



Real Driving Emissions (RDE) equivalent Chassis Dyno Test Cycle

1 Introduction

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 Test Procedure provides a description for Real Driving Emissions (RDE) equivalent testing on chassis dyno. This makes the test reproducible for development work and executable independent from season and in different altitudes.

The test cycle is designed to cover the upper border of "normal condition of use" in terms of torque/power demanding operation like e.g. dynamic driving, uphill driving.

Passing the test does not automatically mean to meet all RDE requirements.

Passing the test should mean to pass random valid road PEMS trips with a high percentage.

Complementary RDE-verification with PEMS on road is necessary on top of dyno testing.

1.2 Applicability. This Test Procedure is applicable for diesel and gasoline powered vehicles.

Alternatively to vehicle chassis dyno the test can also be performed on high dynamic engine bench

1.3 Remarks. Real Driving Emissions (RDE) is a new regulatory requirement to determine emissions of regulated pollutants under normal customer usage. It requires testing on public roads using a mobile measurement equipment (PEMS). Tests are unique and not exactly repeatable.

Note: In case this document is released to vendors that supply chassis dyno or HD bench testing, following paragraphs do not apply:

- 3.5.1
- 4.1.1

2 References

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

2.1 External Standards/Specifications.

EC 715/2007 EC 692/2008 Annex IIIa EN 590 WLTP GTR 15

2.2 GM Standards/Specifications.

None

2.3 Additional References.

CG4386 "Real Driving Emissions equivalent Chassis Dyno Test Cycle"

"Real-world driving cycles for measuring cars pollutant emissions", Part A: The ARTEMIS European driving cycles, Report INRETS-LTE 0411, June 2004

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.

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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 Chassis Dynamometer. Test execution requires a chassis dyno with following capability:

- Iterative adjustment of given road load
- Inertia setting of real vehicle mass, not clustered in inertia mass classes
- Up and downhill driving, i.e. continuous variation of F0-Factor (Road Load Polynomial)
- Grade indicator strongly recommended to visualize the grade to the test driver on top of the speed-trace.
- Accurate modal tailpipe measurement (cross-check with PEMS)

3.1.4 Fan. Test requires a speed proportional wind from fan.

The maximum wind speed should be 130 km/h minimum. It is acceptable to perform faster sections of the test cycle with 130 km/h wind speed.

3.1.5 Engine Hood. Hood shall be closed according to normal vehicle operation on road.

3.1.6 HD Bench. For execution of the test cycle on a HD engine bench it is important to have a good approximation of vehicle conditions, especially for temperature of coolant, intake air and exhaust gas.

3.2 Equipment. Not applicable.

3.3 Test Vehicle/Test Piece. Test vehicles used for emission calibration work are typically IV vehicles, but also mule vehicles up to PPV build stage with suitable engine and calibration can be used.

3.4 Test Time.

Calendar time: -

Test hours: 45 minutes (without preconditioning)

Coordination hours: -

3.5 Test Required Information.

3.5.1 Description of Normal Driving. Several parameters have been identified to describe normal driving:

- Dynamic driving: v*apos
- Uphill/downhill driving: Grades and maximum cumulative altitude gain
- Idle share: Time portion at vehicle speeds < 1 km/h
- Speed bin share Sections of city, extra urban, motorway driving

3.5.2 Test Outputs.

3.5.2.1 Minimum Required Data (Evaluation without normalization tool). The following is the minimum required data for test (the Test Engineer may require additional data):

- A** Engine speed (in min⁻¹)
- B** Effective torque
- C** Mass emissions (in g/s) of emission pollutants NO_x, CO, CO₂
- D** Particulate number emissions (in #/km)
- E** Ambient air temperature
- F** Exhaust mass flow
- G** Coolant-out temperature
- H** Oil temperature (sump)
- I** Time
- J** Date

3.5.2.2 Optional Data (depending on test purpose).

- A** Mass emissions (in g/s) THC, NO, NO₂, N₂O, NH₃, CH₄
- B** Particulate mass emissions (in g/s) or (in g/km)

3.5.2.3 Data input for Emroad. The following data is required as 1 Hz xls data. An example input-file is stored in the Emroad documentation file.

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Parameter	Measurement technique	Alternative techniques	
HC Concentration	FID Analyser	None	○
CO Concentration	NDIR Analyser	None	●
CO ₂ Concentration	NDIR Analyser	None	●
NO _x Concentration	CLD or NDUV Analyser	None	●
Exhaust Mass Flow	EFM	(1) Fuel flow sensor + intake air flow sensor ² (2) Fuel or Air flow sensor + calculated A/F ³	●
Exhaust temperature	Sensor	ECU	●

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Engine Torque	ECU		○
Engine Speed	ECU		○
Coolant temperature	ECU		●
Intake air temperature	ECU or Sensor		●
Fuel rate	ECU or Sensor		●
Intake air flow rate	ECU or Sensor		○
Fuel Temperature	ECU		○
Boost Pressure	ECU		○
Oil pressure	ECU		○
Fault status	ECU		○
Oil temperature	ECU or Sensor		○
Ground speed *	GPS	ECU	●
Latitude *	GPS		●
Longitude *	GPS		●
Altitude *	GPS		○
Road grade *	Inclinometer		○

* No GPS signal available on chassis dyno. It is recommended to use the roller velocity signal from chassis dyno and the ECU velocity signal, because Emroad uses both velocity signals for the time alignment. Road grade is fix for chassis dyno test.

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