
Instruments for measuring vehicle exhaust emissions

Part 3: Report Format

Instruments de mesure des gaz d'échappement des véhicules

Partie 3: Modèle de Rapport



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Foreword

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- **International Documents (OIML D)**, which are informative in nature and which are intended to harmonize and improve work in the field of legal metrology;
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International Recommendations, Documents, Guides and Basic Publications are published in English (E) and translated into French (F) and are subject to periodic revision. Additionally, the OIML publishes or participates in the publication of **Vocabularies (OIML V)** and periodically commissions legal metrology experts to write **Expert Reports (OIML E)**. Expert Reports are intended to provide information and advice, and are written solely from the viewpoint of their author, without the involvement of a Technical Committee or Subcommittee, nor that of the CIML. Thus, they do not necessarily represent the views of the OIML.

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Bureau International de Métrologie Légale
11, rue Turgot - 75009 Paris - France
Telephone: 33 (0)1 48 78 12 82
Fax: 33 (0)1 42 82 17 27
E-mail: biml@oiml.org
Internet: www.oiml.org

Instruments for measuring vehicle exhaust emissions

Part 3 - Report Format for Type Evaluation

1 Introduction

All references in this Report Format are to OIML R 99-1 & 2:2008. This Report Format applies for any kind of instrument for measuring vehicle exhaust emissions (independent of its technology). It presents a standardized format for the results of the various tests and examinations, described in Part 2 of OIML R 99-1 & 2:2008, to which a type of an instrument for measuring vehicle exhaust emissions shall be submitted with a view to its approval based this OIML Recommendation.

It is recommended that all metrology services or laboratories evaluating and/or testing types of instruments for measuring vehicle exhaust emissions according to OIML R 99-1 & 2:2008, or to national or regional regulations based on Part 1 of R 99-1 & 2:2008, use this Report Format, directly or after translation into a language other than English or French. In case of a translation, it is highly recommended to leave the structure and the numbers of the clauses unchanged: in this case most of the contents is also understandable for those who can not read the language of the translation.

It is also recommended that this Report Format in English or in French (or in both languages) be transmitted by the country performing the tests to the relevant authorities of another country, when requested for issuing a national or regional type approval.

In the practical application of the Report Format, in addition to a cover page by the Issuing Authority, as a minimum clauses A–F (as necessary) shall be included.

2 Applicability of this Report Format

In the framework of the *OIML Certificate System for Measuring Instruments*, and the *OIML Mutual Acceptance Arrangement (MAA)* applicable to instruments for measuring vehicle exhaust emissions in conformity with Part 1 of R 99-1 & 2:2008, use of this Report Format is mandatory, in French and/or in English with translation into the national languages of the countries issuing such Certificates, if appropriate.

Implementation of this Report Format is informative with regard to the implementation of Part 1 of OIML R 99-1 & 2 in national regulations.

3 Guidance for the application of this Report Format

Key to the symbols and expressions used on the following pages:

The “summary of the results” and the “results of the tests” shall be completed according to the following examples:

	Class 00	Class 0	Class I	No	
Passed for	x				passed for class 00
Passed for		x	x		passed for class 0 and I
Passed for				x	failed for all classes
Passed for	/	/	/	/	test is not applicable for this instrument

Unless prescribed otherwise, “Date” in the reports refers to the date of testing.

Note (1) Instead of the prescribed volume fractions in % vol, test gases with the same fractions in % mol can be used as well.

Note (2) The name(s) or symbol(s) of the unit(s) used to express the test results shall be specified in each form.

In case a prescribed test is not relevant for the type of instrument to be tested, the reason why the test is omitted shall be clearly stated in the field “Remarks” (for instance surge tests on signal lines shorter than 30 m, tests related to AC mains supply in the case of an instrument only powered by batteries, or partial testing after modification of a previously tested type).

The number of the report and the page numbers shall be completed in the heading.

Pages 1–6 of this Report Format may be replaced by a cover page by the Issuing Authority.

The user is free to change the length of the cells (for instance “Remarks”) as required in a specific case.

4 The Evaluation Report

The format for the Report is given on the following pages.

