

Leutert G. / Air Consult, Switzerland

Swiss Rule SNR 277205 and ISO-Standard Project on Testing Particle Filter Systems

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This testing procedure is based to a great extent on the VERT suitability test which is in use since about 10 years. It describes the way particle filter systems should be tested regarding technical, physical and chemical criteria. Hence, the SNR 277205 describes the technical testing procedure only. It does not comprise requirements in the sense of limit values that should be met.

The Swiss rule SNR 277205 is available in German and English:

- In printed form at the Swiss Association for Standardization (SNV)
www.snv.ch
- As free PDF download from the Swiss Federal Office for the Environment (BAFU)
www.bafu.admin.ch > (Language) Deutsch > Luft > Gesetzgebung und Vollzug > Industrie und Gewerbe > Filterliste BAFU/Suva > SNR 277205 (in German and English)

(2) Switzerland has initiated a **project to elaborate an ISO standard** on a testing procedure for particle filter systems.

The Swiss proposal basically was accepted by ISO. It has been further discussed and revised in an ISO meeting on May 15, 2008 in Paris. At present this revised proposal is out for voting. All persons, institutions, enterprises, organizations and administrations who agree that such an ISO standard should be elaborated are kindly invited to contact their national standardization organization. Make reference to document "ISO/TC22/SC5 N 1656" of May 16, 2008 and ask your national standardization organization to vote "YES" in order to elaborate such an ISO standard. Such positive reactions are very important, because otherwise the project would be cancelled.

The deadline for the answer of the national standardization organizations to the competent ISO body (ISO/TC22/SC5) is July 15, 2008.

Short C.V.

- Born 1939 in Zurich
- Apprenticeship as Mechanic
- B.Sc. in Communication Technology / Electronics (ZFH Winterthur)
- M.Sc. in Experimental Physics (Swiss Federal Institute of Technology, ETH Zurich)
- Ph.D. in Technical Chemistry (Swiss Federal Institute of Technology, ETH Zurich)
- 1972 Scientific Expert at the Swiss Federal Office for the Environment
- 1978 to 2004 Head of Air Pollution Control and NIR Division of this Federal Office
- Since 2004 Consultant in Air Pollution Control (Air Consult, Berne)

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Abstract

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(1) Swiss rule SNR 277205 on the testing of particle filter systems for internal combustion engines

Objectives

The SNR 277205 aims at defining methods and procedures for testing the efficiency and the suitability of particle filter systems for internal combustion engines. Direct addressees of this rule are test laboratories. Indirect addressees are filter manufacturer, filter users and public authorities.

Technical basis and contents

This testing procedure is based to a great extent on the VERT suitability test which is in use since about 10 years. It describes the way particle filter systems should be tested regarding technical, physical and chemical criteria.

The SNR 277205 describes the technical testing procedure only. It does not comprise requirements in the sense of limit values that should be met.

Legal import

Like all standards the SNR 277205 has no legal force out of itself. It is a technical consensus paper and has the significance of a recommendation. Standards obtain legal force only if there is made reference to them in private contracts or in laws and ordinances prescribing the import of a specific standard or rule.

Publication

The Swiss rule SNR 277205 is available in German and English. French and Italian translations will follow.

Available in printed form:
Swiss Association for Standardization (SNV)
<http://www.snv.ch>

Available as free PDF download:
Swiss Federal Office for the Environment (BAFU)
<http://www.bafu.admin.ch> > (Language) Deutsch > Luft > Gesetzgebung und Vollzug > Industrie und Gewerbe > Filterliste BAFU/Suva > SNR 277205

Guiding principles for filter testing in SNR 277205

The guiding principles of this SN-Rule 277205 can be summed up in five items:

1. Filtration is a physical process which - under the same conditions - always works in the same way. It essentially depends on the particle size and the space velocity of the exhaust gases in the particle filter. Therefore on the engine test-bed main emphasis is given to test the pure physical properties of the filter system. These physical properties in principle are independent of the future application of the filter.
2. Filter systems which (a) are based on the same filter technology, (b) consist of the same main components, (c) are constructed in the same way, (d) but only differ in their size, form a so called filter family. As they all are functionally identical, it is enough to test only one single representative of a filter family. The test results can be applied to other samples of the same filter family.
3. The filtration properties of particle filter systems are characterized exclusively by the filtration efficiency for the number of ultra fine solid particles in the size range of 20 to 300 nanometer. This focuses the filtration test on those particles which are most important regarding adverse health effects and, moreover, gives reliable measurement results. Because of the applied hot gas dilution and by restricting the measurement to solid particles, measuring artifacts which could be generated by condensation of volatile exhaust gas components can be eliminated.
4. Particle filter systems can generate toxic secondary emissions. This can particularly be the case if catalytically active substances (e.g. in filter coatings or as fuel borne additives) are used. For this reason, the SN-Rule includes also a secondary emissions test.
5. In addition to the filter testing on the engine test-bed, and with regard to the intended use of the particle filter system, an endurance test under real operating conditions has to be done. This test is carried out in a typical application for which the filter system is intended to be used (e.g. a construction site machine, a road vehicle, a stationary engine). With this endurance test possible weak points of the filter system under long-term stress can be revealed.

