

Regulation No. 103 - Uniform provisions concerning the approval of replacement pollution control devices for power-driven vehicles

I. (Legal) State of Play

Regulation No. 103 applies to the approval of pollution control devices to be fitted in one or more types of motor vehicles of categories covered by the scope of the related version of Regulation No. 83 as replacement parts. Catalytic converters and particulate filters are considered to be pollution control devices for the purposes of Regulation No. 103.

The replacement pollution control device shall be designed, constructed and mounted so as to enable the vehicle to comply with the provisions of those Regulations which it was originally in compliance with. Pollutant emissions shall be effectively limited throughout the normal life of the vehicle under normal conditions of use. Therefore Regulation No. 103 foresees general durability requirements while mainly referencing to the requirements of Regulation No. 83 but no mandatory durability testing or follow-up testing (as for in-service conformity or in-use compliance) is foreseen.

II. Recent findings and developments

Findings of a study undertaken by Germany (Report is expected to be published 1st semester 2014, extracted results see in *Annex*) on the durability of replacement catalytic converters show that the performance of catalytic converters currently available on the market can vary to a high extent. Besides quite well performing catalytic converters currently also less performing and less durable systems could generally be placed on the market under the legal regime of Regulation No. 103. As catalytic converters are used to reduce harmful exhaust emissions the emission behavior of the vehicle would be negatively affected in case insufficiently performing catalytic converters were used. This should therefore be avoided by appropriate legal requirements.

In Germany recently a “Blue Angel Eco Label” for catalytic converters as replacement parts (RAL-UZ 184, Replacement Catalytic Converters, see under: http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=281) was published. The Blue Angel is an environment-related label for products and services, which can be applied by manufactures - on a voluntary basis - to mark their products as notably environmental friendly. The Blue Angel for catalytic converters comprises dedicated requirements to award the Environmental Label which are based on but going beyond current requirements of Regulation No. 103. This is to ensure that the systems guarantee sufficiently low emissions and remain fully functional also in the long term. The process to develop the Environmental Label showed that there is interest also on manufacturer side to improve the current legal framework and this way to create a level playing field.

III. Conclusions

Based on these findings Germany considers a further improvement of Regulation No. 103 to be necessary. Therefore e.g. the following issues should be investigated:

- Introduction of robust and mandatory durability testing procedures,
- Introduction of (additional) testing reflecting mechanical and chemical aging,
- Introduction/strengthening of the surveillance regime for replacement pollution control devices being placed on the market,
- Improvement of requirements ensuring durable and full functioning of the original OBD monitoring system,
- Inclusion of other pollution control devices like e.g. EGR, SCR, LNT.

To achieve above mentioned targets recent

- developments on UNECE level as the new “Regulation on uniform provisions concerning the approval of Retrofit Emission Control Devices (REC) for heavy duty vehicles, agricultural and forestry tractors and non-road mobile machinery equipped with compression ignition engines”
- improvements/activities on regional level as e.g. EU activities on Euro VI replacement control devices
- national developments as e.g. the German “Blue Angel Eco Label” for catalytic converters

should also be taken into account.

IV. Guidance from GRPE

Germany would highly welcome guidance and support from GRPE especially on whether

- Regulation No. 103 should be supplemented and further improved to improve durability and emission performance of Regulation No. 103 approved systems?
 - Whether a GRPE informal working group should be established to investigate possible improvements and work out a proposal to amend Regulation No. 103?

Annex

Joint study of the German Ministries of Transport and Environment on long-term emission performance of replacement catalytic converters

I. Scope and general approach

The general scope of the corresponding part of the German research project was to examine the long-term emission performance of replacement catalytic converters. The other part of the study examined the exhaust emission behavior of passenger and light commercial vehicles in operation.

