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Air Pollution Control and Chemicals Division

Testing and certification of particle filters in accordance with the Ordinance on Air Pollution Control (OAPC)

Notes on the application of Standard SN 277206

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Contents

Purpose of this document

The Ordinance on Air Pollution Control (OAPC) specifies requirements for construction machines and their particle filters (Article 19a, OAPC). Construction machines may only be operated with a particle filter system for which a certificate of conformity with the requirements specified in Appendix 4, items 32 and 33, has been issued. Measurement and testing procedures are based on the best available technology, specifically Swiss standard SN 277206 (current version: 2014-06).

The purpose of this document is to explain how SN 277206 has to be applied for the testing and certification of particle filters in accordance with the requirements of the OAPC.

Calculation of particle separation efficiency

Principle

- For the testing and certification of particle filters in accordance with the requirements of the OAPC, it is sufficient to measure the filtration efficiency on an “integral particle measurement” basis (cf. SN 277206, chapters 5.3.3, 5.3.4 and 8.2.6).
- Particle filtration efficiency is calculated in four test cycle stages (5-7-3-1).
- The results of these measurements are calculated per cycle stage (before and after regeneration), not across the various cycle stages.
- In each of the 4 cycle stage, the filtration efficiency must be at least 97 percent.

Measurement of filtration efficiency prior to endurance test
- Measurement before filter regeneration in the 4 cycle stages (5-7-3-1).
- Measurement after filter regeneration in the 4 cycle stages (5-7-3-1).
- The results of the measurements of both filter conditions (before and after regeneration) are calculated for each individual cycle stage.
- In each of the 4 cycle stages, the separation efficiency calculated as described above must be at least 97 percent.

Measurement of filtration efficiency after endurance test
- Measurement of the filter in the state in which it was delivered, in the 4 cycle stages (5-7-3-1).
- (Note: after the endurance test, regeneration is no longer measured, which is why there is no “measurement of filtration efficiency after regeneration”).
- In each of the 4 cycle stages, the filtration efficiency must be at least 97 percent.

Regeneration test

- The particle filtration efficiency during regeneration is measured in 10 load stages (cf. Table D.6).
- The mean value calculated from these 10 load stages must be at least 90 percent.

Assessment of secondary emissions

Nitrogen dioxide (NO_2):
- The $\Delta NO_2/NO_x$ ratio is calculated in 10 load stages (cf. Table D.7.1).
- The mean level calculated from these 10 load stages must not exceed 50 percent.

Trace substances:
- The basis for calculation is Table D.7.2 (“Trace substances with catalytically coated filters”).
- The test report can only be accepted if at least 70 percent of the components specified in the test program have been measured quantitatively in the unfiltered exhaust gas.
- For the conformity assessment, it is the total of polycyclic aromatic hydrocarbons (PAH) designated as carcinogenic or mutagenic, the total of nitro-polycyclic aromatic hydrocarbons (nitro-PAH) designated as carcinogenic or mutagenic, and the TEQ of PCDD/F that are of relevance.
- The testing laboratory may subcontract the measurement of secondary emissions (chapter 5.5) to a laboratory with the necessary accreditation if the laboratory concerned is active in this field and is able to demonstrate that it has published related scientific literature (SCIE/E Index).
- Existing test reports may only be used, if all results as well as the specifications of the tested system according to SN277206 are available within the test report. If necessary, the accredited testing laboratory may complement existing reports for this purpose.

Transferability of test results

- The transferability of test results is regulated in SN 277206, Annex A (“Particle filter families”).
- Results obtained from the endurance test (stage F) can be transferred in the same way as the filtration test results (SN 277206, Annex A.1.1).
- Secondary emission results that have been obtained from a representative of a filter family without DOC, with catalytic fuel additive and with catalytic coating may be transferred to other filter families (with or without DOC) without catalytic fuel additive, if the filter medium has the same coating.

Extension of conformity certificate

- Certificates of Conformity are issued by the designated conformity assessment body.
- The conformity assessment body designated to assess the conformity of particle filtersystems with the OAPC is EMPA (Swiss Federal Materials Testing and Research Laboratories) in Dübendorf (contact: Mr. Christian Bach).
- The validity of conformity certificates is limited to five years.
- After a Certificate of Conformity has expired, the holder may apply to the conformity assessment body for an extension for a further five years.
- Under special circumstances, the conformity assessment body may issue certificates with a shorter period of validity.
- Applications for the extension of existing certificates should be submitted to the conformity assessment body using the corresponding form (which can be obtained from the EMPA website: www.empa.ch/pdf).

Deviations from SN 277206

- Deviations from SN 277206 (e.g. use of other measurement instruments) require the consent of the relevant accreditation authority.
- In the case of particle filter systems with DOC, which do not possess any other catalytically active components, in the secondary emissions test (stage D), only NO_2 has to be measured (chapter 5.5.1). Measurement of trace substances (chapter 5.5.2) does not have to be carried out.
- Endurance test (chapter 5.7): subject to the consent of the conformity assessment body, sealing by a laboratory may be waived if, for the system to be tested, a short report is supplied with the following content:
    - Designation and identification of the particle filter system.
    - Description of the vehicle on which it is installed (make, type, chassis number).
    - Date of installation and removal of the particle filter system, and number of hours of operation.
    - Description of any repairs or other work that may have been carried out on the particle filter system.
    - Confirmation that, during operation, the system fully corresponds to the particle filter family for which a certificate of conformity is being requested.
- Other applicable test standard: upon consultation with the conformity assessment body, testing may be carried out in accordance with UNECE Regulation No. 132 (REC, including Amendment 01), instead of SN 277206:
    - Regulation No. 132: http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/updates/R132e.pdf
    - Amendment 01: http://www.unece.org/fileadmin/DAM/trans/doc/2014/wp29/ECE-TRANS-WP29-2014-043e.pdf
- The conformity assessment body may accept test reports according to SNR 277205 or SN 277206 without accreditation, if the testing laboratory confirms that the test report is based on tests which have been conducted in an identical matter as tests covered by accreditation. This provision aims to ensure that the conformity assessment body is permitted to accept test reports according to SNR 277205 or SN 277206, which have been issued by the testing laboratory prior to its accreditation. This only applies for testing laboratories, which meanwhile have obtained accreditation or are demonstrably in the process of doing so.