

Blue Angel

The German Ecolabel



Replacement Catalytic Converters

DE-UZ 184

Basic Award Criteria

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Version 1

The Environmental Label is supported by the following four institutions:



The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is the owner of the label. It regularly provides information on the decisions taken by the Environmental Label Jury.



The German Environmental Agency with its specialist department for "Ecodesign, Eco-Labeling and Environmentally friendly Procurement" acts as office of the Environmental Label Jury and develops the technical criteria of the Basic Criteria for Award of the Blue Angel.



The Environmental Label Jury is the independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.



RAL gGmbH is the awarding body for the Environmental Label. It organises the process for developing the relevant award criteria in independent expert hearings – which involve all relevant interest groups.

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This document is a translation of a German original. In case of dispute, the original document should be taken as authoritative.

1 Introduction

1.1 Preface

In cooperation with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the German Environmental Agency and considering the results of the expert hearings conducted by RAL gGmbH, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label. RAL gGmbH has been tasked with awarding the Environmental Label.

Upon application to RAL gGmbH and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH, the permission to use the Environmental Label may be granted to all products, provided that they comply with the requirements as specified hereinafter.

The product must comply with all the legal requirements in the country in which it is to be marketed. The applicant shall declare that the product meets this requirement.

1.2 Objectives of the Environmental Label

Catalytic converters are used to reduce harmful exhaust emissions from combustion engines in motor vehicles.

Relevant requirements for pollutant emissions are regulated in the exhaust emissions standard. Motor vehicles are divided here into pollutant classes (e.g. EURO 3 to 6) and limits have been defined for carbon monoxide (CO), nitrogen oxide (NO_x), hydrocarbons (HC) and particles (PM).

In the original installation, catalytic converters are factory fitted in order to guarantee observance of the emission limits for the relevant pollutant classes. However, these catalytic converters need to be replaced in the event of a defect. The Blue Angel can be issued to these replacement catalytic converters (Rep-Cat) if the products guarantee sufficiently low emissions and remain fully functional in the long term. Therefore, the Rep-Cats are subjected to an ageing process under defined loads. The artificially aged replacement catalytic converters are then subsequently tested. Alongside the measurement of emissions, the tests also include, amongst other things, a determination of the precious metals content.

Due to varying quality in the production process, regular monitoring of the products in the form of yearly follow-up tests is prescribed within the award process for the Blue Angel.

This is designed to signal to the end customer, specialist workshop or the trade that the products carrying this label reliably meet defined quality characteristics and also guarantee low emissions in the long term.

Synthetic mineral fibres (also known as Man Made Mineral Fibres) with biopersistent characteristics can be used in the production of support mats for catalytic converters. Therefore, the process for awarding the Blue Angel also prescribes criteria for the reduction of negative effects on health.

The Blue Angel Environmental Label for replacement catalytic converters may be awarded to products featuring the following environmental properties:

- Permanent reduction in emissions
- Annual follow-up tests
- No use of mineral fibres harmful to health

Therefore, the following benefits for the environment and health are stated in the explanatory box



2 Scope

These Basic Award Criteria are valid for replacement catalytic converters that are intended as separate technical units in accordance with ECE Regulation no. 103¹ for installation in vehicles.

In order to obtain the Environmental Label, combined systems comprising a pre-catalyst and post-catalyst are considered as a whole. In combined solutions, the entire exhaust gas treatment is contained in one component.

3 Requirements

If the vehicle has a catalytic converter close to the engine and an underbody catalytic converter, the underbody catalytic converter is not considered on its own due to its relatively low contribution to the exhaust gas conversion process. It is not possible to evaluate the effectiveness of the underbody catalytic converter because the catalytic converter close to the engine performs most of the conversion.

The Environmental Label illustrated on the first page may be used for labelling replacement catalytic converters, provided that the following requirements are complied with:

¹ <http://www.bmvbs.de/cae/servlet/contentblob/44946/publicationFile/41708/r-103-austausch-katalysatoren-pdf.pdf>

3.1 Reduction of emissions and durable functionality

The functionality of a replacement catalytic converter in terms of its reduction of pollutant emissions must be guaranteed during proper use. This also applies to combined components (e.g. catalytic converters close to the engine and underbody catalytic converters).

This requirement is evaluated using a test of the replacement catalytic converters based on the rules and regulations contained in the test process for the initial test in accordance with Appendix I, as well as the further requirements in accordance with Paragraph 4.

Compliance Verifications:

The applicant shall submit Annex 1 and the complete test report in accordance with the requirements in Paragraph 4. The tests must be documented in a technical report by the commissioned testing institution according to Paragraph 6, which verifies that the tested replacement catalytic converters (test samples) meet the requirements in the Basic Award Criteria.

3.2 Completion of follow-up tests

The applicant undertakes to ensure that yearly follow-up tests are carried out on those products labelled with the Environmental Label. For this purpose, the applicant will commission a testing institution according to Paragraph 6 to purchase the products on the market and test them. As part of the contract for the follow-up tests, the commissioned testing institution will propose three suitable item numbers (different catalytic converters) from which RAL will select one item number at random.

