` was the reference for testing. This document does not overrule the test standard EN 12595, but is intended to help users of the standard to be aware of the important factors. However, the reference for testing remains EN 12595. Temperatures, times, and dimensions and their tolerances must be strictly observed, that is checked for accuracy and for maintaining the tolerance during application.

Practical Information:

All parts of the capillary viscometer system must be checked and/or calibrated regularly for accuracy.

- A detailed description how to calibrate viscometers is given in Annex B of EN 12595.
- Capillary viscometers shall preferably be calibrated at the intended operational temperature.
- The timing device must be calibrated and accurate to 0,5 s.
- The testing bath temperature must be (135 ± 0,5) °C (or ± 0,3 °C if measured at 60 °C), and should be checked regularly.

The test temperature must be selected carefully.

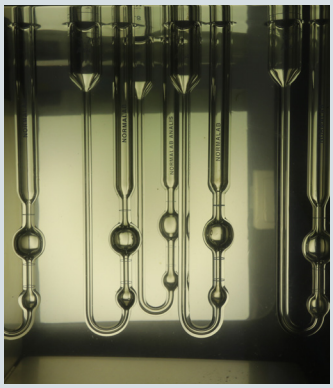
- Usually, the test is carried out at 135 °C or at 60 °C.
- Other temperatures are possible, if calibration constants are known.
- The precision for this test method is based on determinations made at 60 °C or 135 °C, and applicable to unmodified bitumens.

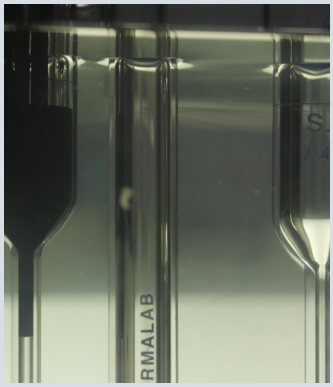
The sample needs to be prepared for testing.

- The sample preparation is described in EN 12594 and section 6 of EN 12595.
- The viscometer tube must be clean and dry before filling.
- The viscometer tube must be heated to the test temperature before filling.
- Carefully pour the sample into the viscometer tube, according to the manufacturer´s instructions. Avoid overfilling the viscometer tube as this may lead to covering of tube markings, so measurements become unprecise.
- The viscometer has to be suspended in a vertical position in the bath.
- The sample needs to be conditioned in the tube at the test temperature for at least 1 hour.

Testing and expression of results.

- EN 12595 recommends that paraffin or silicone oils are used as bath fluids for measurements at 135 °C. Water may be used for measurements at 60 °C.
- Ensure that the temperature within the bath does not vary by more than 0,5 °C (if tested at 135 °C) or 0,3 °C (if tested at 60 °C) over the length of the viscometer tube. This can be done by making temperature checks at different levels of the bath liquid.
- Select the correct viscometer tube, as described in section 7.1 of EN 12595. The flow time must be greater than 60 s.
- Measure the time taken for the sample to flow between the timing marks.
- The kinematic viscosity is calculated by multiplying the flow time in seconds by the viscometer calibration constant, and expressed in mm^2/s.
- From experience, tubes can easiest be cleaned by hanging them upside down in an oven to let the bitumen flow out. After the bitumen has flowed out, the tubes should be cooled and rinsed several times with an appropriate solvent, followed by a completely volatile solvent. Dry the tube by passing filtered dry air through the capillary until all traces of solvent are removed. For details, see section 7.2 of EN 12595.









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