Informal document **GRPE-92-45**
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Agenda item 4.(a)

OICA comments on Supplement for UN R49-07 ECE/TRANS/WP.29/GRPE/2025/12

General

- OICA fully supports the introduction of FTIR technology for H2O measurement as it is essential for the introduction of H2 ICE technology.
- OICA requests to hold the proposal of introducing FTIR and QCL as optional measurement instruments for NOx, CO, CO2, CH4, in UN R49-07 with the arguments in following slides
- OICA express concerns about the inclusion of HD OBFCM requirements, as they are still under discussion at European level. We suggest to evaluate the OBFCM inclusion in a later stage, taking also into account that for UN R49 such a feature is not needed.

BACKUP
Detailed comments

Arguments on FTIR and QCL

1. There is no urgent need of introducing new measurement technology for the conventional component measurement
2. Any introduction of a new principle of measurement technology shall be done with great care, since the measurement instrument is one of the most important tools to verify the compliance of the engine emissions
3. The new measurement technology should be verified via sound statistic data considering performance, repeatability and reproducibility (at least the last two exercises are missing at current stage)
4. We have special concern for the FTIR technology. We are aware of the wide use of FTIR instruments in R&D lab work, however the UN R49 structure would make the technology a legal tool not only in lab but also in PEMS testing. So far, very limited PEMS FTIR instruments have been evaluated (two only, with one of them showing very poor performance).
5. We are concerned about the feasibility of FTIR instrument for compliance purpose considering the high noise level impacting low concentration measurements. Especially attention must be paid at NOx < 10 ppm level considering both the accuracy and linearity of FTIR, since that is emission level of current and future engine technology.
6. Interference check and compensation algorithms of FTIR instrument are critical when it comes to the instrument accuracy and can not be verified by OEMs. Leaving all the procedures to the instrument supplier's declaration could create the possibility of opening doors for non-serious instrument suppliers.
7. OICA also suggests interference check shall be done with a mixed gas (which is the working environment of the instrument and essential for the compensation algorithms), not allowing to run interference gases separately for each individual component.
8. The interferences requirement must be separately specified according to fuel type, since the interferences are directly connected to fuel types,
9. The linearity check must be also so done with the presences of interferences gases separately with different fuel type
10. OICA suggests that the analyzer accuracy, noise, drift and repeatability specifications, cross sensitivity specifications shall be certified by an authorized organization rather leaving it to instrument manufacturer declaration.
11. It is important to point out, a non-proper instrument could lead to misjudgment of the emission performance, could even create "loopholes" in the regulation

Regarding OBFCM

OICA strongly recommends not including now OBFCM in UN R49

- OBFCM is a pure EU §CO2 regulation, there is no corresponding UN-R
- Many countries/regions base their national regulations on UN R49, hence any requirements on OBFCM is misplaced
- Depending on the final outcome of the OBFCM regulation, it may be suitable to introduce the proposed amendments in (EU) 582/2011 (not in UN R49)
- The EU HDV OBFCM regulation is still under development with many discussions and uncertainties yet to be finalized, hence it should not be added to UN R49 regardless of above points

HDV OBFCM related proposals

5. The European Union has set CO_2 emission targets for heavy-duty vehicles towards 2040.

6. The effectiveness of these targets is strongly dependent on the real-world representativeness of the methodology used for determining the CO_2 emissions. Therefore, the EU is putting in place a mechanism to assess the real-world representativeness of the CO_2 emission and energy consumption values determined with VECTO through on-board fuel and/or energy consumption monitoring (OBFCM) devices.

7. These OBFCM devices are being introduced in the EU, and to ensure that the data provided by these devices remain representative during the use of the vehicles, while minimising the additional testing burden, the accuracy of these devices should be verified during the regulatory procedures, such as the PEMS test.

8. Therefore, a targeted supplement to the UNR49 Regulation should enable the relevant OBFCM data to be collected during the PEMS.