The test report will be sent to both the client and RAL at the same time.

The yearly follow-up tests must be carried out according to the test process defined in Appendix B in accordance with the requirements in Appendix E.

Compliance Verifications:

The tests must be documented in a technical report completed by the commissioned testing institution according to Paragraph 6, which verifies that the tested components meet the requirements in the relevant test specifications. The applicant shall submit the completed Annex 1 as verification.

If it is determined during a follow-up test that a component does not meet the requirements, the manufacturer must be informed immediately by the testing institution. A second identical test sample must then be purchased in accordance with the regulations in Paragraph 4.1, although from a different production batch. If this second sample also fails to meet the requirements, the rules stated in the Contract on the Use of the Environmental Label will be applied.

The reports required to verify the follow-up tests must be independently sent without request on a yearly basis from the year after the original award of the Blue Angel Environmental Label by December 31 each year to RAL gGmbH and at the same time to the applicant.

3.3 Synthetic mineral fibres (SMF) / High-temperature wools (HTW)²

Synthetic mineral fibres with biopersistent characteristics in respirable dimensions can be used in the production of support mats for catalytic converters. These synthetic mineral fibres with biopersistent characteristics in respirable dimensions may not be used.

The following requirements apply to ensure avoidance of any damaging effects to health.

3.3.1 Requirements for ceramic mineral fibres / mineral wools

Ceramic mineral fibres, i.e. glassy (silicate) fibres with a total alkali metal oxide and earth alkali metal oxide content ($\text{Na}_2\text{O} + \text{K}_2\text{O} + \text{CaO} + \text{MgO} + \text{BaO}$) of less than or equal to 18 percent by mass may not be used.

3.3.2 Requirements for high-temperature glass wools

Glass fibres designed for high-temperature applications such as high-temperature glass wools (AES wools, alkaline earth silicate wools)² must correspond to the requirements of the Hazardous Substance Ordinance (Annex II, Paragraph 5 "Biopersistent fibres")³ and the Chemicals Prohibition Ordinance (Annex to §1, Paragraph 23 "Biopersistent fibres")⁴.

The applicant shall submit a declaration of compliance with the requirements in 3.3.1 and 3.3.2 from the manufacturer or distributor of the support mats (Annex 3). The determination of the carcinogenicity index (CI) or the determination of the biopersistence must be carried out in accordance with TRGS 905⁵.

The manufacturer / distributor of the support mats shall provide information on the type and composition of the materials used (in accordance with TRGS 619, Paragraph 2, Definitions).

3.3.3 Requirements for mineral wools

If other mineral wools such as glass wool and rock wool are used, a test report verifying that the carcinogenicity index (CI) of the products concerned is ≥ 40 and, hence, the insulating materials used need not be classified as carcinogenic or suspected of causing cancer according to the current classification scheme of TRGS 905 must be submitted. In justified exceptional cases, a determination of the biopersistence can also be used.

Compliance Verifications

The applicant shall submit a measurement report from a testing institution accredited in accordance with DIN EN ISO/IEC 17025. The determination of the carcinogenicity index (CI) or the determination of the biopersistence shall be carried out in accordance with TRGS 905 on the basis of the measured values obtained in accordance with DIN 51001.

3.3.4 Requirements for products with non-respirable fibres

Independently of the requirements according to Paragraphs 3.3.1 to 3.3.3, other products made out of synthetic mineral fibres can also be used if their respirable fraction is negligible. This is the case when not more than 0.1 percent by mass of the contained fibres (relating to

² Technical Rules for Hazardous Substances (TRGS) 619 "Substitution for products made out of aluminium silicate wool" in the currently valid version, last amended in February 2007.

³ Hazardous Substance Ordinance from 26 November 2010 (BGBl. I, No. 59, Page 1643), last amended by Article 2 of the law from 28 July 2011 (BGBl. I, No. 41, Page 1622).

⁴ Chemicals Prohibition Ordinance from 13 June 2003 (BGBl. I, No. 26, Page 867), last amended by Article 5 Paragraph 40 of the law from 24 February 2012 (BGBl. I, No. 10, Page 212).

⁵ Technical Rules for Hazardous Substances (TRGS) 905 "Directory of carcinogenic and mutagenic substances and substances toxic to reproduction" in the currently valid version, last amended and updated in May 2008.

the support mat or the product) exhibit measurements based on the WHO definition (fibre diameter < 3 µm, fibre length > 5 µm, ratio of fibre length to fibre diameter larger than 3:1).

Compliance Verifications

The applicant shall submit a declaration of compliance with the requirements in 3.3.4 from the manufacturer or distributor of the product made out of synthetic mineral fibres.

The manufacturer / distributor of the products made out of synthetic mineral fibres shall provide information on the type and composition of the materials used (in accordance with TRGS 619, Paragraph 2, Definitions). (Annex 3).

