

PROPOSAL FOR REGULATION FOR RETROFIT EMISSION CONTROL SYSTEMS FOR ENGINES USED IN NONROAD MOBILE MACHINERY AND AGRICULTURAL TRACTORS

At the 59th GRPE session, EUROMOT introduced informal document GRPE-59-09 proposing to develop under the 1958 Agreement a new Regulation on retrofit emission control (REC) systems for engines used in NRMM and agricultural tractors with respect to the emissions of pollutants. GRPE welcomed in principle the proposal, but requested EUROMOT to prepare for the next session of GRPE a more detailed document on the scope of the proposal. The text reproduced below was prepared by the expert from EUROMOT in response to GRPE's request.

A. SCOPE OF THE PROPOSAL

The proposed regulation applies to test procedures for NO_x and PM retrofit emission control (REC) systems for CI engines used in NRMM and agricultural tractors and covered by ECE regulation 96. The regulation is based upon the measurement procedure of the 30th Order amending the German Road Traffic Approval Order (StVZO), Annex XXVII (Federal Gazette 31/05/2007), since this regulation best matches the general outline of an ECE regulation. Also, Annex XXVII has been in force for NRMM for several years. Elements from the Californian (Title 13 CCOR, Chapter 14) and the Swiss (SNR 277205) retrofit regulations will be integrated in order to allow for the highest degree of international harmonization. The regulation serves for approval of the aftertreatment system only and does not affect the engine approval.

The proposal will provide technology neutral harmonized technical requirements for retrofitting existing machinery and engines, which would be the basis for local retrofit regulations. The proposal is not intended to mandate any contracting party to introduce retrofit regulations in their own territory, nor does it mandate the contracting parties which test results (emissions limits or emissions reduction) to use as basis for their retrofit regulations.

B. STRUCTURE OF THE PROPOSAL

The regulation will follow the structure of Annex XXVII. The following chapters go beyond some of the Annex XXVII requirements, e.g. the REC degreening provisions and the durability period.

1. Test engine and test cycle

The test engine to be selected needs to refer to the engine classification (power category), emissions stage, and application (relevant test cycles, e.g. C1) for which the REC is to be approved.

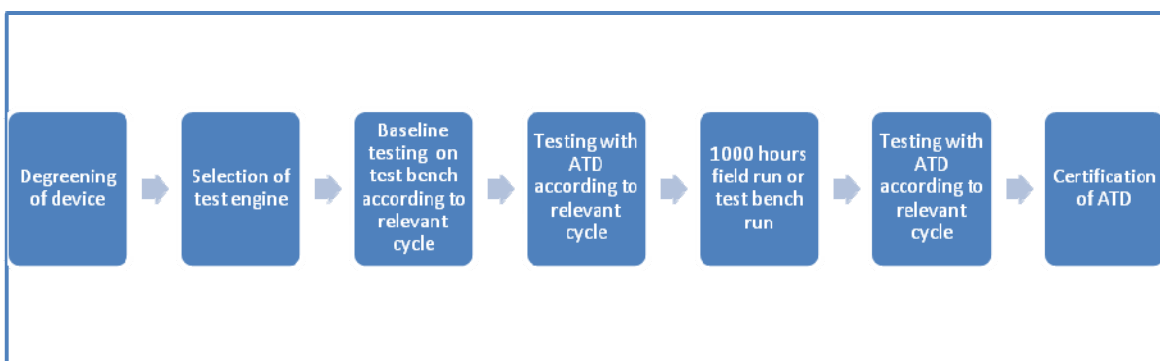
2. General procedure

The REC will be “degreened” for a minimum of 25 hours, and a maximum of 125 hours before testing.. Baseline testing will be done to measure the emissions of the selected test engine in its original configuration on the relevant test cycle. A test run with with the REC installed (control figuration) incl. any necessary reagents (e.g. additives, urea) will follow on the same test bench in order to determine the emissions reduction efficiency of the REC.

