Informal document **VIAQ-12-05**

Working Items for the second stage of a new Mutual Resolution (M.R.3) development concerning Vehicle Interior Air Quality

PARIS, March 28-29th 2018

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Co-Chair: Jongsoon LIM, The Republic of Korea

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- **Purpose**

New part (III) of Mutual Resolution 3 will contain the provisions and harmonized test procedure for the measurement of interior air pollution from exhaust gases entering into vehicle cabin air, concerning the protection of passengers and driver from toxic emissions.

Working Items

1.Vehicle Category

2.Test Vehicle age/millage

3.Substances to be Measured

4.Meteorological Conditions

5.Test Conditions

6.Test Modes

7.HVAC Modes

8.Test Procedure

9.Measurement Methods

10.Sampling Points

11.Sampling Method

12.Test Protocol

Working Items

1. Vehicle Category

Agreed Item

Category 1-1

2. Test Vehicle age/millage

For discussion

New cars
Millage not less than
3000 km

Used cars, prototypes, test cars do not included

Working Items

3. Substances to be Measured

Russian Standard

Formaldehyde CH_2O
Nitrogen dioxide NO_2
Nitrogen oxide NO
Carbon monoxide CO
Saturated hydrocarbons (C_2H_6…C_7H_{16})
Methane CH_4

Agreed substances

Carbon monoxide CO
Nitrogen oxide NO
Nitrogen dioxide NO_2
Formaldehyde CH_2O
Methane CH_4 (only for natural gas vehicles)

Korea

Carbon monoxide CO
Nitrogen oxide NO
Nitrogen dioxide NO_2

For discussion see **VIAQ-12-06**

Volatile organic compounds (VOC)
Aromatic and aliphatic hydrocarbons
Particulate matter (PM)

Working Items

4. Meteorological Conditions

Russian Standard

- ✓ ambient air temperature:
  from -15°C to +30°C
- ✓ relative humidity:
  from 30% to 90%
- ✓ wind speed
  3.5 ± 1.5 m/s
- ✓ atmospheric pressure
  from 84.0 to 108.7 kPa

Korea

- ✓ average wind speed:
  less than 3 m/s
- ✓ ambient temp range:
  from +5°C to +32°C

OICA

Impact of temperature, pressure and humidity not known, probably neglectible: no definition needed; wind speed for idling should be low for reproducible results: *m/s

Working Items

5. Test Conditions

Russian Standard

- tests are carried out on paved roads with the slope of up to 6.0%
- no other vehicles with engine running or other sources of air pollution are permitted in the testing zone windows, doors, quarter lights, ventilation hatches and canopy are closed
- test vehicle shall be fueled not less than 6 h before the beginning of the testing

Korea

- test road: straight road
- general inspection should be checked before testing
- windows, doors and ventilation hatches should be closed
- HVAC (A/C and/or heater) should be turned off. If the driver want to turn HVAC on, in case, they use the lowest fan speed level of HVAC system.

Working Items

5. Test Conditions

1. Test road: straight road < 6% slope
2. General inspection should be checked before testing
3. Windows, doors and ventilation hatches should be closed
4. HVAC outside flaps have to be closed.
5. A/C and/or heater should be turned off.

Working Items

6. Test Modes (see **VIAQ-12-07** for additional information)

Test Mode	Russia	Korea	OICA
Idling	for a stationary vehicle, idling with the minimal stable RPM	Engine idling in normal condition	Duration of idling, what is realistic?
Constant speed driving	Speed - 50 km/h	Speed – 80±5 km/h, 100±5 km/h, 120±5 km/h, 140±5 km/h	50 km/h
Acceleration-deceleration		65-130-65… km/h	Acceleration mode to be discussed. Does Russia have a proposal?
Real-road driving		Real-road driving mode with/without acceleration	

Working Items

7. HVAC Modes (see **VIAQ-12-06** for additional information)

Test Mode	Russia	OICA
For all test modes	• interior air recirculation system is off; • if a vehicle is equipped with an interior air cleaning system (IAC) the tests are carried out with the IAC system switched on; • heating, climate control or air conditioning systems shall be used by the operator to provide the interior temperature of the driver's cab/passenger compartment within a range of +18 to +30°C. The recommended temperature is (20±1)°C.	We want to test the exhaust gas entry system from the own vehicle. Main objective: test of the leak into the car body. The HVAC system should stay on during the driving mode and the recirculating on. The instrument can be outside the car. For the driving mode the HVAC conditions can't be completely controlled and depend on wind velocity, so we suggest not to focus on the HVAC and to collect more data.
Constant speed driving	forced ventilation is switched on, airflow level is in the lowest position	
Idling	test shall be performed with both the forced ventilation switched on (optional for vehicles of category M) and with the forced ventilation switched off	The ventilation should be Off and the speed and direction of the wind standardized.