4 Tests

4.1 Formation of system families

A prerequisite for the testing of the products is the formation of a system family.

A system family is limited to a working process (diesel / spark ignition engine) and a fuel type (petrol / diesel).

The description of the technical framework conditions for a system family is based on the information document in Appendix F. The information document must be provided to the testing institution according to Paragraph 6 by the applicant and added to the test report. The scope of the system family is thus technically defined.

A system family can cover any number of types of catalytic converter (definition according to ECE R.103, Point 2.4) from the manufacturer's product range. It is formed from the system limits of the CAT application on vehicles with the smallest and largest power output from the field of application according to Appendix C. The field of application for the replacement catalytic converters in the tested system family must be listed by the applicant in accordance with Appendix C.

Two complete tests according to Paragraph 4.4 carried out for two types of catalytic converter based on the field of application (Appendix C) that are freely selected by the testing institution according to Paragraph 6 make it possible to cover up to 50 types of catalytic converter (definition according to ECE R.103, Point 2.4) from a system family. The measurements must be carried out here on replacement catalytic converters that are designed for different types of vehicles. A further test in accordance with Paragraph 4.4 is required for every additional 50 types of catalytic converter per system family.

4.2 Selection of the test vehicles

The vehicles selected for the tests must correspond to the intended future field of application for the component, whereby one vehicle from both the lowest and highest power output range must be selected.

The test vehicles should be selected so that the component being tested (two stage or combined system) can be directly installed without making any technical modifications. The commissioned testing institution must ensure that the worst case vehicle is selected in each case based on their best technical judgement.

The reference mass of the test vehicle must be determined according to relevantly valid ECE regulation for replacement catalytic converters and the corresponding vibration mass setting must be made for the measurements.

4.3 Fuel quality

The applicable measurements for testing the replacement catalytic converter must be carried out with a commercially available fuel suitable for the vehicle in accordance with Directive 98/70/EC in its currently valid version.

4.4 Test process for the initial test

The measurements are each carried out on two vehicles per type of catalytic converter in accordance with emissions class Euro 4 based on ECE R 83 (Amendment point 5.3.1.4, Approval B) and these measurements are also to be viewed as representative of the emissions classes up to Euro 3 according to ECE R 83 in its relevant series of amendments. In the case of catalytic converters whose field of application does not include Euro 4 vehicles, the next highest emissions class in the field of application must be selected for the test. In the case of emission classes Euro 5 and 6, separate tests are required that do not cover classes Euro 1 to 4. The test process for all emission classes is carried out in accordance with the regulations in Appendix A.

The required test samples must be purchased anonymously from the retail trade by the commissioned testing institution according to Paragraph 6. In justified exceptional cases, the testing institution according to Paragraph 6 is authorised to freely select test samples directly from the manufacturer's production process. 1-2 test samples are required for each test vehicle:

- For the emission measurements and evaluation of the new Rep-Cat
- For the ageing process with subsequent emission measurements and OBD test
- For the determination of the precious metals content and the geometric component measurements

It is necessary to firstly complete the whole test process including the emission measurements according to the relevantly valid ECE Regulation for replacement catalytic converters in its currently valid version before assessing the test sample/component. Passenger cars from pollutant classes Euro 6c/d upwards must be measured in accordance with the test criteria in the WLTC testing cycle.

In addition, the test sample/component must be aged in accordance with the requirements in Paragraph 4.4.1. Afterwards, the replacement catalytic converter must be tested again in accordance with the requirements in the relevantly valid ECE regulation for replacement catalytic converters or in accordance with the WLTC. Following the ageing process, the component must correspond to the limit values in the relevant thresholds for the test vehicle in accordance with the relevantly valid ECE Regulation.

Furthermore, a geometric component measurement and an evaluation of the relevant parts in the replacement catalytic converter in accordance with Paragraph 4.4.2, as well as a quantitative determination of the precious metals content (platinum, rhodium, palladium) of the catalyst support according to Paragraph 4.4.3 must be carried out.

4.4.1 Ageing process

The ageing process is carried out on a product sample procured in accordance with Paragraph 4.1. The product sample must be aged in accordance with the process description in Appendix D.

4.4.2 Geometric component measurement

The geometric component measurement is carried out on a test sample procured according to Paragraph 4.1 and compared to the given weights and dimensions from the information document (Appendix F). If deviations above the given tolerances provided by the applicant are detected, another test sample can be procured according to Paragraph 4.1, although from a different production batch, and the geometric component measurement carried out again. If deviations are once again detected, the test is cancelled and the requirement is classed as being not fulfilled.

In justified exceptional cases, the testing institution according to Paragraph 6 is authorised to freely select test samples directly from the manufacturer's production process.

4.4.3 Precious metals content of platinum, palladium and rhodium

The test for the content of platinum, palladium and rhodium is carried out in accordance with the process described in Appendix E [1] on a test sample procured according to Paragraph 4.1 and is then compared to the information provided by the manufacturer.