Cover page by the Issuing Authority

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A Authority responsible for this Report

Name	
Address	
Report number	
Application number	
Period of tests	
Date of issuing this Report	
Name and signature of the person responsible	
Stamp(s) (if applicable)	

B Synopsis of the results of the examinations and tests*(To be completed by the Issuing Authority)*

The tested specimen fulfils ALL the applicable requirements in OIML R 99-1 & 2:2008 Part 1 for:			
<input type="checkbox"/> Class 00	<input type="checkbox"/> Class 0	<input type="checkbox"/> Class I	<input type="checkbox"/> No
Remarks:			

C Summary of the results of the examination and tests

(To be completed by the Issuing Authority)

C.1 Examinations

(Refer to clauses in R 99-1 & 2)

For details, refer to the examination: clause E of this Report as indicated in the last column.

Clause(s)	General requirements	Complies		details in
		Yes	No	
5.1	Indication of the measured result			E.1
5.2	Measuring range			E.1
5.3	Resolution of indication			E.1
5.4	Durable recording of measuring results			E.2
5.11	Lambda calculation			E.3
6.1.1	Materials			E.4
6.1.2	Sampling probe			E.5
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6.1.9	Interface / Data printer			E.10
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6.3.1, -2, -3, -4, -5	Checking facilities			E.14
6.3.6, -7, -8	No measurements when not adjusted			E.15
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7.1	Inscriptions			D.4
7.2	Operating instructions			E.19
8.1.1	Documentation for the type approval			E.20

C.2 Performance tests*(Refer to Annex A of OIML R 99-1 & 2)*

For details, refer to the tests: clause F of this Report as indicated in the last column.

Clause	Performance tests	Complies				Details in
		Class 00	Class 0	Class I	No	
A.2	Error curve					F.1
A.3	Stability with time or drift					F.2
A.4	Repeatability					F.3
A.5	Dry heat					F.4
A.6	Cold					F.5
A.7	Damp heat, steady state					F.6
A.8	Atmospheric pressure					F.7
A.9	Voltage and frequency variation					F.8
A.10	Cross sensitivity					F.9
A.11	Mechanical shock					F.10
A.11	Vibrations					F.11
A.12	AC voltage dips, short interruptions and voltage variations					F.12
A.13	Burst (transients)					F.13
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A.15	Electrostatic discharge					F.15
A.16	Surges on data, control and power lines					F.16
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A.18	Mains frequency magnetic fields					F.18
A.19	Warm-up time					F.19
A.20	Response time					F.20
A.21	Low flow					F.21
A.22	Leakage					F.22
A.23	HC residue					F.23
A.24	Filter unit					F.24
A.25	Water separator					F.25
A.26	Propane/hexane equivalency factor (PEF)					F.26

D General information**D.1 Manufacturer**

Company	
Address	

D.2 Applicant

Company	
Representative	
Address	
Reference	
Date of application	

Remarks:

D.3 Testing laboratories involved in the tests*(This table is to be completed for each test laboratory)*

Name			
Address			
Application number			
Tests by this laboratory			
Date/period of tests			
Name(s) of test engineer(s)			
Accredited by		Number:	Expires (date):
Accreditation includes R 99-1 & 2	<input type="checkbox"/> Yes		<input type="checkbox"/> No
Details of relevant peer assessment or assessment by other means			
In case tests have been performed at another location than the premises of this laboratory, give details here			
Name of the person responsible			
Date of signature			
Stamp (if applicable) and signature of the person responsible			

Remarks:

--

D.4 General information concerning the type
and the sample(s) supplied for the tests
(as stated on the instrument / provided by the manufacturer)

Information indicated on the instrument (<i>ref. R 99-1 & 2 Part 1, 7.1</i>)			
Manufacturer's trade mark			
Year of manufacture			
Accuracy class			
Type designation			
Model number (<i>if applicable</i>)			
Serial number(s) of the sample(s)			
Instrument is pressure compensated		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Type description of the <u>main</u> transducer			
Serial number of the <u>measuring</u> transducer			
Type of the oxygen fuel cell			
Type(s) of other oxygen fuel cell(s)			
Serial number of the oxygen fuel cell			
Minimum flowrate			
Nominal flowrate			
Electrical power			
Propane/hexane equivalency factor	single value		
	200 ppm vol C ₃ H ₈		
	2 000 ppm vol C ₃ H ₈		
	4 000 ppm vol C ₃ H ₈		
Identification of software	Version number		
	Checksum/identification code		
CO	Maximum measured value:	% vol	Resolution of indication: % vol
CO ₂	Maximum measured value:	% vol	Resolution of indication: % vol
HC	Maximum measured value:	ppm vol	Resolution of indication: ppm vol
O ₂	Maximum measured value:	% vol	Resolution of indication: % vol

Remarks:

