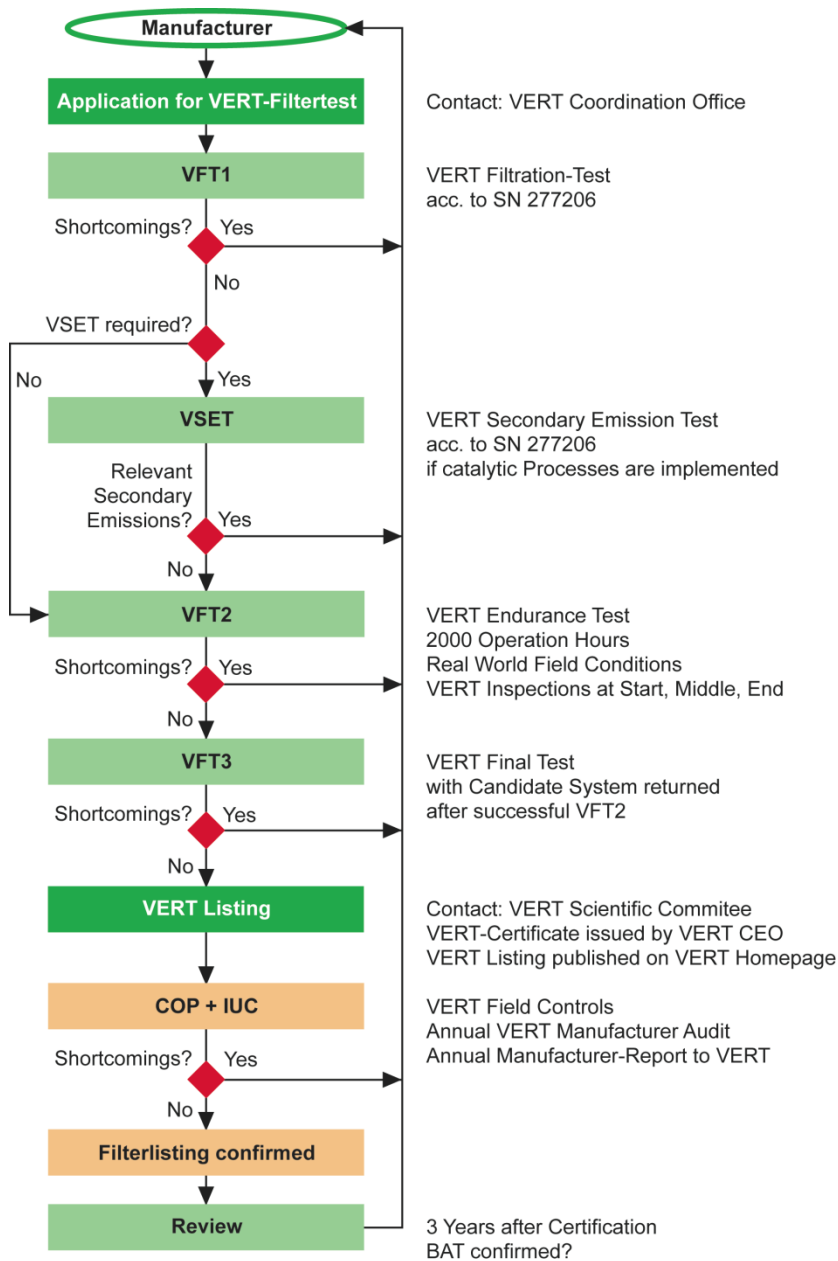


# VERT TESTING OF PARTICLE FILTER SYSTEMS

The VERT® tests, in place since 1997, is now codified by the Swiss Technical Standard SN 277206 [1]



## **1. Particle filter systems for retrofitting**

The VERT<sup>®</sup> tests are performed, according to the above scheme, on all PFS systems and components intended for retrofitting. Retrofitting is defined as fitting PFS to vehicles and equipment, which were type-tested without particle filters. Irrelevant is whether the retrofitting is done in the factory, at the vendor, by a retrofitting company or by the operators themselves. Also irrelevant is whether the engine is new or has been deployed for a long time.

Enrolment in the VERT<sup>®</sup> filter list is only possible after successful completion of the full VERT test, consisting of VFT1 + VSET (if applicable) + VFT2 + VFT3 according to SN277206, check of conformity with VERT-rules and final examination of the results by the VERT<sup>®</sup> scientific committee.

A similar procedure is performed for combined VERTdePN-systems, consisting of filters and NO<sub>x</sub>-reduction catalysts [2, 3]. They must successfully complete VPNT1, VPNT2, VPNT3 and VPNSSET.

When retrofitted each system must perform a so-called VERT<sup>®</sup> acceptance test and a respective protocol.

## **2. Particle filter systems as original equipment**

Alternatively, if the PFS is not tested as an individual component for retrofitting new or older Diesel engines, instead, the engine (vehicle) manufacturers themselves engineer the system component for original equipment or as integrated equipment, then the assumption is that the engine (vehicle) manufacturer performs meticulous and prolonged testing. Moreover, the manufacturers themselves ensure integration, guarantee filter/engine compatibility and provide the electronic monitoring of the entire system.