The quantitative determination of the precious metals content is only to be carried out on the first system family included in the application for the Environmental Label. In the event of the system family being extended to encompass over 50 types of catalytic converters, the test will only be carried out as part of the requirement to complete follow-up tests.

4.4.4 OBD requirements

The component aged according to Paragraph 4.4.1 must be subjected to a complete OBD test according to Annex 11 of ECE R 83 in its currently valid version on a test vehicle suitable for the field of application of the catalytic converter. The OBD system in the vehicle must not detect any faults, initiate any fault responses or store/save any faults caused by the component during this test.

If there is no OBD system, the test is not required.

5 Changing the system family for an existing contract

The user of the label can apply to change the field of application for a system family already awarded the Environmental Label. This process requires the submission of a technical report from the commissioned testing institution according to Paragraph 6 that describes this change. Changes that affect the description and functionality of the system family awarded the Environmental Label must be immediately shown to RAL gGmbH without request and updated in the existing field of application according to Appendix C as an amendment.

6 Testing institutions

The approval for testing institutions to carry out the initial test and all follow-up tests with the exception of the precious metals analysis is based on the following criteria:

[1] Testing institutions named by the Federal Motor Transport Authority (KBA) are approved to carry out the measurements according to EC Regulation 715/2007. The approved testing

institutions are published on the internet at www.kba.de in the section Vehicle Technology / Type Approvals / Designated Technical Services / Testing of Product Characteristics / Correlation of Technical Service and EU Directive/Regulation in the section "Regulation (EC) 715/2007 (incl. Regulation (EC) 692/2008 Annex III-VIII, X-XII (emission of vehicles))".

[2]The testing institutions approved according to Paragraph 6.1 must be able to present statistically verified evaluations from the emissions test results. Verification is provided in the form of a report containing a summary and statistical evaluation of all of the recorded emissions test results (tables, graphical representation and key figures).

[3]The testing institutions approved according to Paragraph 6.1 must be capable of carrying out the required measurements for the oven ageing (according to Appendix D) and the vibration test (according to Appendix E [2]). Verification must be provided in the form of references. For this purpose, the testing institution must submit 3 test reports for each test.

The testing institution will apply for approval from RAL based on the required references and technical reports. RAL may involve the Federal Environment Agency in the process at its own discretion.

The approved testing institutions are published in Appendix H of the Basic Award Criteria.

7 Applicants and Parties Involved

Manufacturers or distributors of products according to Paragraph 2 shall be eligible for application.

Parties involved in the award process are:

- RAL gGmbH to award the Blue Angel Environmental Label,
- the federal state being home to the applicant's production site, Umweltbundesamt (German Environmental Agency) which after the signing of the contract receives all data and documents submitted in applications for the Blue Angel in order to be able to further develop the Basic Award Criteria.

8 Use of the Environmental Label

The use of the Environmental Label by the applicant is governed by a contract on the use of the Environmental Label concluded with RAL gGmbH.

Within the scope of such contract, the applicant undertakes to comply with the requirements under Paragraph 3 while using the Environmental Label.

Contracts on the Use of the Environmental Label are concluded to fix the terms for the certification of products under Paragraph 2. Such contracts shall run until December 31, 2023. They shall be extended by periods of one year each, unless terminated in writing by March 31, 2023 or March 31 of the respective year of extension.

After the expiry of the contract, the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

