



INFORMATION

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Filtration Test 663

Evaluation of the filtration behavior of Diesel fuels

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1 Introduction

To improve the quality of diesel fuels and, additives (MDFI, WASA, performance additives, lubricity additives, stabilizers) are used.

These additives, if not of the required specification and/or sufficient incorporation in the diesel fuel, FAME and mixtures of both, resp. or due to undesired side effects because of interaction, can cause clogging of vehicle and filling station filters.

The method described below is suitable to test diesel fuels with or without FAME component. The development of this method was based on the SEDAB-filtration test [1] modified concerning sample treatment, filter material and reduction of the filtration temperature.

The purpose of the filtration test described below is to test the filtering characteristics of diesel fuels containing additives to identify trends leading to the clogging of filters. All applicable safety requirements should be observed when carrying out the filter test.

Note:

This method – like any test method based on passage through a filter – responds very sensitively to seemingly minor modifications. The details in the test procedure should therefore be followed strictly, notably the sample preparation, the type and setting up of the filter, the filtration pressure and the avoidance of heat during filtration (e. g., due to light sources). The inspection of the filtration unit with water is a major component of quality assurance of the test result.

2 Brief description

500 mL of a prepared diesel fuel are sucked through a glass fiber filter. The time, in seconds, needed for filtering this volume at 7 °C sample temperature and 200 mbar absolute pressure is taken.

3 Tools / materials

- Filter for diesel fuel filtration: glass fiber filter
Glass fiber GF/F, size 47 mm, pore size 0.7 µm, Whatman order No. 1825-047
- Filter for checking the filtration unit with water:
cellulose nitrate membrane filter
diameter 50 mm, pore size 0.45 µm, Whatmann order No.10401 114
- Stainless steel vacuum filtration unit, Sartorius 500 mL, for filter 50 mm, type 16201-CS, sintered disk diameter: 4 cm
- PTFE sealing rings, Sartorius order No. 6980102
- Filtering flask with 1000 mL capacity

- Vacuostat (automatic vacuum controller), e.g., TOM-VA1 Automatic Zero System with 200 mbar minimum pressure
- Pressure gauge for checking vacuum (e.g., mercury pressure gauge)
- Drying cabinet for heating to 90 °C
- Temperature cabinet for holding at 7 °C
- Water bath for holding at + 40 °C
- Pincers, flat, without teeth, no pointed tip
- Glass Petri, approx. 125 mm diameter, with cover
- Stop watch
- Graduated cylinder for measuring 500 mL
- Glass bottle 500 mL
- Exsiccator
- for cleaning: toluene, tetrahydrofuran (THF, p.a.-Quality, stabilized, e. g. VWR International, Order no. 28551.321) and acetone

4 Checking the vacuum

Check the vacuum set by means of the vacuostat using a separate measuring tool, e.g., a mercury pressure gauge. Install the pressure gauge parallel with the vacuostat. Adjust the setting of the vacuostat, if necessary.

5 Installation of sintered disk and sealing rings

The tapered sintered disks can be delivered by the manufacturer. The difference in diameter between the top and the bottom surface should not exceed 3 mm.

Install the side with the larger diameter up, i.e., pointing towards the filter.

In contrast with the manufacturer's instruction, install 2 sealing rings. Install one sealing ring between the sintered disk and the base frame, the other sealing ring between the filter and the top mount.

6 Filter preparation

Treat the filters in the drying cabinet at 90 °C for 30 minutes and then store them in an exsiccator until used.

7 Cleaning the filtration unit

After filtration clean the filter top mount and the sintered disk first twice with 25 mL toluene and afterwards twice with 25 mL mixture of tetrahydrofuran and water at the rate of 95% (V/V) to 5% (V/V) and then dry. To accelerate the drying process, remove the rests of the mixture THF/water by rinsing with acetone.

Make sure that the equipment is at room temperature before the measurement is made.

8 Preparing the samples

Every sample should be free of all so called memory effects before the measurement starts. For this, place the whole sample in a water bath or a heating cabinet at 40 °C and then homogenize it by swinging (5 strokes).

Measure 500 mL in a graduated cylinder and transfer it to a 500 mL glass bottle.

Store the samples transferred in the 500 mL glass bottles in the temperature cabinet or a refrigerator for 24 hours at 7 °C.

9 Test performance

9.1 Conditions for filtration

The valve of the filtration unit is closed at the beginning of the measurement. An absolute pressure of 200 mbar is set in the vacuum unit (use only an automatic vacuum controller, but never side air flow control).

The filtration unit itself is at room temperature. Make sure that the samples are not exposed to intensive heat radiation (e.g., by a light source) during filtration.

9.2 Filtration

After preparing (24 hours at 7 °C) the sample (500 mL in a glass bottle), remove the sample from the temperature cabinet or refrigerator, swing it (5 strokes) for homogenizing and then transfer the complete volume in the hopper of the filtration unit without delay.

Open the valve when the sample has been filled. Take the time between opening the valve and disappearance of the liquid level on the filter (end of filtration).

10 Expression of results

The filtration time is expressed in full seconds. If not all the sample has been filtered after 1200 s, stop the filtration and transfer the remaining sample volume in a graduated cylinder for measurement. In this case, the result is expressed as ">1200 s, remaining volume x mL".¹

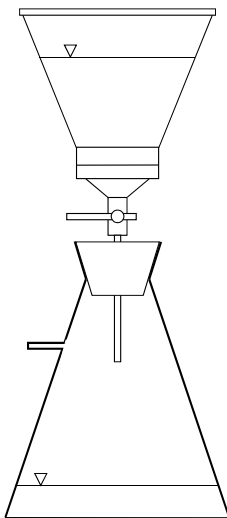
Record the room temperature during all measurements and include it in the result report.

11 Checking the filtration unit with water

The filtration unit is checked with water. Suck 600 mL distilled water at room temperature through a 0.45 µm cellulose nitrate filter at 200 mbar absolute pressure and measure the time for filtration.

The time for filtration should be between 60 and 70 seconds. If the time for filtration is outside these limits, the equipment should be checked.

12 Filtration unit schema



13 References cited

- [1] DGMK-Forschungsbericht 531-1 Aufstellung eines Kriterienkataloges zur Testung von Lubricity-Additiven in Dieselmotoren für den Raffinerieeinsatz – Fortschreibung, Margret Schmidt, Hamburg, 2004

¹ Evaluation criteria for the results obtained are not part of this DGMK-Information.