



# INFORMATION

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## DGMK-Progress Report 550-05

### Vapour Recovery and Monitoring Systems at Petrol Stations

#### Project Monitoring

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1. DGMK have examined the effectiveness of vapour recovery systems at petrol stations as a member of a research team since 1998. The findings of this research have been published in the DGMK research reports 550 to 550-04.
2. Vapour recovery systems operate in such a way that the fuel-vapour-air mixture displaced from the vehicle tank is absorbed at the filler neck by the vapour recovery nozzle. In order to reabsorb fuel-vapour-air mixtures proportionally to the liquid flow of the refuelling process, controlling and regulating measures are necessary.

Generally vapour recovery systems are electronically controlled. They are steered by means of the pulses sent by the pulser at the fuel volume measuring device. The pulses are passed to the pump computer where the dispensed fuel volume is calculated. The control unit of the vapour recovery system is adapted to the above mentioned pulses of the fuel pump so that the fuel flow in the vapour recovery control system can be calculated correctly. The basis for this selection of the vapour recovery is a system and installation related adjustment by means of a simulated fuel flow (e.g. with the help of the "Bürkert-Koffer"). The vapour flow is controlled by an actuated vapour recovery pump or a proportional valve.

Since the main components of the vapour recovery system are available in different designs and in different combinations there are a great number of system variants. In the meantime there exist appr. 250 approved system variants (TÜV Rheinland, TÜV Süd).

3. The most frequent technical faults during the extensive tests for the functionality of the vapour recovery systems (with total failures up to 30 %) were
  - vapour pump defects
  - defective computer control
  - faulty adjustments

In addition there were installation and maintenance faults while the most frequent faults appeared in the adjustment of the vapour recovery (pulse rate, correction factor).

4. In spite of progress in developments, multiple tests and the discussion thereof in a colloquium, the functionality of vapour recovery systems at petrol stations could not always (or continuously) be ensured. This led to the development of automatic monitoring systems in order to be able to react more quickly to recorded faults.

Eventually the systems of two manufacturers (FAFNIR and TOKHEIM) proved to be more suitable than those of a number of suppliers. Their suitability was established through a limited field test 2002/2003 (DGMK project 550-04). Both systems have been certified by TÜV Süd.

5. Since the amendment of the 21<sup>st</sup> BImSchV became effective on 18<sup>th</sup> May 2002 automatic monitoring systems have been prescribed by law which continuously monitor the functionality of the vapour recovery system. New petrol stations have had to be fitted with this system since 01.04.2003. For existing petrol stations – according to their quantity of gasoline sold per year – staggered retrofitting periods will apply between 01.01.2005 and 01.01.2008.
  
6. After a year the implementation of the amended 21<sup>st</sup> BImSchV was reviewed by the DGMK on 01.04.2004. The contributions of the parties involved in this process (pump manufacturers, manufacturers of monitoring systems, specialist companies and petrol station operators) clearly showed their varied and controversial points of view depending to their own interests. During the discussion the specialists pointed out their numerous service operations involving considerable time and expense. However, with the growing number of new and retrofitted petrol stations, previously unknown problems became apparent in addition to the already known ones, such as
  - formation of condensate
  - vibration processes
  - faulty correction factor
  - problems using the “Bürkert-Koffer”
  - software problems
  
7. In April 2004 this knowledge led to correspondence with the BMU requesting to suspend the mandatory requirements and transition periods of the amended 21<sup>st</sup> BImSchV concerning automatic-monitoring until there be a sufficiently safe “state of the art”.
  
8. Parallel to this action a great effort is being made to solve the problems which have arisen so far.
  - Condensate influences and vibration processes are eliminated through conversions.
  - Through software updates of the “Bürkert-Koffer” malfunctions could be eliminated.
  - During the check of relevant certificates of vapour recovery systems revisions were incorporated to include new correction factors.
  - System insufficiencies of the VAPORIX (FAFNIR)-system that did not come to light during the field test were eliminated with the software update revision 1.33.

Furthermore the training of the specialists regarding the installation and maintenance of the systems and equipment also with a view to the great variety of components in the existing petrol stations is being intensified by the organisation of specialized companies BBS/GT (Bundesverband Behälterschutz/ Gütegemeinschaft Tankschutz), E.R.S.T. GmbH as well as by the manufacturers of pumps and systems.

9. Based on the knowledge gained the following procedures promise to be successful:

- specialist companies with well trained personnel, sufficient experience and knowledge concerning the interaction of the vapour recovery system with the pump
- specific training for the installation of the appropriate monitoring system (FAFNIR, TOKHEIM) for each gas pump type.
- Supplying the specialist companies with suitable measuring devices and tools
- Testing the existing vapour recovery system and, if necessary, finding the faults and eliminating them in order to achieve the faultless operation of the vapour recovery
- Installation of a monitoring system according to the manufacturer's documentation and installation instructions especially for all suitable pump types
- Constant exchange of information and experience among all concerned

Those petrol station operators who put these measures into effect can regard the recognized problems as eliminated or manageable as documented by their own facts and experiences.

The considerable improvement of the situation (as of 01.08.2008) shows that this is the right way of dealing with these problems. The failures in the vapour recovery systems of new installations or retrofittings could be lowered considerably. Evaluations and training programmes always contain the latest findings.

10. At present appr. 600 service technicians have had basic training (as of 01.08.2004). According to MWV data there are only appr. 40 to 50 qualified installation teams (of 2 employees each) with sufficient experience in the field of vapour recovery and monitoring. These teams do not only carry out retrofitting but also new installations as well as maintenance and repair work.

11. MWV has established the present implementation status of the amended 21<sup>st</sup> BImSchV (as of 01.06.2004) for their member companies.

Since coming into effect on 01.04.2003 295 petrol stations have been fitted with a monitoring system for vapour recovery. Of these 50 % were new installations and 50% retrofittings.

12. On average each petrol station has 4 gasoline pumps, if the yearly sale is over 5.000 m<sup>3</sup> there are usually 6 pumps for dispensing gasoline (petrol):

The cost for each petrol station amounts to:

- for a new installation including the dispensers appr. 60.000 €
- for retrofitting with the adaptation of the existing vapour recovery system (pump, controls, ZVA) appr. 30.000 €
- for retrofitting without further extras appr. 15.000 €

The average time for retrofitting a petrol station with four gasoline pumps is 3 days per installation team (6 man-days).

13. The following table contains the estimated number of petrol stations to be retrofitted as per amended 21<sup>st</sup> BImSchV (data from MWV, UNITI and BFT):

Dates	Number of Petrol Stations	Average Number of Gasoline Pumps	Projected Man Days for Retrofitting
Retrofitted by 01.06.2004	250	1.500	2.250
To be retrofitted by the end of 2004	850	5.100	7.650
To be retrofitted by the end of 2005	5.500	22.000	33.000
To be retrofitted by the end of 2006	6.500	19.500	29.250
To be retrofitted by the end of 2007	1.000	2.000	3.000

The maximum available capacity of the 50 installation teams amounts to 100 x 200 = 20.000 man-days per year. This capacity is not only available for retrofitting but also for new installations, maintenance and repair work.

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