RWTÜV

Examination report

Diesel fuel filter

SWK 2000/5 - 50

Part A : Differential pressure curves

Part B : Water separation

Part C : Solids separation
and
backwashing

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Reference no. : 3.1.2-46/84
Order no. : 48 05 03/01

Essen, 06.12.93
Scl/Dke

Report
on the examination of diesel fuel filter SWK 2000/5 - 50

Client ..... Willibrord Lösing
Essener Str. 108
45529 Hattingen

Examination object ..... Diesel fuel filter SWK 2000/5-50
with filter elements
- 10 µm
- 30 µm

Aims of the examination .....
A. Measurement of the pressure loss curves
B. Measurement of the degrees of water separation
C. Measurement of solids separation and backwashing behaviour

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Part A

Differential pressure curves

1. Examination object

The diesel fuel filter SWK 2000/5-50 to be examined is designed for installation on the suction side. The nominal flow rate is 6 l/min.

Extra light heating oil with a density of 0.845 g/cm³ (at 15 °C) was used as the test oil.

2. Examination commission

Measurement of the pressure differentials up to the nominal flow rate of 6 l/min. with the 10 µm and 30 µm filter elements and the plotting of the differential pressure curves ($\Delta p = f(V)$).

3. Results of the examination

The differential pressure curves are shown in Annex 1 of Part A of this examination report.