Testing of Particle Filter Systems for Internal Combustion Engines

Prüfung von Partikelfiltersystemen für Verbrennungsmotoren

Test de systèmes de filtres à particules pour moteurs à combustion

Collaudo di sistemi di filtri antiparticolato per motori a combustione

Für diese Norm ist in der Schweiz das nationale Komitee <<VERT Partikelfilter>> des interdisziplinären Normenbereiches zuständig.

En Suisse la présente Norme est de la compétence du comité national <<VERT systèmes de filtres à particules >> du Secteur interdisciplinaire de normalisation

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Survey of test sequence of SNR 277205

| | Test | Main points of test |
|---|---|--|
| A | Technical documentation and visual test | Technical description of the filter system and visual test of the construction |
| B | Filtration test before endurance test | At stationary motor operation: Determination of filtration efficiency for number of solid particle in the size range of 20 nm to 300 nm. At transient motor operation: Determination of exhaust gas opacity after the filter. |
| C | Regeneration test | Determination of exhaust gas temperature and back pressure of the filter at the point where regeneration starts. Particle and gaseous emissions during the regeneration phase. |
| D | Secondary emissions test | Determination of toxic substances which are generated by the filter system (NO ₂ and about 40 trace elements). |
| E | Test of the monitoring of operation before endurance test | Checking the electronic control, monitoring and recording of operation of the filter system, and the triggering of warnings and alerts. |
| F | Endurance test | Real-world-test by operating the filter system in a typical application during 2000 operation hours. |
| G | Filtration test after endurance test | Like above in B |
| H | Test of the monitoring of operation after endurance test | Like above in E |
| I | Test report | Compilation and discussion of test results. |