A 1000 hours durability test will be run with an engine/REC combination, either as field test in a typical machine application or on an engine test cell. The engine for the durability run may be a different one than the test engine. After the durability test, the REC will be demounted, if applicable, and be installed with the test engine on the same test bench as used for the baseline and control figuration testing. The control figuration testing program with the aged REC will be the same as with the degreened REC. The final emissions results will be based on the control figuration testing with the aged REC.

All test results will be reported in brake specific emissions [g/kWh].

The process is shown in the diagram below.



3. Emissions testing

Three hot start tests will be run for both baseline and control configuration at t=0 hours and t=1000 hours. Engine back pressure and exhaust gas temperature must be measured upstream of the REC and recorded on a second by second basis (1 Hertz) during at least one baseline run and each of the control runs. All test results will be reported in brake specific emissions [g/kWh].

For any REC that has distinct regeneration events, emissions that occur during the regeneration must be measured and taken into account when determining the net emission reduction efficiency of the system. The requirements for regeneration adjustment factors defined gtr n° 11 need to be followed.

4. Durability

As a part of the approval procedure, the REC has to run 1000 operation hours before the second set of emissions testing. Any failures, pressure drop data, temperatures and error codes during this durability period need to be recorded and documented. This data will be part of the application documents. The mechanical durability can be proven by structural analyses, vibration testing or field test data within the 1000 hours.

Except for emergency engine repair, only scheduled maintenance on the engine and REC, and re-filling of reagents needed by the REC may be performed during the durability testing period.

5. Emission classification scheme

The basis for emissions classification are brake specific emissions [g/kWh]. With the REC installed, the emissions must not exceed the limit values of the original emissions stage and engine category (e.g. stage 2, 130 to 560 kW). In case a different test cycle is used (e.g. for stage 1 engines), the emissions with the REC installed must not be higher than the baseline results of the engine. NO₂ values must not be higher than 20% of the total NO_x emission.

In addition to the brake specific emissions, the following relative emissions reduction classification is proposed for NO_x and PM. Any combination of reduction (e.g. NO_x level 2 combined with PM level 4) is permitted and must be indicated on the label. If the engine/REC combination fulfills the Stage IV emission limits, the REC will be classified Level 4, irrespective of the percentage emissions reduction. Contracting Parties or local authorities will have the authority to define the brake specific emissions limits and/or the classification levels required within their retrofit schemes.

Classification	NO_x Reduction
Level 1	10%
Level 2	33 %
Level 3	66 %
Level 4	80 %

Classification	PM Reduction
Level 1	33 %
Level 2	66 %
Level 3	80 %
Level 4	95 %

6. REC family concept

A REC family concept is acceptable if it can be proven that the emissions reduction performance is similar. This involves e.g. engines with different numbers of cylinders and different cylinder configuration but having the same technical specifications and installation for the REC. Approval of the REC family will be based on testing the best case and worst case configurations.

7. Safety and noise related issues

In principle, the noise level and the safety aspects of the machine should not deteriorate when the REC is being installed. An appropriate proposal for a certification procedure is still under work.

8. Test fuels

The test fuel is the reference or market fuel in accordance with the specifications in place at the time of the REC approval testing.

9. Service requirements and documentation

The service requirements must be documented in the owner's manual which is part of the approval documentation. The installer of the REC must fill in a document stating that the installation is done according to manufacturers installation guideline. If the installer was required to install the REC in a different way, e.g. due to installation space constraints, the deviations need to be documented. An information document describing the technicalities of the REC must be submitted to the approval authority.

10. Labeling

Each REC shall be assigned an approval number as defined below:

ECE/MMM/XXXXX/YYYY/PM#/NO#/STxxxx/APP

- ECE: Designates an REC approved within the ECE framework
- MMM: REC manufacturer code
- XXXXX: REC type (manufacturers type name)
- YYYY: Year of approval
- PM#: PM reduction level
- NO#: NO_x reduction level
- STxxxx: Original emissions stage
- APP: Application for which the REC is approved

11. Extension of approval

With the prior approval of the type approval authority, the approval may be extended to other power categories (e.g. from 75-130 kW to 37-75 kW) and applications (e.g. from NRMM to agricultural tractor) if it can be proven by e.g. test runs or field data that the approved REC performs as well in this power category or application as with the original approval.