In this case too enrolment is only possible after successful completion of the VERT<sup>®</sup> test. When catalyst coatings or FBC are used, the secondary emission test VSET must be passed. Subsequently, the emission stability must be demonstrated during 2,000 hours deployment. For this purpose the certifying lab must seal the PFS in order to prevent tampering during probationary deployment. However all tests can be performed on the manufacturers test rigs, according to the European certification Directive 97/68/EC. The VFT2 test can be done on the test rig as well within the scope of the European Directive 2004/26/EC on emission deterioration factors.

## **3. Re-certification after technical alterations**

The PFS manufacturer must communicate all intended alterations of an enrolled PFS of component to the VERT<sup>®</sup> coordination office. The VERT<sup>®</sup> coordinator then decides which tests ought to be repeated. [4]

The basic rules are as follows:

- If main components are altered, which impact the PFS filtration characteristics, then the entire test sequence VFT1–3 must be repeated.
- If catalytic components are altered, then the VSET must be repeated.
- If functional elements of the mechanical/electrical auxiliaries are altered, which could impact operational durability, then the VFT2 (deployment during 2,000 operating hours) and concluding VFT3 must be repeated.
- Minor alterations can be administratively approved.

## **4. Approval of filter media**

For the VERT<sup>®</sup> testing of filter media, VFT1 test is sufficient, provided the filter media are not catalytic coated. Catalytic coated media must also pass the VSET secondary emissions test.

## **5. Approval of regeneration additives**

Mandatory is VFT1 plus VSET secondary emission test including a size-specific metal analysis of the emissions. Moreover, the additive must comply with valid European Directives on safety and environmental compatibility.

Further aspects with respect to the additive dosing system, safety on board and monitoring are comprehensively defined in the VERT<sup>®</sup> FBC-System Specification [5].

## **6. Approval of OBM units**

All filter systems (except filters for short duration use – so called snap-on-filters) must have on-board electronic monitoring OBM of back pressure and temperature. The prerequisites for approval are conformity inspection and endurance test according to the VERT<sup>®</sup> OBM-System-Specification [6]. Endurance test shall be combined with a VFT2 filter test during at least 2000 hours of operation with subsequent functional verification.

Filters for short duration use, which cannot be regenerated, only need a pressure indicator which might be mechanic or electronic. Recommended are peak-storing instruments.

## **7. Verification of conformity after 3 years**

At latest 3 years after granting VERT<sup>®</sup> certification, the PFS must be re-certified proving conformity with the prevalent BAT and Directives. If the PFS does not comply, then the manufacturer has 1-year time to improve the PFS. Compliance must be established by partial or complete retesting of the PFS.

Compliance verification can be confined to a “review”, if field experience and technical data indicate successful operation and conformity with the then valid BAT.

Otherwise, supplementary tests can be requested.

## **8. PFS manufacturers' responsibility**

First enrolment in the VERT<sup>®</sup> filter list is based on passing the VERT<sup>®</sup> suitability tests.

To remain enrolled the named PFS manufacturer must identify all delivered PFS with the VERT<sup>®</sup>-label and perform the VERT<sup>®</sup> acceptance tests and accept responsibility for the quality of all PFS delivered to correspond to the tested and approved technology and to be fitted and maintained in accordance with the VERT<sup>®</sup> rules. Furthermore the manufacturer must prove on an annual basis that failure rate in the field of each of his filter families does remain below 5 % for all filters not older than 5 years.

## **9. Non-transferability of the VERT<sup>®</sup> certificate**

The VERT<sup>®</sup> certificate is issued to a named PFS manufacturer. The PFS manufacturer cannot reassign the VERT<sup>®</sup> certificate to another manufacturer, or to the manufacturer's vendors and sales agents.

## 10. References

- [1] SN 277206 Prüfung von Partikelfiltersystemen für Verbrennungsmotoren, Schweizerische Normen-Vereinigung
  - [2] SAE 2009-01-0284, Testing of Combined DPF+SCR Systems for HD Retrofitting – VERTdePN; J. Czerwinski et al.
  - [3] SAE 2011-01-1139, Diesel Emissions with DPF+SCR in VERT dePN-Testing & Procedure; J. Czerwinski et al.
  - [4] Testing and Certification of Particle Filters in Accordance with the Ordinance on Air Pollution Control (OAPC); FOEN-notes on the application of standard SN 277206  
[https://www.bafu.admin.ch/dam/bafu/de/dokumente/luft/fachinfo-daten/erlaeuterungen\\_zur\\_anwendungdersn277206.pdf.download.pdf](https://www.bafu.admin.ch/dam/bafu/de/dokumente/luft/fachinfo-daten/erlaeuterungen_zur_anwendungdersn277206.pdf.download.pdf)
  - [5] VERT-Pflichtenheft Regenerationsadditive; [www.VERTE-certification.eu](http://www.VERTE-certification.eu)
  - [6] VERT-Pflichtenheft elektronische Filterkontrolle; [www.VERTE-certification.eu](http://www.VERTE-certification.eu)
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The VERT Association publishes on its web site information on the topic of particle filter retrofitting. The site also has a comprehensive database of already retrofitted vehicles and machines. The VERT Filter List documents the certified filter systems and their manufacturer: [www.VERTE-dpf.eu](http://www.VERTE-dpf.eu).

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