



## **European Aftertreatment System Aging and Mileage Accumulation Test**

### **1 Scope**

**Note:** Nothing in this standard supercedes applicable laws and regulations.

**Note:** In the event of conflict between the English and domestic language, the English language shall take precedence.

**1.1 Purpose.** This procedure is a condensed version of GMW16614. The document gives suppliers the basic data and execution description so that they can execute the test themselves and/or evaluate their components, which have been undergone the test in a vehicle. The purpose of these tests which are included in this Test Procedure is the durability testing and validation of the exhaust system regarding regulated emissions.

#### **1.2 Foreword.**

**1.2.1 Effort.** The effort is related to specific validation program.

- DR\_10                      **Durability Road 100kkm**
- DR\_RP\_10                **Rü. - Proving Ground 100kkm**
- DR\_CP\_RP\_10          **Chasis Dyno Program 100kkm**

Emission test, vehicle checks and maintenances shall be considered.

**1.3 Applicability.** Gasoline and Diesel engine powered vehicles.

### **2 References**

**Note:** Only the latest approved standards are applicable unless otherwise specified.

#### **2.1 External Standards/Specifications.**

None

#### **2.2 GM Standards/Specifications.**

None

### **3 Resources**

#### **3.1 Facilities.**

**3.1.1 Calibration.** The test facilities and equipment shall be in good working order and shall have a valid calibration label.

**3.1.2 Alternatives.** Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

**3.1.3 Vehicle Chassis Dyno.**

**3.1.4 Proving Grounds.** The Test Track shall offer a sufficient length in order to assure that the "elementary cycle" (Sub cycle DR\_RP\_10 on proving ground) can be driven on a flat test track segment.

**3.1.5 Public Road.** Public roads preferably federal motorways and federal roads.

**3.2 Equipment.** For the preparation of a test run it is necessary to measure following temperatures in order to characterize aging temperatures.

- Gas temperature and temperature at catalyst bed

**GM Confidential**

© Copyright 2013 General Motors Company All Rights Reserved

October 2013

Page 1 of 7

During test run:

- Gas temperature only downstream of catalyst
- Oil temperature in oil pan
- Cooling water temperature

**Note:** Suggested thermocouple tip diameter and type 1.6 mm (Cr-Ni K type). All equipments shall be test appropriate, i.e. high temperature resistant.

### 3.3 Test Vehicle/Test Piece.

**3.3.1** Vehicle As provided / used.

**3.3.2 ECU Calibration.** Provide ECU calibration properly updated.

#### 3.3.3 Temperature Measurements.

**3.3.3.1 Preparation Phase.** At the end of calibration activity, and before starting the aging test, measurements in characterization phase (see paragraph 3.2) should have been run in order to monitor catalyst temperatures.

**3.3.3.2 Aging Phase.** During aging phase only one thermocouple is allowed fitted downstream catalyst.

This measurement shall be regarded more as a safety device (see paragraph 6.2), and its location, downstream catalyst, avoids risk of leakage upstream catalyst due to connections.

**3.3.4 A/F Ratio Measurements.** At the end of the calibration activity, A/F ratio measurements shall have been run in order to monitor A/F during different driving modes upstream catalyst (gasoline).

During the aging phase additional sensors must not be mounted in order to avoid any risk of leakage upstream catalyst due to connections.

### 3.4 Test Time.

**3.4.1 Test Distance.** The test distance shall be agreed by test engineer with Supplier.

### 3.5 Test Required Information.

**3.5.1** General information.

#### 3.5.2 Information for Chassis Dyno Setting.

- Vehicle resistance,  $F_0$ ,  $F_1$  and  $F_2$
- Inertia weight
- Gear shift points
- Description of the cycle (Vehicle speed, acceleration, etc.)

**3.6 Personnel/Skills.** The driving modules that comprise this test are intended to be performed by personnel specifically trained in the proper execution of the driving modules.

## 4 Procedure

### 4.1 Preparation.

**4.1.1 Materials.** Exhaust manifold, catalytic converter package (Closed coupled, pre + main, DPF etc.) and the exhaust system shall be fabricated, according the built phase.

**4.1.2 Particle Hygiene.** Before test start a rigorous check for loose particulate debris of the complete exhaust system shall be performed. Particles > 1 mm (in at least one geometric dimension) which move or might move in the exhaust gas flow after several hours of engine shall be removed from the exhaust system.

**4.1.3 Vehicles.** Before each program start hardware and software check as well as an initial exhaust emission measurement shall be performed.