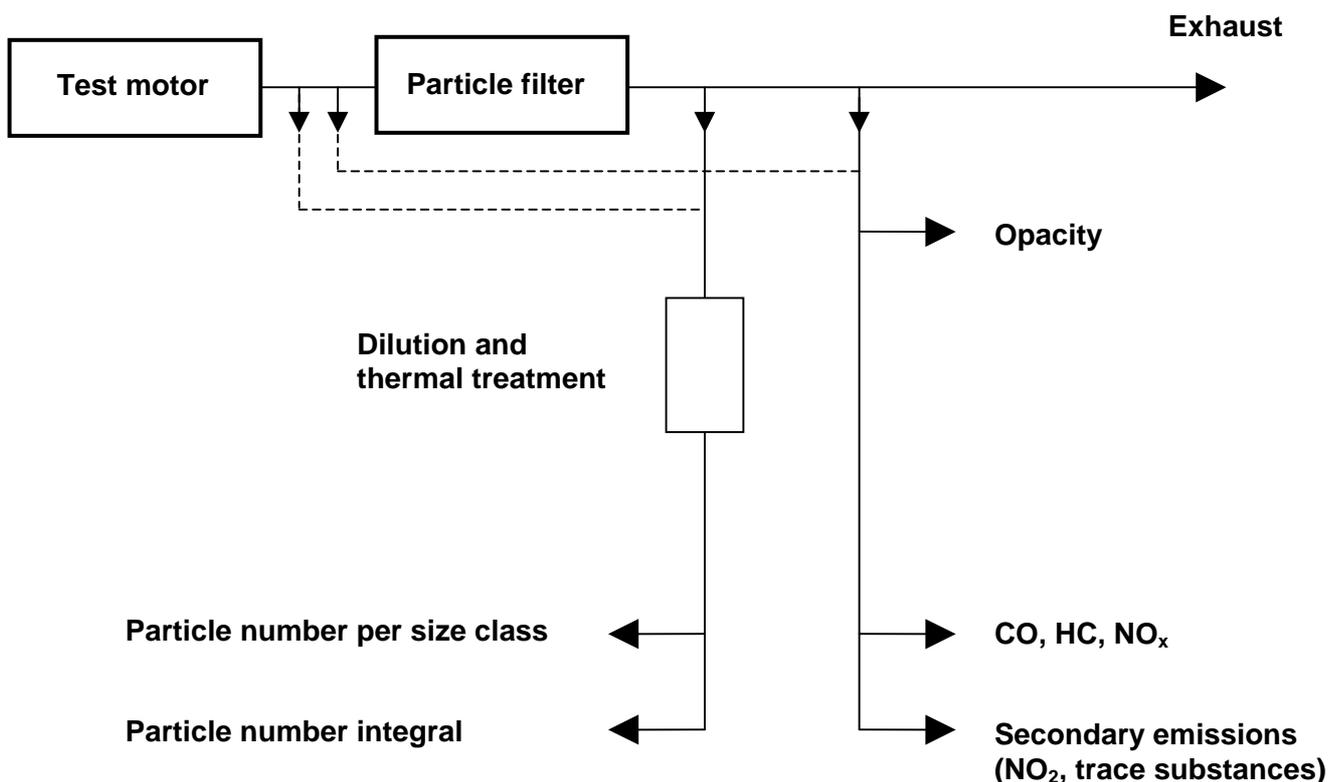
Engine test-bed according to SNR 277205

Unless otherwise stated in the SN-Rule, the equipment of the engine test-bed and the carrying out of the test-bed measurements have to conform with ISO 8178-1.

The test motor and the test-bed equipment must be suited to run the test cycles according to chapter 8 of the SN-Rule and to make the required emission measurements.

As test motor any 4-stroke-Diesel-engine without exhaust gas recirculation and without exhaust gas aftertreatment may be used. The test motor and the filter system to be tested must be matched so that at nominal operating conditions of the test motor the space velocity of the exhaust gases in the filter reaches the maximum value allowed by the filter manufacturer.

Schematic of test-bed setup and emission sampling



(2) Project to elaborate an ISO-standard on a testing procedure for exhaust particle filter systems for retrofit

History

In 2007 Switzerland has initiated a project to elaborate an ISO standard on a testing procedure for particle filter systems.

The Swiss proposal basically was accepted by ISO. It is dealt with in the ISO Technical committee 22, Subcommittee 5 (ISO/TC22/SC5).

The proposal has been further discussed and revised in an ISO/TC22/SC5 comments resolution meeting on May 15, 2008 in Paris.

Actual state

The revised proposal is described below. At present this proposal is out for voting. The deadline for voting is July 15, 2008.

Invitation to vote

According to the general rules of standard setting, everybody who is interested in a certain field of standardization may participate in the work or make comments.

Hence, all persons, institutions, enterprises, organizations and administrations who agree that such an ISO standard should be elaborated are kindly invited to contact their national standardization organization.

Make reference to document “ISO/TC22/SC5 N 1656” of May 16, 2008 and ask your national standardization organization to vote “YES” in order to elaborate such an ISO standard.

The **deadline** for the answer of the national standardization organizations to the competent ISO body (**ISO/TC22/SC5**) is **July 15, 2008**.

Moreover, manufacturers, users, test laboratories, universities, administrations and other bodies are kindly invited to **nominate experts** to participate in the elaboration of such an ISO standard. Please make nominations also via your national standardization organization before July 15, 2008.

Proposed ISO standard

Title

Diesel engines – Exhaust particle filter systems for retrofit - Testing procedure

Introduction

1. The test procedure serves to assess quality attributes of exhaust particle filter systems.
2. The new Swiss rule SNR 277205:2007 on “Testing Particle Filter systems” for IC engines could serve as a starting point, but of course has to be adapted to the following scope.

Scope

1. The aim is to specify a test procedure for exhaust particle filter systems for retrofitting to diesel engines.
2. The focus shall be on size specific separation characteristics for solid ultra fine particles

Note1: testing procedures of secondary emissions will only be informative

3. Exhaust particle filter systems in the sense of the standard are add-on components, intended for the retrofit of in-service diesel engines used in on-road heavy duty vehicles, non-road mobile machinery (NRMM), agricultural and forestry tractors and stationary applications.

Note2: Passengers cars, light duty application, original equipment and replacement components are excluded from this standard.

4. The outcome of the standardized testing procedure shall be technical characteristics of the exhaust particle filter system (e.g. filtration efficiency in percent).

Note3: The standard does not refer to the absolute emissions of engines or motor vehicles (e.g. in g/kWh).

Note4: The standard does not duplicate other existing international standards or regulations, but is complementary.

Note5: The standard is not in contradiction with existing UN/ECE and EU regulations.

5. This test procedure can be used for type-approval of exhaust particle filter systems but is not intended for conformity of production (COP) and in-use compliance (IUC) testing.



