

# NEEDLE PENETRATION

## EN 1426: Bitumen and bituminous binders – Determination of needle penetration

### Overview

The test is used to determine the consistency of bitumen and bituminous binders at intermediate service temperatures under defined conditions of testing.

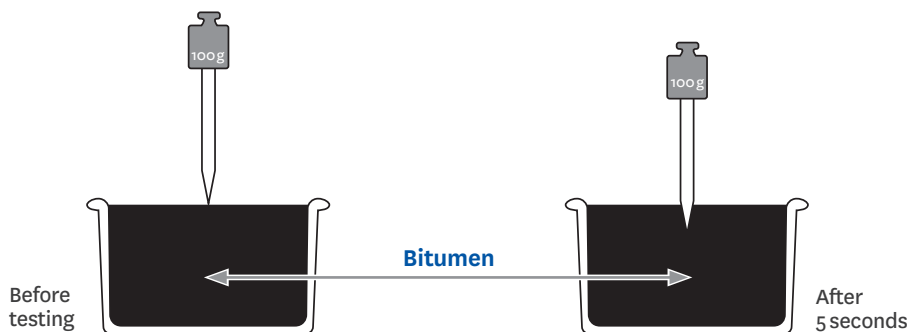
The test is performed in a water bath, usually at 25 °C; other temperatures may be used e.g. 15 °C or 5 °C are common test temperatures.

Testing needle penetration can be performed using manual, semi-automatic or automatic equipment with surface detection.

Needle penetration is the oldest test method applied to bitumen, and it is usually also used to classify the binder, according to product standards.

### Definition and Terminology

Needle penetration: Distance in tenths of a millimetre that a standard needle will penetrate vertically into a sample of the material under specified conditions of temperature, load and duration of loading.





## Practical Information:

### The behaviour of bitumen is highly temperature-dependent, therefore precise temperature control of the water bath is critical.

- Minor fluctuations in temperature can have a major influence on the measured penetration. The temperature needs to be precise within  $\pm 0.15$  °C, see section 5.4 of EN 1426.
- The temperature of the water bath should be checked regularly for accuracy.
- The temperature measuring device should be regularly verified and/or calibrated.
- The thermostat of the water bath needs to be checked regularly in case of off-sets.
- The sample must be given sufficient time to adjust to the test temperature, see section 7.4 of EN 1426.
- Ensure that the temperature is correct and constant at all times, even when using the transfer dish described in sections 5.5.1 and 8.4 of EN 1426.

### The penetration needles must be clean and without damage.

- Only clean, undamaged penetration needles that are free of rust must be used, see sections 5.2 and 8.2 of EN 1426.
- Before using needles, their alignment needs to be checked by rolling them on an even surface, see section 8.2.2 of EN 1426.
- A magnifying lens can be used to verify that the needles are undamaged.
- Penetration needles should be stored lying horizontally and in their original packing.
- Needles must be cleaned with suitable solvent and dried with a clean cloth before use, see section 8.7 of EN 1426. Open flames must not be used to clean the needle.

### The sample surface must be even.

- Avoid air bubbles in the test sample, see note 1 of section 7.4 of EN 1426.
- For hard bitumen samples, to achieve an even surface see section 7.3 of EN 1426.
- When storing the test sample in the container, protect it from dust with a cover.

### The sample needs to be prepared for testing.

- The sample preparation is described in EN 12594 and section 7 of EN 1426.
- The correct sample containers should be used, as described in table 1 of EN 1426.
- The depth of the sample should be at least 10 mm greater than the expected result, see section 5.3 of EN 1426.
- Samples should first be cooled at ambient temperature of  $(25 \pm 5)$  °C. Cooling time of the sample depends on the expected penetration value, see section 7.4 of EN 1426.
- Place the sample in the constant temperature water bath for a similar period to that used for cooling in air.
- Testing starts immediately after the end of the temperature conditioning phase in water, see section 7.4 of EN 1426.

### Testing and expression of results.

- Ensure that the needle holder and its guide are clean and that the needle moves freely in its guide.
- Ensure that the correct needle is chosen when measuring high penetration values, see section 5.2.1 of EN 1426.
- Ensure that the sample temperature remains constant during the testing, see sections 5.4, 7.4, 8.3, 8.4 and 8.5.2 of EN 1426.
- To set the zero position, slowly lower the needle until its tip makes contact with its image reflected by the sample surface. Do not penetrate the surface. In case the surface was penetrated, change the needle and the sample position. Section 8.5.1 of EN 1426 provides description for manual as well as automatic surface detection.
- Note the zero position of the needle, then release the needle holder for the specified period of time (generally 5 s, see section 4 of EN 1426).
- Test 3 times with 3 separate, clean needles.
- The needles need to penetrate the sample surface at points minimum 10 mm from the sides and minimum 10 mm apart.
- If the penetration is higher than  $100 \frac{1}{10}$  mm, leave the needles in the samples until all tests have been completed.
- Ensure that 3 determinations are in the maximum acceptable range, described in table 2 of section 8.6 of EN 1426.
- The penetration value is expressed as the arithmetic mean of the acceptable determinations, in tenth of millimeter rounded to the nearest integer, see section 8 of EN 1426.