Specific comments - Annex 4

9.3.2.1. Introduction

Paragraphs 9.3.2.2. to 9.2.3.7. describe the measurement principles to be used. A detailed description of the measurement systems is given in Appendix 2 **and Appendix 7** to this annex. The gases to be measured shall be analyzed with the following instruments. For nonlinear analyzers, the use of linearizing circuits is permitted.

OICA Comment

- There is an incorrect paragraph to which reference is made.
  The correct descriptions are as follows.

Paragraphs 9.3.2.2. to **9.3.2.9.** describe the measurement principles to be used. A detailed description of the measurement systems is given in Appendix 2 **and Appendix 7** to this annex.

Specific comments - Annex 4, Appendix 2

A.2.1.2. Description of the analytical system

Analytical system for the determination of the gaseous emissions in the raw exhaust gas (Figure 9) or in the diluted exhaust gas (Figure 10) are described based on the use of:

(a) HFID or FID analyzer for the measurement of hydrocarbons;

(b) NDIR analyzers for the measurement of carbon monoxide and carbon dioxide;

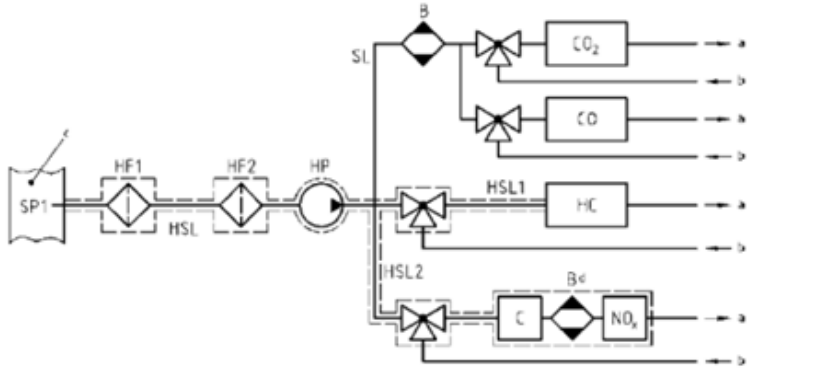
(c) HCLD or CLD analyzer for the measurement of the oxides of nitrogen;

(d) FTIR analyzer for the measurement of methane, carbon monoxide, carbon dioxide, oxides of nitrogen and water from the raw exhaust gas;

(e) QCL analyzer for the measurement of methane, carbon monoxide, carbon dioxide, oxides of nitrogen from the raw exhaust gas. "

Figure 9

Schematic flow diagram of raw exhaust gas analysis system for CO, CO_2, NO_x, HC



OICA Comment

- There is no NH3 in the measured components of FTIR and QCL.
  Does it need to be included?
- FTIR and QCL are missing from the Figure 9.
  Does it need to be included?

Specific comments - Annex 4, Appendix 9

A.9.2. Procedure for the measurement of water (H2O)
The analyzer used for H2O measurement shall meet the criteria specified in paragraph A.9.2.2. When measuring H2O, the H2O analyser shall be calibrated with an accurately humidified gas **using one of the options in paragraph A.9.5.**

[A9.5. H2O calibration gas
A gas mixture with the following chemical composition shall be available.
H2O in purified air or purified nitrogen.
The H2O concentration uncertainty shall be within ±3% of reading (Note it is not ±3% of absolute H2O humidity).]

OICA Comment

- No requirements are mentioned in A.9.5. for the options listed in A.9.2.