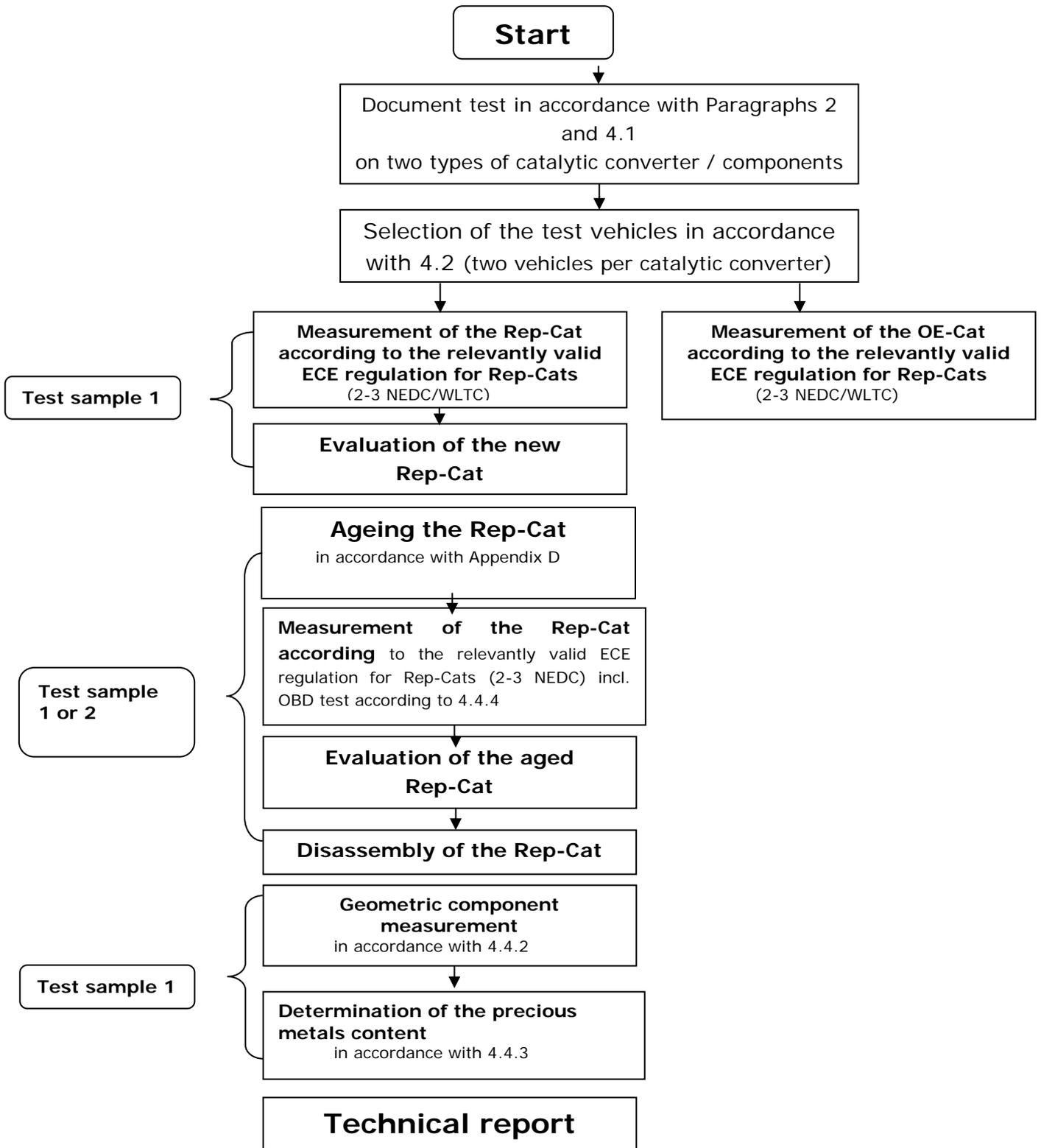
The applicant (manufacturer) shall be entitled to apply to RAL gGmbH for an extension of the right to use the ecolabel on the product entitled to the label if it is to be marketed under another brand/trade name and/or other marketing organisations.

The Contract on the Use of the Environmental Label shall specify:

- Applicant (manufacturer/distributor)
- Brand/trade name, product description
- Distributor (label user), i.e. the above-mentioned marketing organisations.

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Appendix A Test process for the initial test according to Paragraph 4.4



2. Additional remarks on the testing process

A. Document testing

- System family criteria
- Selection of the test vehicles.
- Inspection of the existing ECE regulation approvals

B. Selection of the types of catalytic converter to be tested

- The types of catalytic converter to be tested are to be freely selected by the testing institution

C. Selection of the test vehicles

- "Worst case" vehicles, from the lowest and highest power output range in each case.
- Vehicles selected in accordance with 4.1 of the test process.
- If the field of application includes both vehicles with multiple catalytic converters connected in parallel and also vehicles with just one Cat, at least one vehicle fitted with just one Cat must be measured.

D. Measurement of the replacement catalytic converter⁶ according to ECE R.103 (2-3 NEDC)

- In the event of deviations on two successive NEDC $\leq 15\%$, it is not necessary to carry out a third NEDC.

E. Measurement of the OE catalytic converter according to ECE R.103 (2-3 NEDC)

- In the event of deviations on two successive NEDC $\leq 15\%$, it is not necessary to carry out a third NEDC

F. Evaluation of the new replacement catalytic converter

- $M \leq 0.85 S + 0.4 G$
- $M \leq G$
- M = Average value from three measurements with the replacement catalytic converter
- S = Average value from three measurements with the OE catalytic converter
- If the OE catalytic converter is no longer available on the free market, the average value for the OE catalytic converter can also be taken from the original approval according to ECE R.83.
- G = Limit value for the relevant Euro class incl. the deterioration factor
-

G. Ageing of the replacement catalytic converter

- Hydrothermal ageing of the replacement catalytic converter according to Appendix E

H. Measurement of the replacement catalytic converter according to ECE R.103 (2-3 NEDC)

⁶ Purchased from the independent parts trade.

- In the event of deviations on two successive NEDC $\leq 15\%$, it is not necessary to carry out a third NEDC

I. Evaluation of the aged replacement catalytic converter

- $M \leq G$
- M = Average value from (two) three measurements with the replacement catalytic converter
- G = Limit value for the relevant Euro class
- OBD test according to Paragraph 4.4.4. of DE-UZ184

J. Disassembly of the replacement catalytic converter

- Disassembly of the catalytic converter and removal of the catalyst.