Annex

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To part A of the report dated 06.12.93
Reference no.: 3.1.2-46/84
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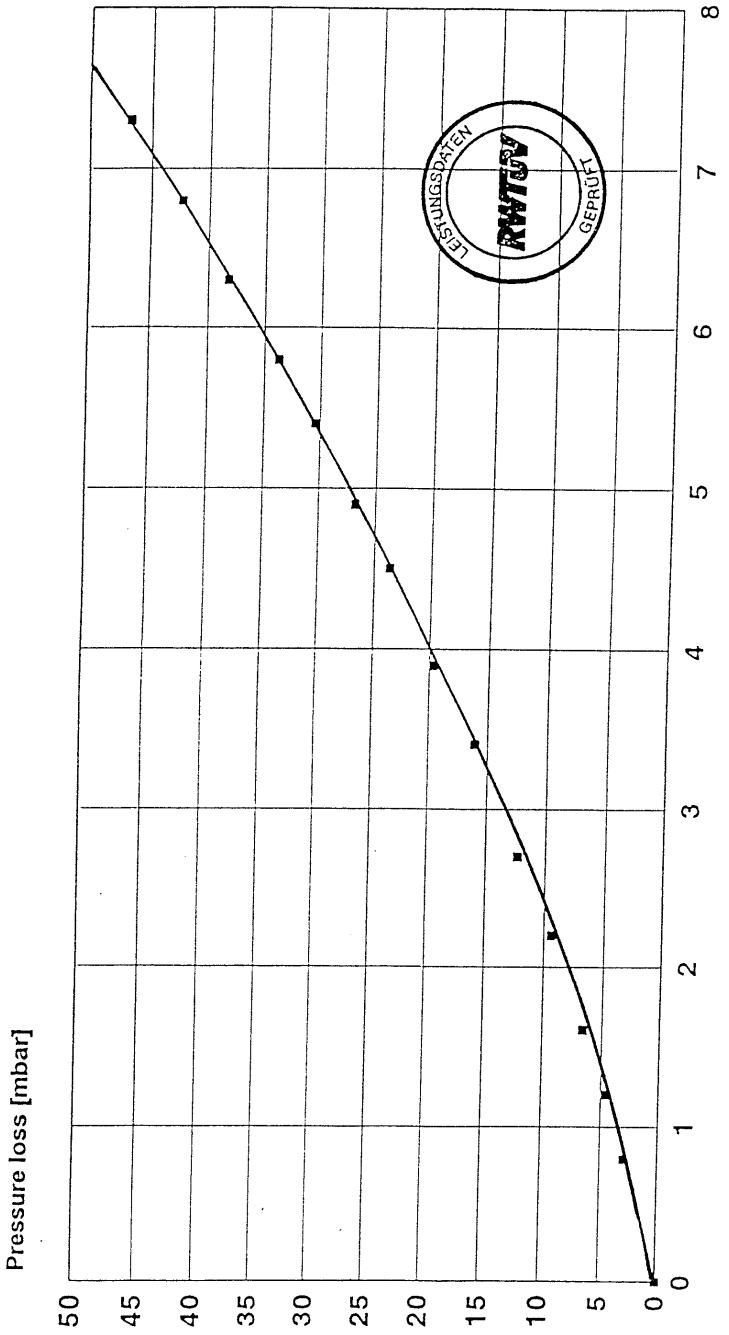
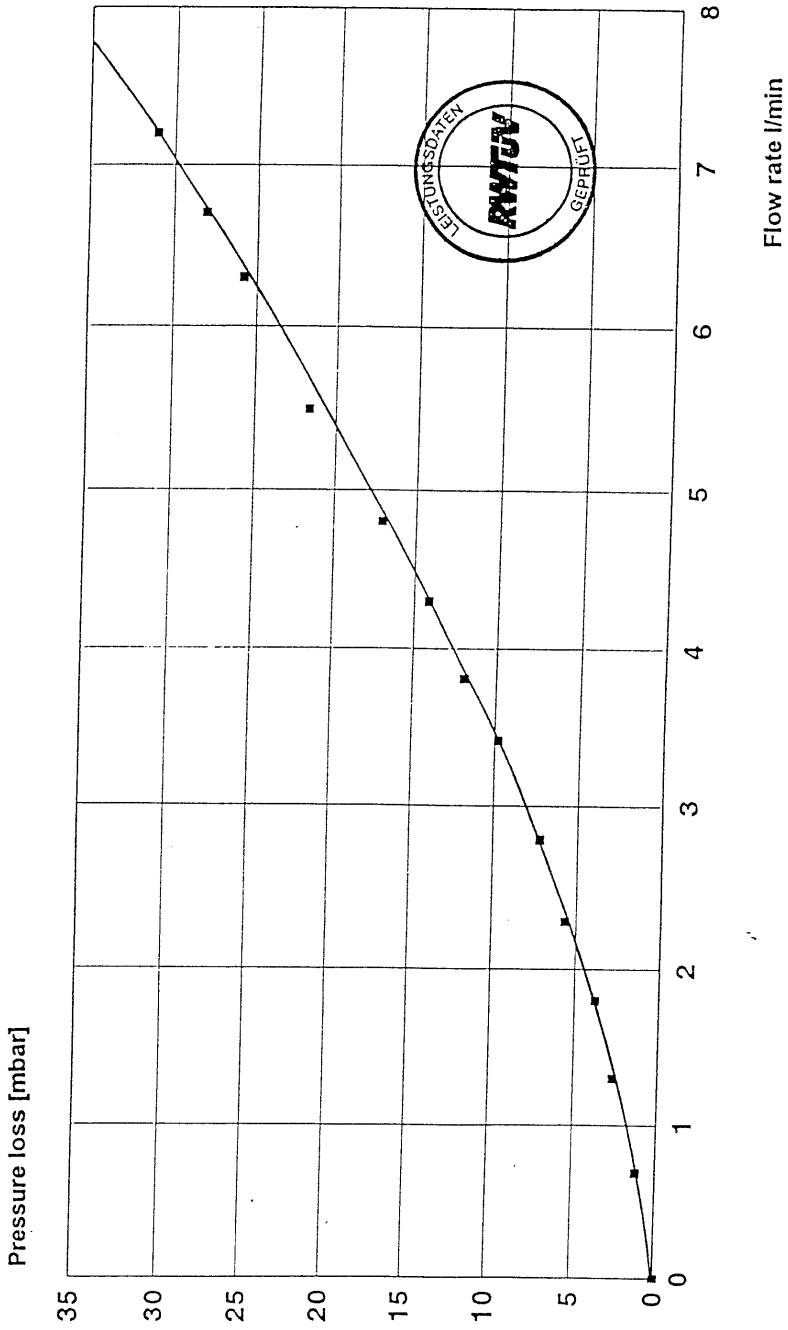
Pressure loss measurement on a diesel fuel filter



Type of filter: Separ SWK 2000/5-50

Filter element: 10 µm

Pressure loss measurement on a diesel fuel filter



Type of filter: Separ SWK 2000/5-50

Filter element: 30 µm

Part B

Water separation

1. Examination object

The diesel fuel filter SWK 2000/5-50 to be examined is designed for installation on the suction side. The nominal flow rate is 6 l/min.

Extra light heating oil with a density of 0.845 g/cm³ (at 15 °C) was used as the test oil.

The water was continuously fed into the filter's suction line and intermittently extracted from the filter casing without interruption of the test run.

2. Examination commission

Determining the degrees of water separation using 10 µm and 30 µm filter elements.

- Feeding water into the test oil stream : 0.2 % by volume
- Test oil flow rates : 2 l/min., 4 l/min. and 6 l/min.
- Test time : 60 mins in each case
- Sampling after 15 mins, 30 mins, 45 mins and 60 mins.

3. Results of the examination

The results of the measurements are shown in Annex 1 of Part B of this examination report.

In the calculation of the degree of separation only the water rate specifically fed into the test oil stream, namely 0.2 % by volume, was taken into account.