### 4.2 Conditions.

**4.2.1 Environmental Conditions.** Not applicable.

**4.2.2 Test Conditions.** Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

**4.2.2.1 Vehicle /Engine Operation and Maintenance.** The operation and maintenance conditions shall be in line with the requirements for the operation of the specified test vehicle and engine.

GM Confidential

© Copyright 2013 General Motors Company All Rights Reserved

October 2013

Page 2 of 7

## 4.3 Instructions.

**4.3.1 Test Preparation.** Using a spare catalyst, and running the car according to the above mentioned aging cycle, necessary checks should be performed by OEM before vehicle delivery to Supplier, or shall be performed in agreement with the OEM. This includes conditions for Torque, Engine speed, Outlet coolant temperature, Inlet oil temperature, Manifold absolute pressure, Minimum oil pressure, Crankcase pressure, Coolant level, Fuel pressure, Exhaust temperatures.

**4.3.2 Durability Program.** The durability program and cycle is described in:

Paragraph 4.3.2.1: DR\_10 (public road)

Paragraph 4.3.2.2: DR\_RP\_10 (proving ground)

Paragraph 4.3.2.3: DR\_CP\_RP\_10 (chassis dyno)

**4.3.2.1 Durability Road DR\_10.** Customer related driving program on public road mainly on federal motorway.

**4.3.2.1.1 Driving Style.** The driving style shall be dependent upon the motor vehicle traffic regulation (StVO) as well as the external conditions. This shall be determined according to individual cases whilst ensuring that no unnecessary risks are taken.

**4.3.2.1.2 Driving Route.** The routine will be specified by GM.

**4.3.2.1.3 Cooling Phase.** The cooling phase shall be 8 h per day.

**4.3.2.1.4 Test Facilities.** Inspection ramp is required to perform a daily vehicle check.

**4.3.2.2 Durability Road Simulation DR\_RP\_10 on Proving Ground.**

**4.3.2.2.1 Driving Style.** For public road part see paragraph 4.3.2.1.1. The maximum vehicle speed on the drive between Ruesselsheim and Dudenhofen as well as the return is limited to 120 km/h. The mileage of this distance is 53 km. After the arrival at the proving ground, the driver shall perform a warm start after 5 minutes engine off.

At the proving ground the driver has to follow the proving ground regulations. Transient phases include fuel cut and deceleration phases followed by subsequent WOT accelerations in order to return to the specified speed.

**4.3.2.2.2 Driving Cycle.**

### 1. Circular track Part I:

The sub cycle begins with a WOT acceleration up to 120 km/h, 5 km 120 km/h constant speed, followed by four fuel cuts every km. Each deceleration is followed by a WOT acceleration starting from 110 km/h up to 120 km/h, then WOT acceleration up to 140 km/h, 5 km 140 km/h constant speed, followed by four fuel cuts every km. Each deceleration is followed by a WOT acceleration starting from 130 km/h up to 140 km/h, then WOT acceleration up to 160 km/h, 5 km 160 km/h constant speed, followed by four fuel cuts every km. Each deceleration is followed by a WOT acceleration starting from 150 km/h up to 160 km/h.

Exit of circular track.

### 2. Ride course:

The maximum vehicle speed in this section is 100 km/h. The driver shall perform four fuel cuts with a deceleration until 90 km/h followed by a WOT acceleration up to 100 km/h. The distance of the ride course is 4.5 km.

Exit of ride course.

### 3. Circular track Part II:

WOT acceleration up to 170 km/h, 5 km 170 km/h constant speed, followed by a fuel cut deceleration. At 140 km/h WOT acceleration up to 180 km/h, 5 km 180 km/h constant speed, followed by a fuel cut deceleration. At 150 km/h WOT acceleration up to 190 km/h, 5 km 190 km/h constant speed, followed by a fuel cut deceleration. At 160 km/h WOT acceleration up to maximum vehicle speed, followed by a deceleration phase with 1 km 180 km/h, 1 km 160 km/h, 1 km 150 km/h, and 1 km 130 km/h.

Exit of circular track.

### 4. Ride course:

The maximum vehicle speed in this section is 100 km/h. The driver shall perform four fuel cuts with a deceleration until 90 km/h followed by a WOT acceleration up to 100 km/h. The distance of the ride course is 4.5 km. The driver shall perform two cycles on the ride course – 9 km.

**GM Confidential**

© Copyright 2013 General Motors Company All Rights Reserved

October 2013

Page 3 of 7