

DYNAMIC SHEAR RHEOMETER (DSR) MSCRT

EN 16659: Bitumen and bituminous binders – Multiple Stress Creep and Recovery Test (MSCRT)

Overview

The test serves to determine the percentage recovery and non-recoverable creep compliance of bitumen and bituminous binders under shear stress, followed by a subsequent relaxation phase.

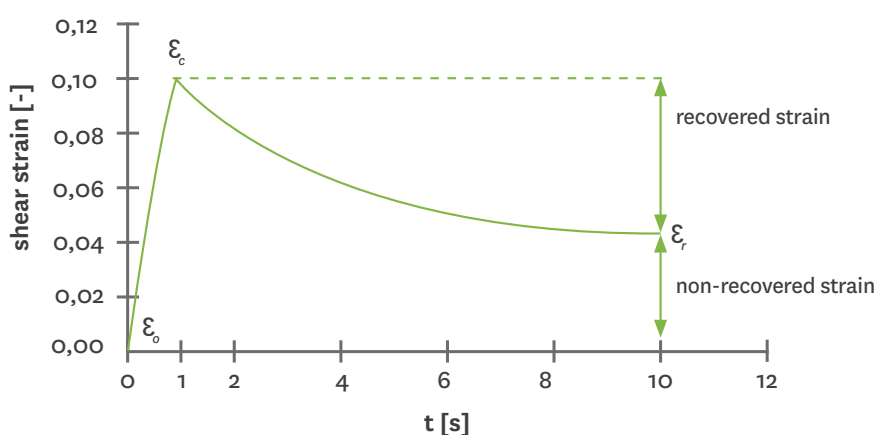
The test determines the rheological characteristics of bitumen and bituminous binders using a Dynamic Shear Rheometer (DSR) at defined test temperatures and stresses.

Testing is conducted at constant temperature and two stress levels, with the stress applied for 1 second (creep) followed by a stress-free phase of 9 seconds (recovery).

Definition and Terminology

Percent recovery (% R): Recovered strain in a specimen during the period of the test cycle, where no load is applied, expressed in percent.

Non-recoverable creep compliance (J_{nr}): Residual strain in a specimen after a creep and recovery cycle divided by the stress applied.



At the time of publication of this document, EN 16659:2015 'Bitumen and bituminous binders - Multiple Stress Creep and Recovery Test (MSCRT)' was the reference for testing. This document does not overrule the test standard EN 16659, but is intended to help users of the standard to be aware of important factors. However, the reference for testing remains EN 16659. Temperatures, times, and dimensions and their tolerances must be strictly observed, that is checked for accuracy and for maintaining the tolerance during application. From experience, rheological tests should preferably be carried out by laboratory technicians trained in the individual procedures to be applied.



Practical Information:

The bitumen sample must adhere securely and completely to the test plates, otherwise the result of the test will not be valid.

- Silicone moulds are recommended for test specimen preparation.
- Grease or release agents must not be used.
- 25 mm parallel plates are used, see sections 4 and 6.1 of EN 16659.
- Test plates must be clean, see section 6.1 of EN 16659.
- Pre-heat test plates to ensure good adhesion, see section 8.1 of EN 16659.
- When the testing is complete, it is recommended to check the test plates to ensure that the sample was fully adhered; if there is any evidence that the sample did not fully adhere discard the results.

The behaviour of bitumen is highly temperature-dependent, therefore precise temperature control of the bitumen sample and the stability of the test temperature are critical.

- The temperature measuring device of the Dynamic Shear Rheometer should be regularly verified and/or calibrated, see section 6.1 of EN 16659.
- Test specimens need to reach thermal equilibrium before testing. Section 8.3.1 of EN 16659 suggests a minimum equilibration time of 15 minutes.
- Test temperatures should be recorded over the duration of the test.
- When the testing is complete, it is recommended to check that test temperatures were within a range of $\pm 0,1$ °C, see section 5.1 of EN 16659; otherwise discard the results.

The software of the DSR must be suitable to ensure that zero-load conditions are met.

- Experience shows that some Dynamic Shear Rheometer software does not apply zero load during the zero-load conditions. In this case the software should be updated by the manufacturer.
- Check whether the test equipment meets the applied stresses and deformations exactly at the times specified and records them, see section 8.3.2 of EN 16659.
- When the testing is complete, check that the Dynamic Shear Rheometer recorded the strain at 1,00 ($\pm 0,05$) and at 10,00 ($\pm 0,05$) seconds as described in section 8.3.2 of EN 16659; if not, discard the test results.
- Allow no rest period between the testing at the different stress levels. The overall duration of testing should not exceed 200 seconds. Discard the specimen after testing, the same specimen cannot be tested twice.

The sample needs to be prepared for testing.

- The rheological behaviour of the sample can be affected by the storage conditions. Section 7.3 of EN 16659 provides information on minimum and maximum storage periods.
- The test specimen dimensions are important, it is therefore recommended that silicone moulds are used to prepare the test specimens.
- Set the zero gap between the plates prior to loading the test specimen, with both plates at the selected test temperature, see section 6.2 of EN 16659.
- After placing the specimen in the test geometry, and before setting the definitive test gap, the bitumen specimen needs to be trimmed to a cylindrical shape, see section 8.2 of EN 16659. We recommend to trim the bitumen specimen at the gap position $+0,05$ mm.
- The sample must not be trimmed after setting the geometry to the definitive test gap.

