

**Working item discussion regarding to test
methodology, conditions, equipment**

Webex, May 24th 2022

The items

1. Vehicle Category
2. Criteria for excluding a vehicle from tests
3. Test Vehicle age/millage
4. Meteorological Conditions
5. Test Conditions
6. Sampling Points/Sampling Lines
7. Background air pollution level
8. Cabin air filter age
9. PM and gas components to be Measured
10. Measurement Methods
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12. Gas Analysers Calibration
13. Test Modes
14. HVAC Modes
15. Test Procedure
16. Test Protocol

Responses from:

VIAQ IWG
Vehicle Interior Air Quality
Informal Working Group

CEN/WS 103*

CEN

**OICA
Members**

OICA

CLEPA
(EU Association of
Supplier)

CLEPA

UTAC/ESTACA
(Paris saclay)

UTAC

**Korea Automobile
Testing & Research
Institute**

Korea

**CabinAir
Sweden AB**

CabinAir

The full text feedback tables are in the document VIAQ-23-09

*CEN/WS 103 items from the document "Real drive test method for collecting vehicle interior air quality data" // Doc. CEN/WS 103 N. 34, 2022

1. Vehicle Category (agreed)

Category 1-1

2. Criteria for excluding a vehicle from tests

Proposals:

Exclusion shall be based on a positive answer to any of the criteria below:

- ✓ Is the vehicle more than one month aged?
- ✓ Does the vehicle not have a full service history?
- ✓ Is there a Malfunction Indication Light showing on the vehicle instrument panel?
- ✓ Has the vehicle had unauthorised vehicle repairs?
- ✓ Has any part of the vehicle's heating and ventilation system replaced with non-original parts?
- ✓ Through visual inspection of the vehicle, are there any damaged ventilation system relevant components?
- ✓ Are there any obstructions to the vehicle air intake path?
- ✓ Is the vehicle not in overall safe operating condition?
- ✓ Is there any damage to the body of the vehicle, including but not limited to doors, windows and the rear?

3. Test Vehicle age/mileage

Proposals:

1. 3 000...15 000 km
2. 3 000...160 000 km
3. <25 000 km and age <2 years
4. >5 000 km

This item needs additional discussion

4. Meteorological Conditions

Proposals:

Weather condition: no rain, fog, snow or standing water on the carriageway

Relative Humidity 40...80%

Atmospheric pressure 85...110 kPa

Temperature:

1. -7...+35°C
2. +5...+25°C
3. +10...+20°C

Temperature range needs additional discussion

5. Test Conditions

Proposals:

- The test must be primarily conducted on city roads and urban locations
- Road condition Paved streets
- It is recommended to avoid long tunnels, high altitudes and construction areas.

Each trip shall meet the conditions below:

- Average speed 30...50 km/h
- Maximum Instantaneous vehicle speed 80 km/h
- Test duration 30...120 min
- Average altitude 0...700 m
- A normal driving style shall be adopted.

The item needs additional discussion

5. Test Conditions

Proposals:

- Windows, doors, sunroof or convertible soft top must be closed at all times. Heated or cooled seats should not be used.
- The vehicle shall have been driven at least 50 km in the seven days prior to the start of the test, to ensure that the vehicle has been in regularly use prior to the test and not left unused for a long period.
- When cleaning the vehicle prior to testing, only a damp cloth should be used. Fragrances and air fresheners should be avoided.
- There should be the driver and one passenger present in the vehicle for the duration of the test. All outer clothing of the driver should be made of polyester to minimise particle generation from the driver. Clothing should cover both arms and legs.
- The occupants should avoid applying any fragrances or make-up prior to or during the test. Further, occupants should not have smoked for at least 24 hours before a test.