With further developed emission standards for vehicles the usage of after-treatment pollution control devices became more and more mandatory. Elementary part of the emissions after-treatment system for both diesel and gasoline vehicles is the catalytic converter. In case of damage or insufficient reduction performance of the catalytic converter the systems need to be replaced. To effectively limit the emissions of the vehicle after the replacement of the OEM pollution control devices also the replacement systems have to be designed, constructed and mounted appropriately.

Due to the unavailability of robust data on sales numbers and market shares of catalytic converters in Germany in the above mentioned study assumptions were made on the current market situation for replacement systems. Based on this one OEM replacement catalytic converter and four Regulation No. 103 approved replacement catalytic converters from different manufacturers for the same test vehicle were chosen for testing. The systems were chosen while mainly aiming at covering the price range of the after-treatment market as far as possible.

The catalytic converters were tested as follows:

First the test vehicle (Volkswagen Golf IV, Euro 4, Engine type BCA, positive ignition, 55 kW, first registration 27th November 2002) was equipped with a new OEM replacement catalyst and pre-conditioned (de-greened) with 12 extra-urban driving cycles (EUDC). Before testing also the vehicle was pre-conditioned in accordance with Regulation No. 103. Three type I tests were carried out. In accordance with Regulation No. 103 the evaluated emission result had to be below the emission limits to fulfil the requirements.

Then the replacement catalysts were mounted to the test vehicle and correspondingly pre-conditioned. Then the systems were tested as described above. To achieve the next step in the aging procedure the emission results (including DF) had to be below the corresponding emission limits. One examined catalytic converters of the study could not fulfil this basic set of requirements (see Figure 6).

Instead of the mainly used “mathematical procedures” of Regulation No. 103 (using fixed DFs) a “physical aging procedure” based on the procedures of Regulation No. 83 was used in the study to examine the long-term emission behavior of the catalytic converters:

- The catalytic converters were aged using burner generated exhaust gas to simulate a driven distance of up to 80.000 km.
- The aging of the catalytic converters was done using the Standard Bench Cycle¹.

¹ EPA developed the Standard Road Cycle (EPA SRC: 40 CFR Part 86, Appendix V) and the Standard Bench Cycle (EPA SBC: 40 CFR Part 86, Appendix VII and Appendix VIII) to provide a universal road/bench aging cycle. These cycles are available to all manufacturers for purposes of demonstrating durability.

- The aging was interrupted at 10.000 km and 40.000 km simulated driving distance for additional measurement of exhaust emissions.
- The investigation of a catalytic converter was concluded in case the measured exhaust emissions exceeded an emission limit at a certain distance.
- After 80.000 km the fully aged catalytic converter was tested.