D.5 Accessories supplied by the applicant

Battery (if applicable)	type	
	nominal voltage	
	number required	
Operating instructions		
Data printer (if applicable)		
Cables		
Sampling probe		
Ancillary facilities		
Other accessories:		

D.6 Selection of sample(s) tested

<p>In case the tests and examination are valid for more versions, give full details of the types, versions, measuring ranges, etc.:</p>
<p>Justification of the selection of the sample(s):</p>

D.7 Adjustments and modifications

Adjustments, modifications, and repairs made to the samples during the testing:

D.8 Additional information concerning the type

Additional remarks and/or information (connection equipment, interfaces, etc.):

D.9 Documentation supplied by the applicant

See E.20

Remarks:

D.10 Information concerning the test equipment used for the type evaluation
(including details of simulations)

If applicable, the laboratory is free to provide this information, instead of a complete overview here, in the appropriate chapter F.x in an extra field below the 1st table (with "Date & Time", etc.). In this case a statement shall be made in this field.

E Examination

(To be completed by the Examining Authority)

E.1 Indication, measuring range, units and resolution (5.1, 5.2, 5.3)

Date:	Observer:	Serial number:
--------------	------------------	-----------------------

Simultaneous indication of the gas components (5.1): Yes No

	Indication (5.1)	Measuring range (5.2)	Resolution (5.3)	
CO		% vol	% vol	
CO ₂		% vol	% vol	
O ₂		% vol	O ₂ ≤ 4 % vol	% vol
			O ₂ > 4 % vol	% vol
HC		ppm vol	ppm vol	

Remarks:

Passed for	Class 00	Class 0	Class I	No

E.2 Durable recording of results (5.4)

Date:	Observer:	Serial number:
--------------	------------------	-----------------------

The instrument is provided with:	Internal	External	No
printing device			
memory device			

Printer fulfils requirements	Yes	No
a) Clarity of print		
b) Resolution		
c) Size of figures		
d) Printed units		

e) Data transmission for external printer: See E.10

Remarks:

Passed for	Class 00	Class 0	Class I	No

E.3 Lambda calculation (5.11)

Date:	Observer:	Serial number:
-------	-----------	----------------

	Yes	No
The instrument is provided with a lambda calculation		
Formula for lambda calculation as in Annex D of OIML R 99-1 & 2		
Maximum permissible error in the lambda calculation according to 5.11		
Indication of the lambda value according to 5.11		
Other applied formula:		
Remarks		

Passed for	Class 00	Class 0	Class I	No

E.4 Materials used (6.1.1)

Date:	Observer:	Serial number:
-------	-----------	----------------

	Fulfil requirements	
	Yes	No
Gas handling system		
Sampling probe		
Risk of influence on gas samples		
Pipe		
Remarks:		

Passed for	Class 00	Class 0	Class I	No

E.5 Size of sampling probe (6.1.2)

Date:	Observer:	Serial number:
-------	-----------	----------------

		Fulfil requirements	
		Yes	No
Length of probe:	cm		
Retaining device			
Remarks:			

Passed for	Class 00	Class 0	Class I	No

E.6 Filter (6.1.3.1)

Date:	Observer:	Serial number:
-------	-----------	----------------

		Fulfil requirements	
		Yes	No
Size of filter (particles)	µm		
Contamination observable			
Replaceable without special tools			
Remarks:			

Passed for	Class 00	Class 0	Class I	No

E.7 Water separator (6.1.4.2)

Date:	Observer:	Serial number:
-------	-----------	----------------

Requirement	Fulfil requirements	
	Yes	No
The instrument has a water separator		
Empties automatically in case of saturation		
Measurement operation automatically stopped in case of saturation		
Remarks:		

Passed for	Class 00	Class 0	Class I	No

E.8 Port for ambient air / Charcoal filter (6.1.5)

Date:	Observer:	Serial number:
-------	-----------	----------------

	Present				Fulfil requirements	
	Yes	No	Upstream	Downstream	Yes	No
HC channel						
Port for ambient air						
Charcoal filter						
Port for reference gas						
Means to maintain pressure						
Remarks:						

Passed for	Class 00	Class 0	Class I	No

E.9 Pump (6.1.6)

Date:	Observer:	Serial number:
-------	-----------	----------------

	Fulfil requirements	
	Yes	No
Effect of vibrations on measurements		
Possible to turn on/off separately		
Possible to make a measurement when pump is off		
Automatic flush with ambient air before pump is switched off <i>(not mandatory)</i>		
Remarks:		