The item needs additional discussion

5. Test Conditions

Alternatively:

EU and UN Requirements for **urban part** of RDE*:

- Vehicle speeds lower than or equal to 60 km/h
- The average speed (including stops) of the urban driving part of the trip should be between 15 and 40 km/h.
- Stop periods, defined by vehicle speed of less than 1 km/h, shall account for 6-30 % of the time duration of urban operation. Urban operation may contain several stop periods of 10 s or longer. However, individual stop periods shall not exceed 300 consecutive seconds; else the trip shall be avoided.
- The start and the end point of a trip shall not differ in their elevation above sea level by more than 100 m.
- Altitude lower or equal to 700 meters above sea level.
- The minimum distance of operation shall be 16 km.

*Requirements regarding: Commission Regulation (EU) 2017/1151

6. Sampling Points/Sampling Lines

Proposals:

1. The interior sampling point should be a head-height between the front headrests
2. The external sampling point should be
 - 2.1. As close as reasonably possible to the ventilation air intake. Sampling should be isokinetic
 - 2.2. A forward-facing, horizontally oriented sampling probe securely mounted to minimize vehicle aerodynamic influences, at least 5 cm from the vehicle surface
 - 2.3. Not measured, and used PM_{10} and $PM_{2.5}$ data from real-time roadside monitoring stations
3. The sampling lines to the analyzer that is designed to minimize particle losses from 10 nm to 2.5 μm . The sampling lines should be constructed of materials to minimize electrostatic particle losses (for example, conductive materials) and sized to minimize inertial and/or diffusional particle losses

The item needs additional discussion



Outdoor sensors

External Sampling Probe



7. Background air pollution level

Proposals:

PN 5 000...100 000 #/cm³

PM_{2.5} concentration:

- 5...100 µg/m³
- 10...200 µg/m³
- 81...150 µg/m³
- > 30 µg/m³

The item needs additional discussion

8.Cabin air filter age

Proposals:

HVAC filter age:

- New, OEM-approved
- Normal filters use for 3000 km or Ageing procedure
- Original OEM HVAC filter with max. 3000 km
- Aged filter out of filter replacement cycle which driving mileage 10 000 km~15 000 km
- Both New and Aged

If a vehicle is not installed with a filter by the OEM, the vehicle to be tested with no filter present.

If necessary to achieve test validity, the filter should be replaced with a matching part to the OEM original. The car should then be driven on the road for a minimum of 100 km before starting the test.

The item needs additional discussion

9. PM and gas components to be Measured

Proposals:

PN

PM_{2.5}

PM₁₀

CO

CO₂

NO₂

Optionally:

small fraction PM (0.1-1 μm)

tVOC

PAH

NO_x (NO₂ & NO)

NH₃

O₃

The item needs additional discussion

10. Measurement Methods

Proposals:

PN concentration	Condensation particle counter with catalytic stripper
PM concentration (<10 µm)	Mini Wide Range Aerosol Spectrometer Aethalometer 90° light scattering & filter-sampling
CO concentration	Non-dispersive infra-red Electrochemical cell
CO ₂ concentration	Non-dispersive infra-red
NO ₂ concentration	Non-dispersive ultra-violet chemiluminescent detector

The item needs additional discussion in connection with item 9

11. Test equipment requirements

Proposals:

PN concentration	0 to 500,000 #/cm ³
PM concentration (<2.5 μm)	0 to 0.5 mg/m ³
PM concentration (<10 μm)	0 to 1 mg/m ³
CO concentration	0 to 1 ppm
CO ₂ concentration	0 to 5,000 ppm
NO ₂ concentration	0 to 0.5 ppm

Alternatively:

PM concentration (<2.5 μm)	0 to 100 mg/m ³
PM concentration (<10 μm)	0 to 100 mg/m ³

The item needs additional discussion in connection with items 9 and 10

12. Gas Analysers Calibration

Proposals:

Calibration and linearisation of the equipment shall be performed according to manufacturer recommendations prior to the commencement of measurements.