AFNOR

Par mandatement

BNA

Bureau de Normalisation de l'Automobile
79 rue Jean-Jacques Rousseau
92150 Suresnes France

ISO/TC22/SC5 N 1656 E/F

Direct dialling for Mr LEGRAND
Phone : 33.1.46.08.87.12
Fax : 33.1.46.08.17.10
e-mail : philippe.legrand@utac.com

Suresnes, le 16 May 2008

Sent to the Members of ISO/TC22/SC5

Subject: Follow-up of resolution n°704 and 692 – Result of the ISO/TC22/SC5 comments resolution meeting held in Suresnes on the 15th May 2008

Please find hereafter the result of the ISO/TC22/SC5 comments resolution meeting which had been called in application of resolution n°704 and 692 taken during the last ISO/TC22/SC5 meeting.

- **Regarding the follow-up of resolution n°704**, the actions to undertake are explained in resolution n°1 taken during the meeting.
- **Regarding the follow-up of resolution n°692**, resolutions n°2 to n°7 clarify the proposal made by the Swiss Committee Member and proposed improved title and scope reflected the intend of this proposal.

ISO/TC22/SC5 and ISO/TC70/SC8 members are requested to give answer to:

- Question n°1: Do you agree to develop an ISO standard on the basis resolutions n°2 to N°7

YES/NO

- Question n°2: If yes, do you intend to nominate experts to actively participate

YES/NO

Names of nominated experts:

...

...

...

- When voting proposed ideas on the request for guidance (see resolution n°7)

We thank you for your early reply. Unless we hear from you before the set deadline of the 15th July 2008, we will take it as a final approval and we will issue the resolution which will then be implemented and you will be notified accordingly.

In case of an explicit abstention, your response will remain and be counted as an abstention.

Thanking you for your kind attention,

Yours sincerely,

Philippe LEGRAND
ISO/TC22/SC5 Secretary

(Continuation of document ISO/TC22/SC5 N 1656 E/F)

Application of resolution SC5 n°704

Resolution n°1

The meeting agrees the ISO/TC22/SC5 chairman approaches the chair person of the informal group PMP of UN-ECE GRPE and asks him for guidance if the group PMP needs to elaborate an ISO standard based on DIS 15900 "Determination of Particle Size Distribution – Differential Electrical Mobility Analysis for Aerosol Particles".

If the need is approved, it shall be proposed to elaborate a specific standard applicable to the road vehicles. This standard would include the relevant points of DIS15900, and/or develop new specifications.

The ISO/TC22/SC5 secretary is asked to verify that road vehicles are excluded from the scope of DIS 15900

Application of resolution SC5 n°692

The meeting noted that Swiss delegates clarified that SNR 277205 is only submitted as a contribution and not a preliminary draft proposal.

Resolution n°2

All comments expressed during the NWIP voting period and after (USA new comments) has been reviewed. As a result of the discussion there is a unanimous agreement, including Swiss delegation, to clarify the title and the scope for this work item that would be submitted to ISO/TC22/SC5 and ISO/TC70/SC8 for ballot (see resolution n°7) by mid July.

Resolution n°3

The meeting agreed that at the contrary to the VERT Method, the standard will not include performance requirements.

Resolution n°4

The meeting agreed that the standard when approved will not be in conflict with existing ISO standards and UN regulations

Resolution n°5

Depending of the acceptance of TC22/SC5 and TC70/SC8, WP29 and/or GRPE will be informed by the Chairmen for information and guidance.

Resolution n°6

If approved, the work should be conducted in a joint ISO/TC22/SC5 – TC70/SC8 working group

Resolution n°7

In later stage other subcommittees interested will be invited to send experts when approved.

Resolution n°8

Title : Diesel engines – Exhaust particle filter systems for retrofit - Testing procedure

Introduction

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(Continuation of document ISO/TC22/SC5 N 1656 E/F)

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Request for guidance

In addition to the above proposed scope and according to resolution n°4, guidance from TC22/SC5 and TC70/SC8 members and/or UN-ECE is requested for:

- Definition of retrofit minimum mileage or running time of retrofitted vehicles or engines
- Secondary emissions according to the note in point 2 of the scope
- Precise applicable definition of heavy duty engines

Question to ISO/TC22/SC5 and ISO/TC70/SC8 and request for guidance

- Question n°1: Do you agree to develop an ISO standard on the above resolutions YES/NO
- Question n°2: If yes, do you intend to nominate experts to actively participate YES/NO
Names of nominative experts
- When voting proposed ideas on the above request for guidance
- Dead line for answer: 15 July 08 (see resolution n°1)