K. Measurement of the catalyst support

- Measurements of length and diameter, determination of the volume and number of cells; comparison with the information provided by the manufacturer.

L. Analysis of the catalyst support

- Quantitative determination of the precious metals content and the ratio of precious metals; comparison with the information provided by the manufacturer.

Appendix B Test process for the follow-up tests according to Paragraph 3.2

1st year after application	Determination of the precious metals content in accordance with Appendix E [1]
2nd year after application	Ageing in accordance with Appendix D and measurement of the aged component in accordance with Appendix E, Item 4
3rd year after application	Test of the design layout in accordance with Appendix E [3]
4th year after application	Vibration test in accordance with Appendix E [2] ⁷
5th year after application	Repeat initial test in accordance with Appendix A

⁷ A vibration test is not required for Cats with metal carriers

Appendix C Field of application for the products in a system family according to Paragraph 4.1

Sequential number	Vehicle manufacturer	Vehicle type	Trade name	Year of manufacture from/to	Engine type	Displacement (cm ³)	Nominal output kW	Number of the valid ECE approval	Emissions class / Euro code	Type of component (single Cat or combination)	Type description of the Rep-Cat / system family	Part number of the Rep-Cat
1												
2												
3												
4												
5												
...												

Appendix D Ageing process for the initial test according to Paragraph 4.4.1

1 General

The ageing process must be carried out under hydrothermal conditions in an oxidizing atmosphere in a suitable oven. The ageing is carried out on the substrate in its original size without canning.

If the substrate displays mechanical damage after disassembly yet the component integrity is still guaranteed then the test can be continued.

If the component integrity is not met, the test can be continued on another product sample / replacement catalytic converter procured according to Paragraph 4.1 of the Basic Award Criteria, although from another source. This test sample is to be conditioned in accordance with the requirements in the test process. If component integrity is once again not met after disassembly, the test is abandoned.

2 Ageing process

2.1 Oven

The heat-up rate of the oven must be at least 4K/min.

2.2 Hold time and ageing temperature

The hold time and the ageing temperature are for:

- Three-way catalytic converters: 4 hours at $980^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- Diesel oxidation catalytic converters:
 - up to emissions class Euro 3
 - (see 4.1 test process): 16 hours at $640^{\circ}\text{C} \pm 10^{\circ}\text{C}$
 - from emissions class Euro 4
 - (see 4.1 test process): 16 hours at $750^{\circ}\text{C} \pm 10^{\circ}\text{C}$

2.3 Hydrothermal conditions

In the hydrothermal ageing process, a gas consisting of the following is sent through the component:

- > 2 % oxygen,
- 10 % water,
- remaining part

nitrogen. The flow rate through the component must be at least 300 litres/hour while observing the requirements according to Paragraph 2.2. The gas dosage starts at the beginning of the heating period and ends at the conclusion of the hold time. The water dosage begins at 200°C and ends at the conclusion of the hold time.

2.4 Renewed canning

After the ageing process, the substrate is packaged again according to the instructions of the manufacturer.

This is carried out by the applicant in the presence of the testing institution.

2.5 Labelling

The substrate must be clearly and permanently labelled on the frontal area at the start of the ageing process and marked as a test sample.

Appendix E Follow-up tests according to Paragraph 3.2

[1]Determining the precious metals content of platinum, palladium and rhodium

Selection of the catalysts for determining the precious metals content

The selection of the components to be tested is carried out randomly by RAL on the basis of three proposals made by the exhaust gas testing institution (see Paragraph 3.2). The catalytic converters to be tested must be purchased from the independent parts trade.