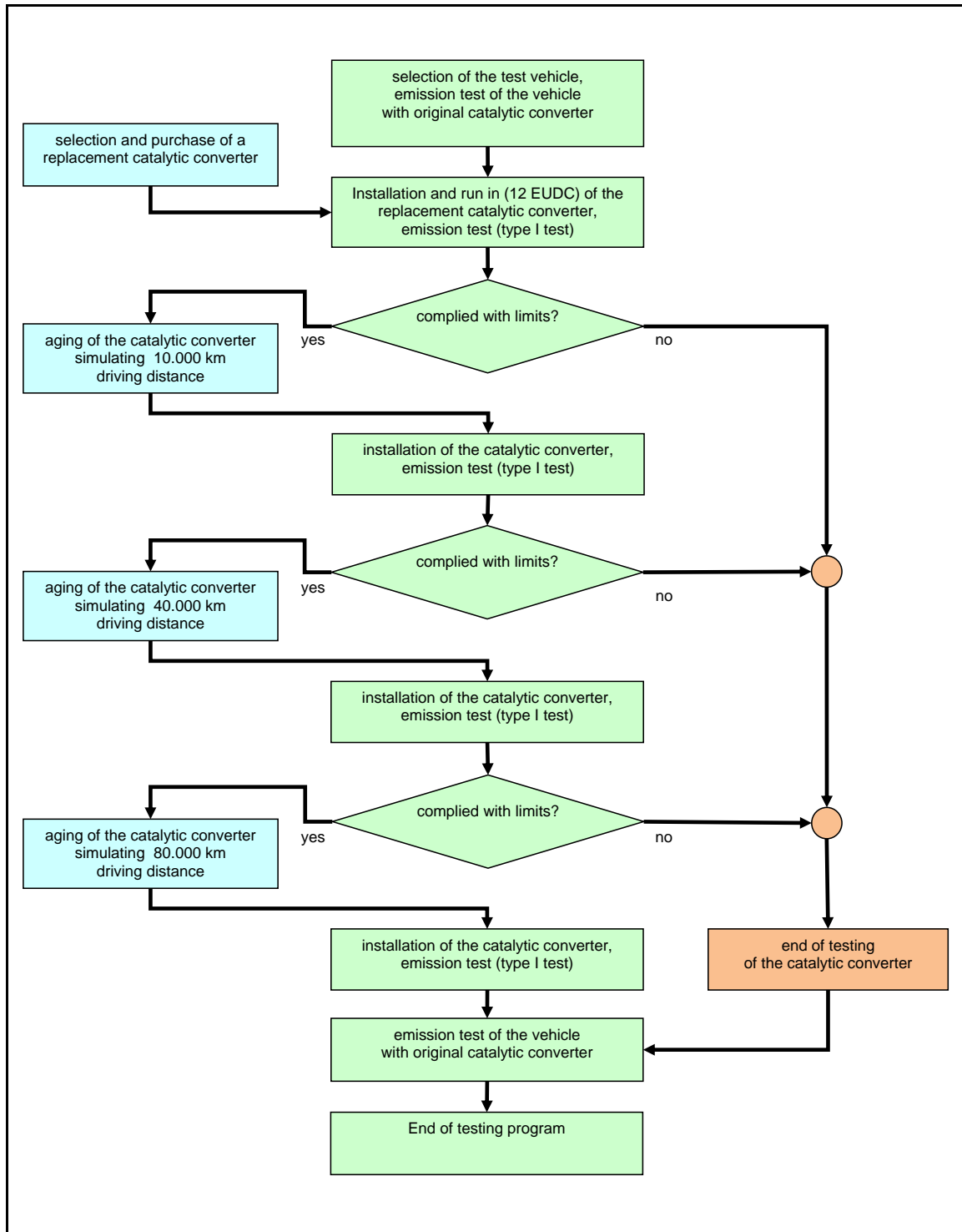


Figure 1: Testing and aging procedure

II. Results

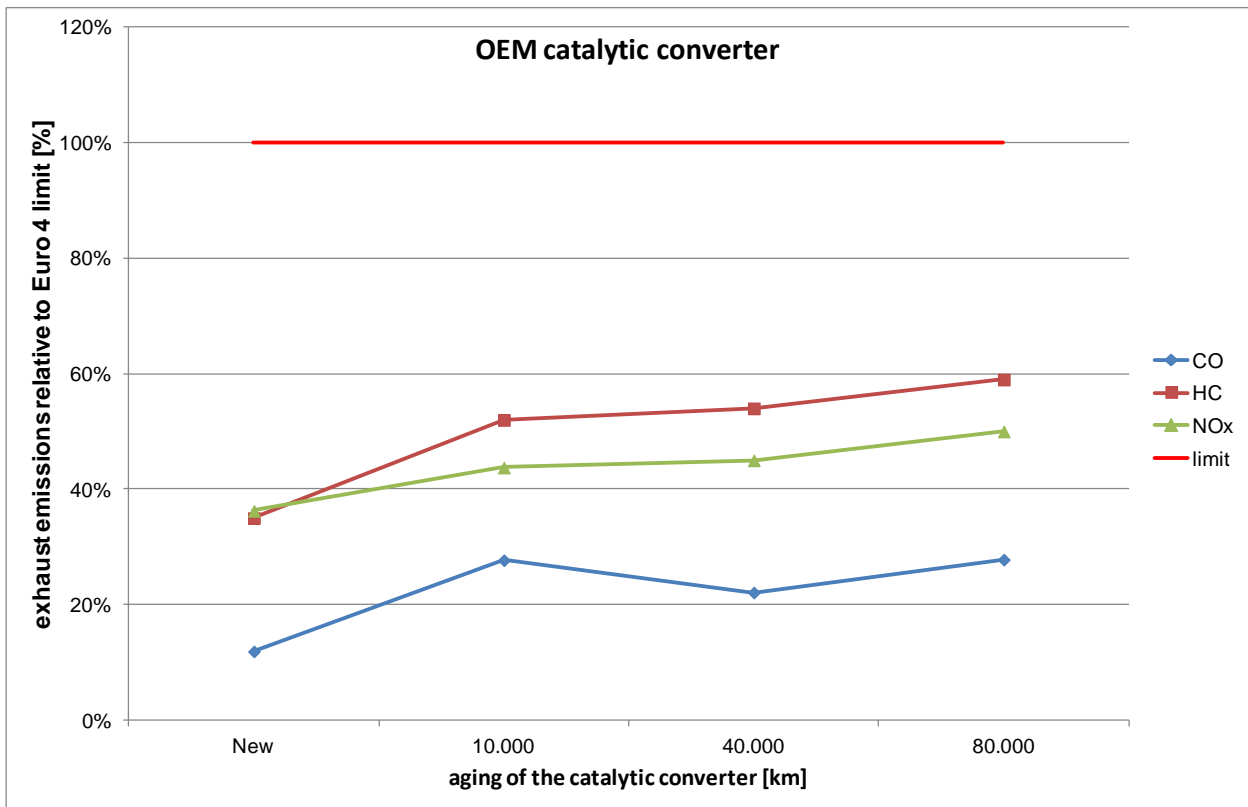


Figure 2: Exhaust emissions with OEM replacement catalytic converter relative to Euro 4 limits