After the equipment is installed in the vehicle, a dynamic calibration shall be performed. The dynamic calibration ensures that the paired instruments are measuring the same concentrations. The dynamic calibration should be run each time there is a new or changes to an existing test equipment installation on a vehicle. For the purposes of this calibration test, a stainless steel Y-piece should be used to split the air from the exterior sample probe equally between the interior and exterior measurement instruments. At the end of the calibration, the Y-piece should be removed and the installation returned to the test configuration.

The dynamic calibration test should be run for at least 30 minutes and expose the vehicle to concentrations in the range defined in item 7. The Pearson correlation coefficient between the data points from each matched pair of measurement devices shall be calculated. For a valid calibration, the r^2 on all devices should be at least 0.98.

The drift of the zero response of the particle number instruments, defined as the mean response to HEPA filtered air at the inlet of the sampling line during a time interval of at least 30 seconds, shall be tested prior to each test and shall be less than 2000 #/cm³.

The drift of the zero response of the carbon dioxide instruments, defined as the mean response to ambient air at the inlet of the sampling line during a time interval of at least 30 seconds, shall be tested prior to each test and shall be 413 ppm ±20 ppm.

Annual calibration following supplier recommendation.

13. Test Modes

Proposals:

1. Urban (city) driving
2. Real driving conditions (urban + rural + motorway)
3. Stationary test
4. Laboratory test (see VIAQ-22-11, VIAQ-23-05, VIAQ-23-10, VIAQ-23-11)

The item needs additional discussion

14. HVAC Modes

Proposals:

HVAC system settings:

- For Automatic mode: temperature 19°C, fan speed if can be manually adjusted 50%/medium
- For manual mode: fan speed 50%/medium, temperature 50%/medium, fresh air mode
- Air conditioning switched OFF
- Ventilation flaps fully open and directed straight ahead
- If a vehicle has manufacturer-installed air quality sensors, these should be left in the predominant mode

Alternatively:

- Temperature 23°C
- For manual HVAC: xx% fresh, yy% in recirculation

The item needs additional discussion

15. Test Procedure

Proposals:

1. Immediately before starting the test, the vehicle must be switched on for at least 20 minutes to allow the HVAC system to stabilise and to avoid cold start operation of an internal combustion engine.
2. A test is a continuous stretch of driving.
3. An involuntary stall invalidates the test, but a short period of deliberate engine-off – for example due to a stop/start system – is permitted.
4. For test results to be deemed adequate for use in comparing interior air quality performance between models within the scope of this CWA, it shall be required to collect:
 - at least 3 valid trips in total
 - in the required fan speed/ventilation modes
 - on 1 vehicle of its type.

Alternatively:

Measurements with two consecutive vehicles (the test is independent on background pollutant concentration)

The item needs additional discussion

16. Test Protocol

Proposals:

The protocol contains

1. Vehicle information (type, variant, version, manufacturer, mileage, engine type, fuel type, filter type and date of installation...)
2. Test condition information (testing date, test locations, test time, test equipment...)
3. Reporting of test results (inside and outside concentrations measurement results, ventilation mode, ambient conditions, mean vehicle speed, test distance, altitude, filtering efficiency...)

The item needs additional discussion

Additional research needed

Working Item	Research needed
4. Meteorological Conditions	Acceptable ambient temperature range
6. Sampling Points/Sampling Lines	External sampling point: <ul style="list-style-type: none">▪ air intake▪ side forward-facing, horizontally oriented sampling tube
8. Cabin air filter age	What is more representative: <ul style="list-style-type: none">▪ New filter▪ Aged filter▪ Need to test both
9. PM and gas components to be Measured	Which substances concentration to measure (taken into account their toxicity) Include or not CO ₂ (non toxic but affects on driver concentration and safety)
13. Test Modes	Which combination of test modes is representative regarding VIAQ assessment: <ul style="list-style-type: none">▪ Urban (city) driving▪ RDE (urban + rural + motorway)▪ Laboratory test
14. HVAC Modes	Which combination of HVAC settings is worst case: <ul style="list-style-type: none">▪ Interior temperature setting▪ Recirculation ON/OFF or xx%-OFF/yy%-ON