Annex

Water separation

Diesel fuel filter SWK 2000/5-50

Filter element : 10 µm
Test oil flow rates : 2 l/min, 4 l/min, 6 l/min
Feeding water : 0.2 % by volume

Point when sample taken [min]	Sample no. [1] [-]	Water content in test oil stream [mg/kg]	Water content of the sample [mg/kg]	Degree of water separation [%]
-	**1st 0-sample**	0 + 27	**27** - 27 = 0	100
15	5-10-2-15	2381 + 27	**30** - 27 = 3	99,87
30	5-10-2-30	2381 + 27	**35** - 27 = 8	99,66
45	5-10-2-45	2381 + 27	**33** - 27 = 6	99,75
60	5-10-2-60	2381 + 27	**34** - 27 = 7	99,71
-	**2nd 0-sample**	0 + 24	**24** - 24 = 0	100
15	5-10-4-15	2381 + 24	**39** - 24 = 15	99,37
30	5-10-4-30	2381 + 24	**30** - 24 = 6	99,75
45	5-10-4-45	2381 + 24	**34** - 24 = 10	99,58
60	5-10-4-60	2381 + 24	**35** - 24 = 11	99,54
-	**3rd 0-sample**	0 + 16	**16** - 16 = 0	100
15	5-10-6-15	2381 + 16	**31** - 16 = 15	99,37
30	5-10-6-30	2381 + 16	**27** - 16 = 11	99,54
45	5-10-6-45	2381 + 16	**32** - 16 = 16	99,33
60	5-10-6-60	2381 + 16	**78** - 16 = 62	97,40
	4th 0-sample	0 + 20	**20** - 20 = 0	100

[1] **Structure of sample no.:** type of filter - size of pores [µm] - test oil flow rate [l/min] - point when sample taken [min]

Water separation
Diesel fuel filter SWK 2000/5-50

Filter element : 30 µm
Test oil flow rates : 2 l/min, 4 l/min, 6 l/min
Feeding water : 0,2 Vol. %

Point when sample taken [min]	Sample no. [1] [-]	Water content in test oil stream [mg/kg]	Water content of the sample [mg/kg]	Degree of water separation [%]
-	**1st 0-sample**	0 + 47	**47** - 47 = 0	100
15	5-30-2-15	2381 + 47	**45** - 47 = 0	100
30	5-30-2-30	2381 + 47	**44** - 47 = 0	100
45	5-30-2-45	2381 + 47	**33** - 47 = 0	100
60	5-30-2-60	2381 + 47	**36** - 47 = 0	100
-	**2nd 0-sample**	0 + 40	**40** - 40 = 0	100
15	5-30-4-15	2381 + 40	**145** - 40 = 105	95,59
30	5-30-4-30	2381 + 40	**101** - 40 = 61	97,44
45	5-30-4-45	2381 + 40	**49** - 40 = 9	99,62
60	5-30-4-60	2381 + 40	**48** - 40 = 8	99,66
-	**3rd 0-sample**	0 + 32	**32** - 32 = 0	100
15	5-30-6-15	2381 + 32	**113** - 32 = 81	96,60
30	5-30-6-30	2381 + 32	**427** - 32 = 395	83,41
45	5-30-6-45	2381 + 32	**267** - 32 = 235	90,13
60	5-30-6-60	2381 + 32	**645** - 32 = 613	74,25
	4th 0-sample	0 + 35	**35** - 35 = 0	100

[1] **Structure of sample no.:** type of filter - size of pores [µm] - test oil flow rate [l/min] - point when sample taken [min]

Part C

Solids separation and backwashing behaviour

1. Examination object

The diesel fuel filter SWK 2000/5-50 to be examined is designed for installation on the suction side. The nominal flow rate is 6 l/min.

Extra light heating oil with a density of 0.845 g/cm³ (at 15 °C) was used as the test oil.

Coarse air cleaner test dust was used as the solid.

2. Examination commission

Measurement of solids separation and backwashing behaviour with use of 10 µm and 30 µm filter elements was as follows:

(1) Exposure of the filter to clean test oil (filtered through a 2 µm filter element) and the measurement of pressure loss.

(2) Switching over to the contaminated oil tank.

(3) At $\Delta p > 300$ mbar the pump was switched off and, at the same time, the filter was shut off on both the suction and the pressure sides.

(4) Opening of the vent screw and draining of the test oil from the filter casing including all the solid slurry; determination of the solids content in this sample.

(5) Restart-up of the system with clean test oil and measurement of pressure loss.

(6) etc.

- Test oil flow rate : 5 l/min.
- Solids concentration in the test oil : 0.05 % by weight with 10 µm filter element
  0.1 % by weight with 30 µm filter element

3. Results of the examination

The results of the measurements conducted with regard to the solids separation and backwashing behaviour are shown in Annex 1 of Part C of this examination report.