8. Test Procedure (1)

Russian Standard

Constant speed driving at 50±5 km/h

1. Before the testing, the vehicle's engine is switched off, the windows, doors and hatches are opened and the driver's cab/passenger compartment is ventilated for 1 to 5 minutes. Then the windows, ventilation hatches, and doors are closed and a gas analyser is turned on to carry out an express analysis. Gas analyser mode throughout the entire testing process – pursuant to the manual of the gas analysing instrument.
2. The engine is switched on, the vehicle is started, stabilized and continuously driven with a controlled speed on an agreed route, heating up the engine and other vehicle aggregates as well as equalizing the temperature of all cooling liquids and lubricants and pressure in the lubrication system for (20±5) min.
3. After (20±5) min have passed, an express analysis is performed and/or air samples are taken at the measurement points.
4. The on-line measurements shall be performed during a period of 20 to 30 minutes during which at least 5 instrument readings shall be taken for each of the pollutants to be determined. The duration of sampling is defined by the requirements of the appropriate measurement method.

Question:

How many persons into the vehicle : idling : no passenger driving : ?

8. Test Procedure (2)

Russian Standard

Idling

1. Test mode II is carried out at an open parking place, immediately after test mode I. The vehicle is positioned in such a way that its exhaust pipe is oriented against the wind direction.
2.Prior to testing, the driver's cab/passenger compartment is aired (see p.1 mode I)
3.An on-line measurements of pollutants in the ambient air shall be carried out. During the on-line measurements, the gas analyser rests on the installed seats of the test vehicle, the engine is off. The sampling tubes of the gas analyser are pulled out through the open windows or doors of the test vehicle at a distance of 0.5-1 m from the vehicle body.
4.The test shall begin when the concentration of pollutants in the test area does not exceed 0.3 of limit value.
5.The engine is switched on. The engine is operating in mode II with forced ventilation switched on.
6.After (20+5) min after reaching the operating temperature of the engine and other aggregates in order to equalize the temperature of all the cooling liquids and lubricants as well as the pressure in the lubricating system, an on-line measurement is made and air samplings are taken inside the vehicle at the specified points. Registration and air sampling time shall be the same as in mode I (see p. 4 mode I)
7.After finishing on-line measurements and air sampling, the engine is switched off. The vehicle is aired in accordance with p.1 (mode I).
8.The engine is switched on, the test is carried out again pursuant to p.6. with forced ventilation off.
9.The tests are finished, the engine is switched off and the air samples collected during mode I and II tests in all sampling points and from ambient air are handed over to the laboratory.
10.The air samples are stored in a thermostat or in an enclosed space under constant conditions (air temperature 20°C, relative humidity 50%). The period of sample storage prior to the performance of their laboratory chemical analysis is defined by the measurement methods.

9. Measuring Methods (see **VIAQ-12-08** for additional information)

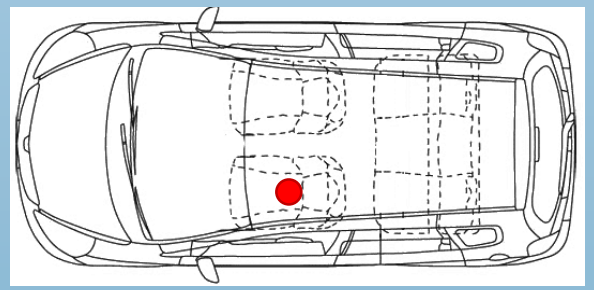
Substaces	Russia	OICA
CH_2O	1) high performance liquid chromatography UV detection; 2) gas chromatography with nitrogen phosphorus detection, or mass spectrometer and capillary or packed columns; 3) photo-electric colorimetric method	1) high performance liquid chromatography UV detection; 2) gas chromatography with nitrogen phosphorus detection, or mass spectrometer and capillary or packed columns; 3) photo-electric colorimetric method
NO, NO_2	1) chemiluminiscence; 2) high-sensitivity electrochemical detection;	1) chemiluminiscence; 2) high-sensitivity electrochemical detection;
CO	1) infrared photoacoustic spectroscopy; 2) electrochemical detection;	1) infrared photoacoustic spectroscopy; 2) electrochemical detection; Infrared is the most accurate. Calibration process to be specified for all the substances
C_2H_6-C_7H_{16}	1) FID (Flame ionization detector), capillary and packed columns gas chromatography;	no need
CH_4	1) FID or TCD (thermal conductivity detector) gas chromatography 2) infrared photoacoustic spectroscopy	For natural gas vehicles - 1) PID or TCD (thermal conductivity detector) gas chromatography 2) infrared photoacoustic spectroscopy

Working Items

10. Sampling Points / 11. Sampling Method

Russian Standard

Sampling Point:
driver's breathing zone;



Sampling Method: aspiration

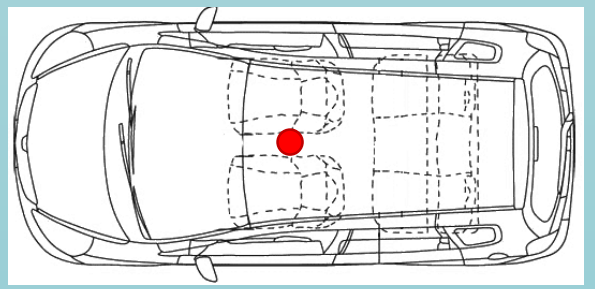
Korea

Measurement devices setting position

- Nose position of front seat, back seat
- Center position of truck
- Rear of vehicle

OICA

Sampling Point:
Suggestion: front (between the 2 seats)



Sampling Method:
for formaldehyde: active sampling

12. Test Protocol

Proposed

To be determined