Quantitative determination of the precious metals content

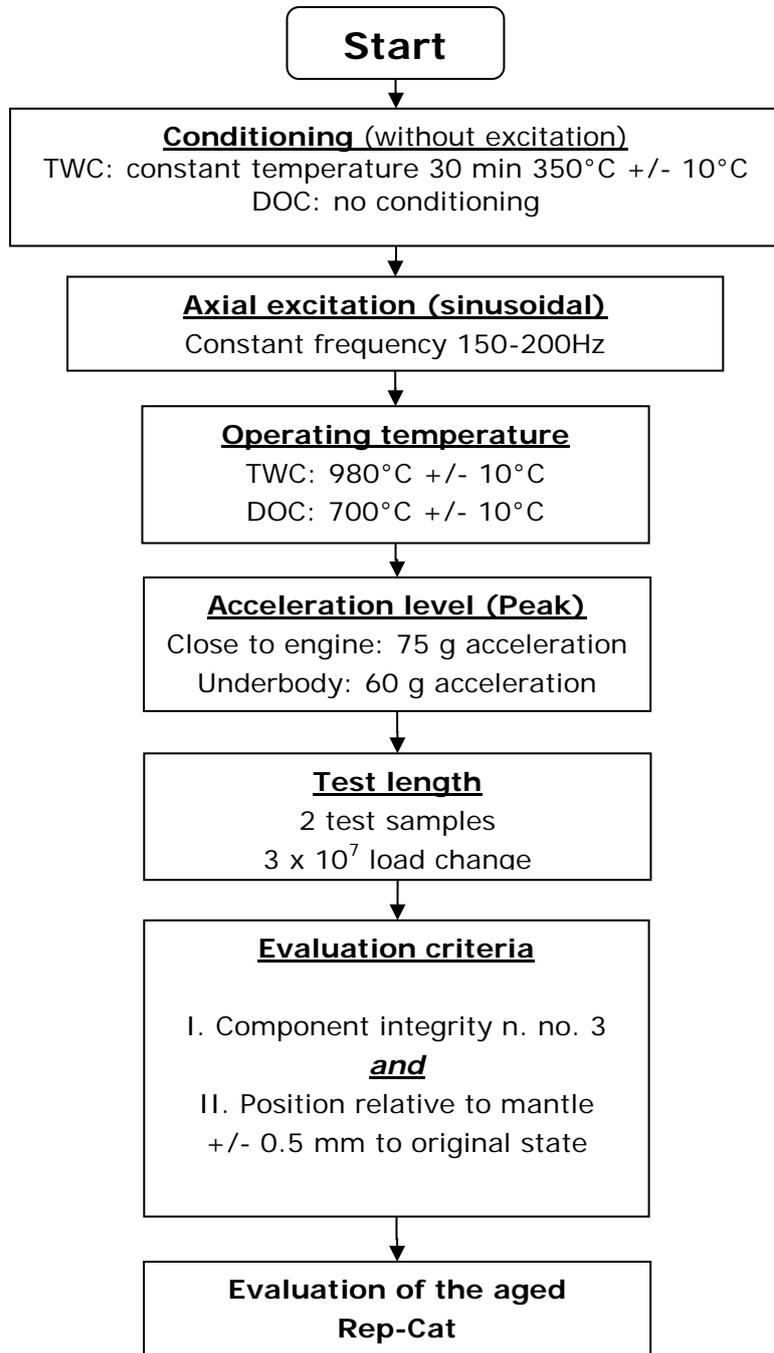
In the determination of the precious metals content of platinum, palladium and rhodium, the analytical method focuses on the material used for the catalyst support.

- **Ceramic monolith catalytic converters**
- The quantitative analysis of platinum (Pt), palladium (Pd) and rhodium (Rh) is carried out using the X-ray fluorescence method (XRF) or the ICP method (Inductively Coupled Plasma). A sufficiently large catalyst sample is crushed and homogenised for this process. The preparation of the samples is carried out according to the guidelines and regulations for the selected process.
- The determination of the precious metals content can be carried out on the basis of calibration curves that have been set up based on the known contents of standard samples. This enables interference with promoters and other non-precious metal elements to be taken into account when using the measurement technology.
- As an alternative to the process using calibration curves, a wet chemistry separation process can be carried out and a suitable collection / extraction process (e.g. Cu collection melting process) completed.

- **Metal monolith catalytic converters**
- The XRF method is not available for catalytic converters on metal monoliths.
- There are two possible processes available.
 - ♦ **Dissolving the washcoat from the metal matrix**
 - ♦ The metal monolith is coarsely ground and milled. A mechanical process is used to dissolve the washcoat from the metal foil. The washcoat is then separated without loss from the metal part of the ground material. The precious metals content of the separated washcoat can then be determined as described in 1.2.
 - ♦ **Wet chemical analysis**
 - ♦ In the wet chemical determination of the precious metals content, the complete metal support is dissolved in acid (aqua regia). The precious metals are then separated from the solution using suitable extraction processes.
 - ♦ The quantitative determination is then carried out using atom absorption spectroscopy (AAS) or the ICP method (Inductively Coupled Plasma).

Testing institutions must be certified according to DIN EN 17025 for precious metals analysis, possess the described analysis methods and have already used them on catalytic converters for vehicles. At least 3 references must be submitted for this purpose.

[2]Vibration test - overview of the test process



All temperatures are given as an average before / after substrate.

The vibration test is carried out on a complete catalytic converter (coated substrate plus canning) incl. cones but without piping. All test samples are to be concentrically mounted. The selection of the catalytic converters to be tested is carried out randomly by the testing institution. The catalytic converters to be tested must be purchased from the independent parts trade.

[3]Testing the design build of the replacement parts

The selection of the catalytic converters to be tested is carried out randomly by the testing institution. The catalytic converters to be tested must be purchased from the independent parts trade.

The applicant must verify using suitable documentation (technical drawings, etc.) that the air flow distortion and all probes correspond to the replaced OEM part.

In the case of replacement catalytic converters whose air flow distortion and all probes do not correspond to the OEM part, a CFD simulation needs to be carried out and submitted.

[4]Ageing process for the follow-up tests

The selection of the catalytic converters to be tested is carried out randomly by the testing institution. The catalytic converters to be tested must be purchased from the independent parts trade.