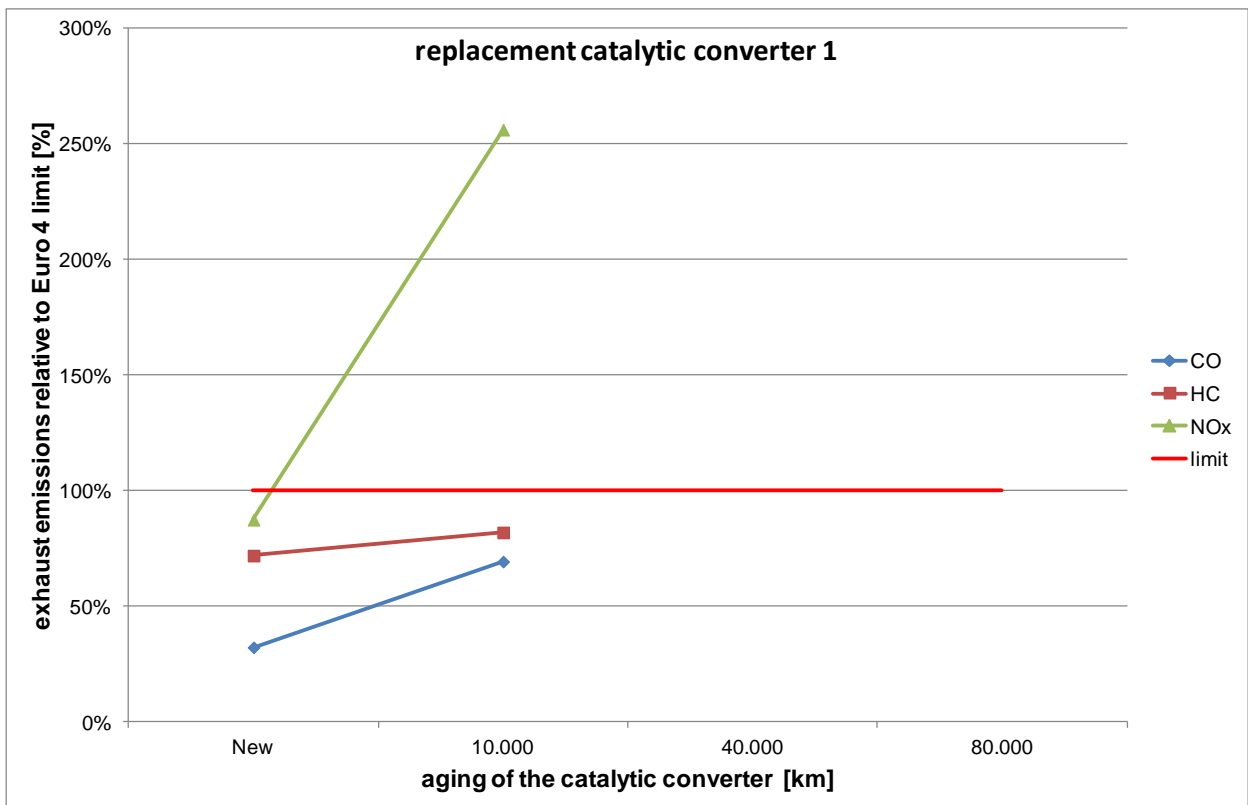


Figure 3: Exhaust emissions with replacement catalytic converter "1" relative to Euro 4 limits