Annex

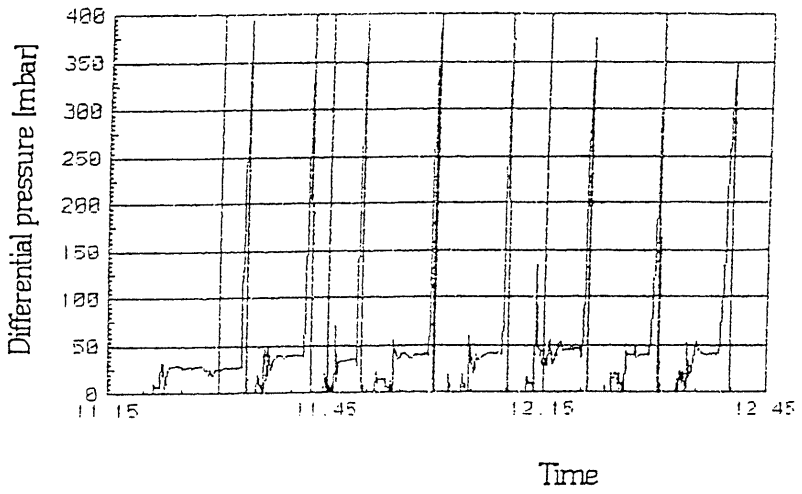
For the contents

Dipl.-Ing. R. Schüler

RWTÜV Anlagentechnik GmbH
Energy Technology Subdivision

Solids separation measurement

Filter	:	SWK 2000/5-50
Filter element	:	10 µm
Solid	:	Coarse air cleaner test dust
Solid concentration rate at the start	:	0.05 % by weight (corresponding to 63 g)
Test oil flow rate	:	5 l/min.



Δp at the start	:	27 mbar		
Δp after run 1	:	39 mbar;	amount of solids in the sample:	12.2 g
Δp after run 2	:	36 mbar;	amount of solids in the sample:	11.1 g
Δp after run 3	:	40 mbar;	amount of solids in the sample:	6.2 g
Δp after run 4	:	40 mbar;	amount of solids in the sample:	7.6 g
Δp after run 5	:	45 mbar;	amount of solids in the sample:	5.0 g
Δp after run 6	:	40 mbar;	amount of solids in the sample:	3.4 g
Δp after run 7	:	40 mbar;	amount of solids in the sample:	3.7 g
Δp after run 8	:	--- ;	amount of solids in the sample:	3.8 g
			total amount of solids:	53.0 g

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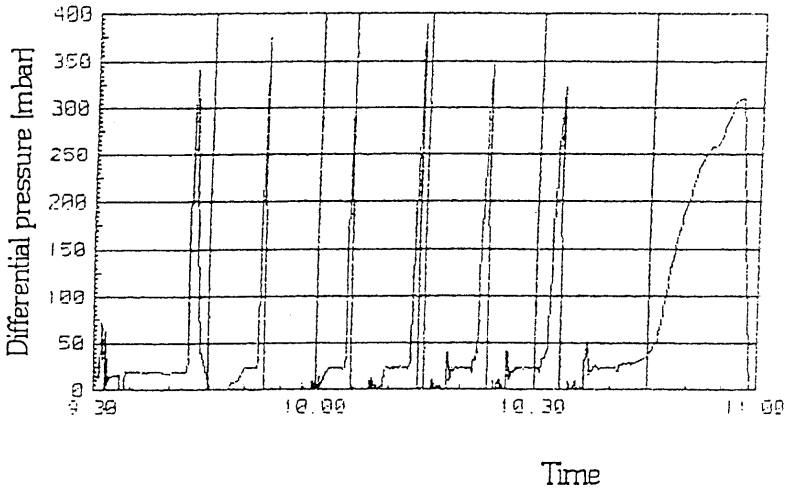
Solids separation measurement

Filter	:	SWK 2000/5-50
Filter element	:	30 µm
Solid	:	Coarse air cleaner test dust
Solid concentration rate at the start	:	0,1 Gew. % by weight (corresponding to 126 g)
Test oil flow rate	:	5 l/min.



Δp at the start	:	22 mbar		
Δp after run 1	:	24 mbar;	amount of solids in the sample:	31.6 g
Δp after run 2	:	24 mbar;	amount of solids in the sample:	26.5 g
Δp after run 3	:	24 mbar;	amount of solids in the sample:	20.6 g
Δp after run 4	:	23 mbar;	amount of solids in the sample:	13.9 g
Δp after run 5	:	23 mbar;	amount of solids in the sample:	7.4 g
Δp after run 6	:	23 mbar;	amount of solids in the sample:	4.8 g
Δp after run 7	:	--- ;	amount of solids in the sample:	4.7 g
			total amount of solids:	109.5 g