The ageing process described in Appendix D is used for the follow-up tests just like in the initial test.

Evaluation criteria:

Once the new measurements have been completed, the aged replacement catalytic converter must correspond to the limit values for the relevant thresholds for the test vehicle in accordance with ECE Regulation 83.

[5]Repeat tests

The repeat tests comprise the complete test process in accordance with the process for the initial test described in Appendix A on one type of catalytic converter for the field of application.

Appendix F Information document

If drawings are enclosed, these must be in A4 format or folded to this format and contain sufficient detail at a suitable scale.

If photographs are enclosed, these must contain sufficient detail.

If the systems, components or separate technical units feature electronically controlled functions, information on their performance characteristics must be provided.

1. General

- 1.1 Brand name (trade mark of the manufacturer):
- 1.2 Type:
- 1.3 Name and address of manufacturer:
- 1.4 For components and separate technical units, attachment location and the type of attachment for the ECE type approval symbol and the attachment of the Environmental Label:
- 1.5 Address(es) of the production location(s):

2 DESCRIPTION OF THE REPLACEMENT CATALYTIC CONVERTER SYSTEM

- 2.1 Brand name and type of replacement catalytic converter:
- 2.2 Drawings of the replacement catalytic converter identifying in particular all the characteristics referred to in Points 2.3 to 2.3.2 of this appendix:
- 2.3 Description of the vehicle type(s) for which the replacement catalytic converter is intended (see Appendix D)
 - 2.3.1 Number(s) and/or symbols characterizing the engine and vehicle type(s):
- 2.4 Description and drawings showing the position of the replacement catalytic converter relative to the engine exhaust manifold(s):

3 DESCRIPTION OF THE TYPE OF CATALYTIC CONVERTER

- 3.1 Precious metal load per type of catalytic converter $\pm 15\%$ (g/ft³ and g/l)
(all tolerances occurring are contained in this value)
- 3.2 Precious metal ratio per type of catalytic converter
- 3.3 Zone coating (Yes/No; Zones, Coating etc.)
- 3.4 Storage / mounting of the substrate
- 3.5 Canning (material, support mats etc.)
- 3.6 Weights and dimensions
 - 3.6.1 Weights and dimensions of the substrate
(cell thickness / material thickness / ratio of frontal area to length of the substrate / oval, round)
 - 3.6.2 Weights and dimensions of the canning (with cones without piping)

Appendix G List of abbreviations

AAS	Atom absorption spectroscopy
Rep-Cat	Replacement catalytic converter
°C	Degrees Celsius
CFD	Computational Fluid Dynamics
COP	Certificate of Production
DIN	German Institute for Standardisation
DOC	Diesel oxidation catalytic converter
ECE	Economic Commission for Europe of the United Nations
EC	European Community
EN	European standard
ft ³	Cubic foot
g	Gram
g-Accel	g-Acceleration (9.81 m/s ²)
Hz	Hertz
ICP	Inductively Coupled Plasma
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
K	Kelvin
Cat	Catalytic converter
kg	Kilogram
l	Litres
M1	Vehicle designed and built for transporting passengers with a maximum of eight seats excluding the driver's seat.
min	Minutes
mm	Millimetres
N1	Vehicle designed and built for transporting goods with a total permissible mass of up to 3.5 tonnes.
NEDC	New European Driving Cycle
OBD	On Board Diagnostics
OE	Original Equipment
OEM	Original Equipment Manufacturer
XRFA	X-ray fluorescence analysis
TWC	Three-Way Catalytic Converter
WLTC	Worldwide Harmonized Light-Duty Vehicle Test Procedure

Terms and definitions

The required terms are to be taken from the above named ECE Regulation 103 in the currently valid version. The following terms are also valid:

- "*Field of application*": describes the vehicle versions for which the replacement catalytic converter or the system family is intended.
- "*System family*": describes a range of replacement catalytic converter products from an applicant for which the Environmental Label can be applied.
- "*Substrate*": describes the support structure for the active catalytic material.
- "*Component integrity*": describes the full functionality of the components after the macroscopic structural changes caused during operation. This includes component cracks, cell deformations and clogged cells.
- **Component**: A catalytic converter system that is purchased from the independent parts trade as a ready-to-install element. This can consist of one or more types of catalytic converter that in turn contain one or more carrier substrates.

Appendix H Approval of testing institutions

The criteria according to Paragraph 6 of DE-UZ 184 are used as the basis for evaluating and approving testing institutions.

The following testing institutions are approved:

- TÜV NORD Mobilität GmbH & Co. KG IFM - Institute for Vehicle Technology and Mobility
Mail: rjohannsen@tuev-nord.de
- TÜV SÜD Auto Service GmbH
Mail: Abgaslabor@tuev-sued.de
- FAKT-GmbH Kraftfahrtechnisches Prüf- und Ingenieurzentrum
Mail: sgebauer@fakt.com