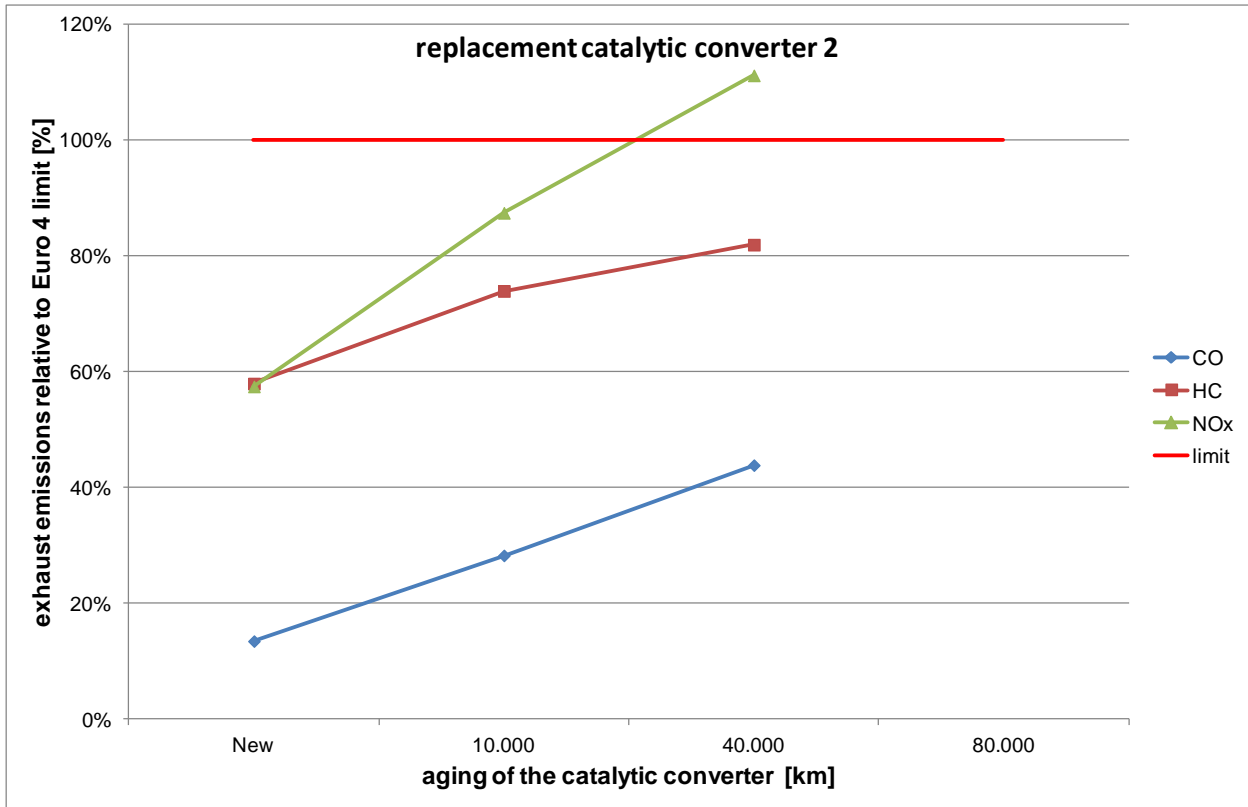


Figure 4: Exhaust emissions with replacement catalytic converter “2” relative to Euro 4 limits

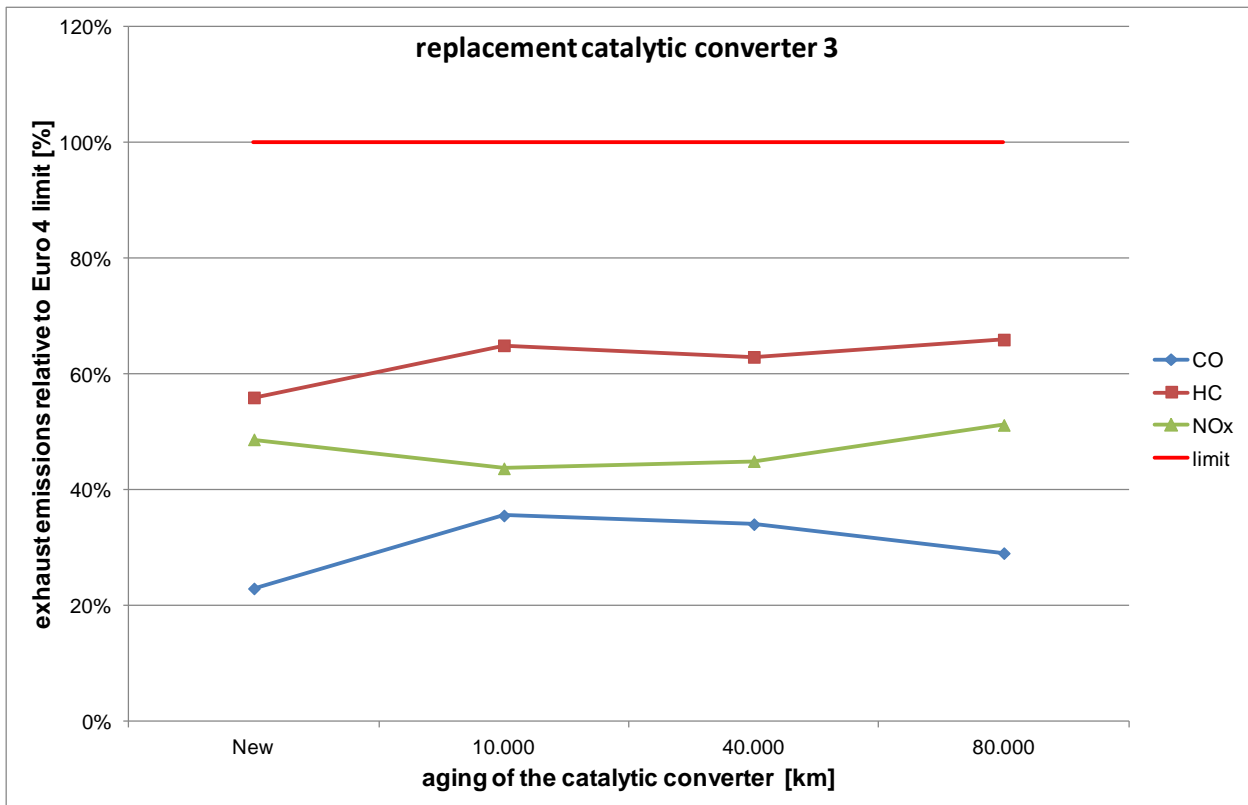


Figure 5: Exhaust emissions with replacement catalytic converter “3” relative to Euro 4 limits