Specific comments - Annex 4, Appendix 9

A.9.2.2.3.1. CO2 interference verification for H2O FTIR analyzers
The amount of CO2 interference shall be determined after initial analyzer installation and after major maintenance.
If the FTIR analyzer uses compensation algorithms that utilise measurements of other gases to meet this interference verification, these other measurements shall be conducted simultaneously to test the compensation algorithms during the analyzer interference verification.
An H2O FTIR analyzer shall have a CO2 interference that is within (0.0±0.4) mmol/mol.
Procedure:
(1) Start, operate, zero, and span the H2O FTIR analyzer as would be the case before an emission test.
(2) Use a CO2 span gas that meets the specifications of paragraph 9.3.3. to this annex and a concentration that is approximately the maximum CO2 concentration expected during emission testing.
(3) Introduce the CO2 test gas into the sample system.
(4) Allow time for the analyzer response to stabilize. Stabilisation time may include time to purge the transfer line and to account for analyser response.
(5) While the analyzer measures the sample's concentration, record 30 seconds of sampled data. Calculate the arithmetic mean of this data. The analyzer meets the interference verification if this value is within (0.0 ± 0.4) mmol/mol.

OICA Comment

- CFR 1065 contains requirements for exclusions to be possible in the case of non-carbon fuels.
- JAMA think that UNR49 also needs to include requirements for exclusions, considering the case of pure H2 fuels.

Specific comments - Annex 8, Appendix 1

A.1.2.2.
Table 1: Test parameters

…	…	…
Vehicle longitude	degree	GPS
H_2O concentration [8]	**per cent**	**Gas analyser**
Total fuel consumed (lifetime)	**kg**	**OBFCM device or ECU (if applicable)**
Total fuel consumed (lifetime)	**l**	**OBFCM device or ECU (if applicable)**
Total distance travelled (lifetime)	**km**	**OBFCM device or ECU (if applicable)**
Engine fuel rate	**g/s**	**OBFCM device or ECU (if applicable)**
Engine fuel rate	**l/h**	**OBFCM device or ECU (if applicable)**
Vehicle fuel rate	**g/s**	**OBFCM device or ECU (if applicable)**
Vehicle total mass	**kg**	**OBFCM device or ECU (if applicable)**

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Table 1: Test parameters

Parameter	Unit	Source
THC concentration[1]	ppm	Gas analyser
CO concentration[1]	ppm	Gas analyser
NO_X concentration[1]	ppm	Gas analyser
CO_2 concentration[1, 5]	ppm	Gas analyser
CH_4 concentration[1, 2, 5]	ppm	Gas analyser
PM number concentration	#/cm^3	PM number analyser
Dilution setting (if applicable)	-	PM number analyser
Exhaust gas flow	kg/h	Exhaust Flow Meter (hereinafter EFM)
Exhaust temperature	K	EFM
Ambient temperature[3]	K	Sensor
Ambient pressure	kPa	Sensor
Engine torque[4]	Nm	ECU or Sensor
Engine speed	rpm	ECU or Sensor
Engine fuel flow	g/s	ECU or Sensor
Engine coolant temperature	K	ECU or Sensor
Engine intake air temperature[3]	K	Sensor
Vehicle ground speed	km/h	ECU and GPS
Vehicle latitude	degree	GPS
Vehicle longitude	degree	GPS
Lambda value [6]	-	ECU or Sensor
Air mass flow [7]	kg/h	ECU or Sensor

OICA Comment

- The current UNR49 07 series has λ and Air mass flow under Vehicle longitude.
- However, these two items are missing from the current proposal and need to be added.

Specific comments - Annex 8, Appendix 2

Portable measurement equipment

A.2.2.3. Sampling of gaseous emissions
The sampling probes shall meet the requirements defined in paragraphs A.2.1.2. and A.2.1.3. of Appendix 2 to Annex 4 to this Regulation.

OICA Comment

- It is inconsistent with the sampling line temperatures for FTIR and QCL specified in Annex 4 9.3.2.8, 9.3.2.9 and Annex 4 Appendix 9.2.2.2.
- Therefore, it is considered necessary to add FTIR and QCL requirements in the PEMS.

A.2.2.3. Sampling of gaseous emissions
The sampling probes shall meet the requirements defined in paragraphs A.2.1.2. and A.2.1.3. of Appendix 2 to Annex 4 to this Regulation. **The sampling line shall be heated to 190 deg. C (+/-10 deg. C).**