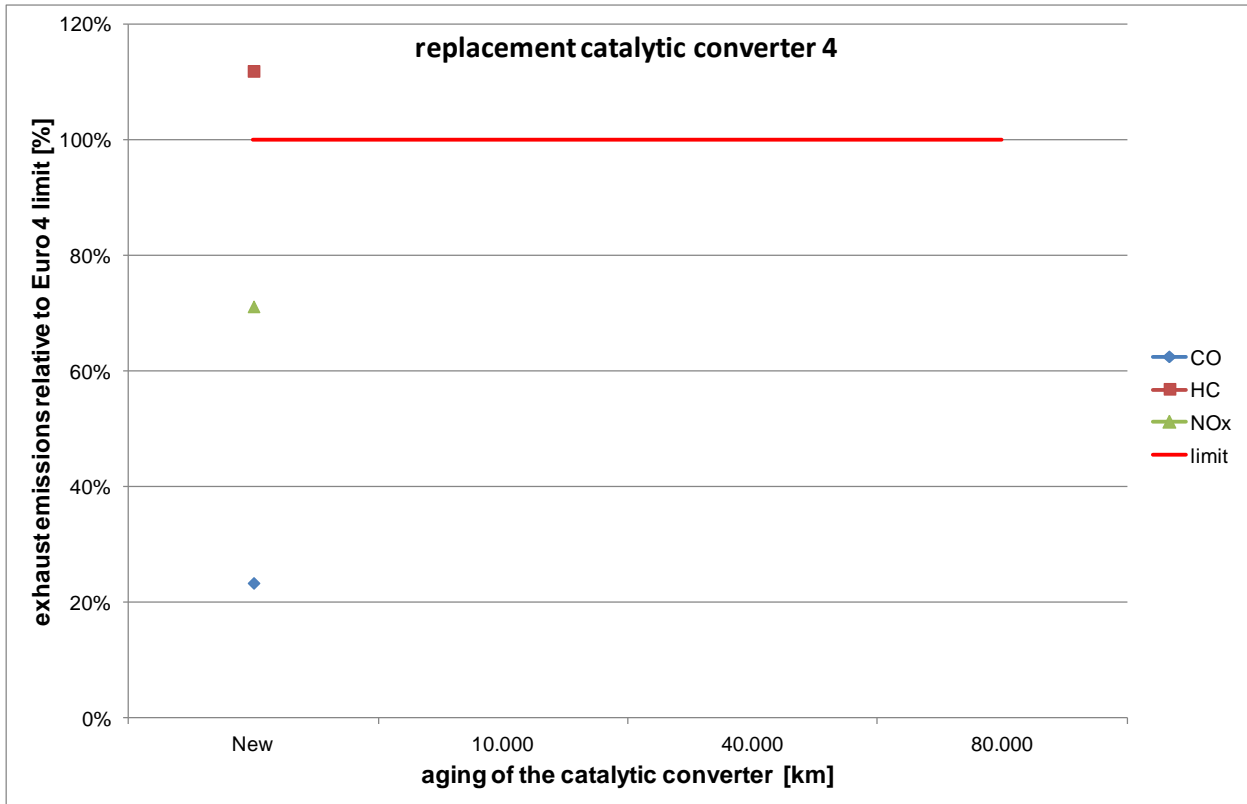


Figure 6: Exhaust emissions of replacement catalytic converter “4” relative to Euro 4 limits²

² With converter “4” the Euro 4 limits were exceeded already at starting conditions, therefore no aging was conducted.