Passed for	Class 00	Class 0	Class I	No

E.10 Interface (6.1.9)

Date:	Observer:	Serial number:
-------	-----------	----------------

	Present		Fulfil requirements	
	Yes	No	Yes	No
Interface				
Printer <i>(see also E.2)</i>				
Other data storage				
Description of data storage:				
Remarks:				

Passed for	Class 00	Class 0	Class I	No

E.11 Adjustment facilities (6.2.1, 6.2.2)

Date:	Observer:	Serial number:
-------	-----------	----------------

Adjustment facilities	Requirement (*)	Actual (*)			
		No	M	SA	A
Zero-setting	A				
Gas calibration	M, SA, or A				
Internal adjustment	A				
(*) M = Manual, SA = Semi-automatic and A = Automatic					
Remarks:					

Passed for	Class 00	Class 0	Class I	No

E.12 Cross-influence of adjustments (6.2.3)

Date:	Observer:	Serial number:
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Any cross-influence found	Yes	No
If "Yes", give details here:		
Remarks:		

Passed for	Class 00	Class 0	Class I	No

E.13 Negative indications (6.2.4)

Date:	Observer:	Serial number:
-------	-----------	----------------

Negative indication down to	
Remarks:	

Passed for	Class 00	Class 0	Class I	No

E.14 Disturbances / checking facilities (6.3.1, -2, -3, -4, -5)

Occurrence of significant faults (6.3.1): for test results, please refer to F.11 - F.18)

Date:	Observer:	Serial number:
-------	-----------	----------------

		Present		Function ⁽¹⁾	
		Yes	No	P	I
Checking <i>facilities</i> present	(6.3.1)				
Possibility to check the <i>facilities</i>	(6.3.1)				
Checking facility HC residue	(6.3.2, -3)				
Automatic recognition of <i>malfunctioning of</i> O ₂ sensor	(6.3.4)				
Warm-up check	(6.3.5, a)				
Low flow check	(6.3.5, b)				
HC residue check	(6.3.5, c)				
Internal reference adjustment check	(6.3.5, d)				
Gas adj. check (6.3.5, e)	Time interval: month				
Leak check ⁽²⁾ (6.3.5, f)	Time interval: h				

⁽¹⁾ P = permanent automatic, I = Intermittent automatic

⁽²⁾ For test results of leak check, refer to F.22

Remarks:					
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Passed for	Class 00	Class 0	Class I	No

E.15 Measurements when not adjusted (6.3.6, 6.3.7, 6.3.8)

Date:	Observer:	Serial number:
-------	-----------	----------------

Adjustment facility	Automatic	Semi automatic

Adjustment facility	Possibility / warning		Meets requirement	
	Yes	No	Yes	No
Possibility to make a measurement when adjustment is not completed (6.3.6)				
Possibility to make a measurement when adjustment is required (6.3.7)				
Warning for required adjustment (6.3.8)				

Remarks:

Passed for	Class 00	Class 0	Class I	No

E.16 Sealing (6.3.9)

Date:	Observer:	Serial number:
-------	-----------	----------------

Effective sealing / other protection of:	Yes	No
Adjustment means		
Software integrity		
Disposable oxygen fuel cell		
Others:		

Remarks:

Passed for	Class 00	Class 0	Class I	No

E.17 Software (6.3.10)

Date:	Observer:	Serial number:
Version of software:		Identification code:

	Yes	No
Software protected by sealing		
Automatic change of identification code		
Fixed version number		

Remarks:

Passed for	Class 00	Class 0	Class I	No

E.18 Influence by remote devices (6.3.11)

Date:	Observer:	Serial number:
-------	-----------	----------------

	Yes	No
Possible influence by remote devices		

Remarks:

Passed for	Class 00	Class 0	Class I	No

E.19 Operating instructions (7.2)

Date:		Observer:
Language(s):		
Version:		

	Yes	No	N/A	Remarks
Operating instructions available (7.2.1)				
Time intervals for adjustment (7.2.2.a)				
Adjustment procedures (7.2.2.a)				
Time intervals for maintenance (7.2.2.a)				
Maintenance procedures (7.2.2.a)				
Time interval of leak test (7.2.2.a)				
Leakage test procedure (7.2.2.b)				
HC-residue check instruction (7.2.2.c)				
Storage temperature (7.2.2.d)				
Specifications of portable generator (7.2.2.e)				
Rated operating conditions, etc. (7.2.2.f)				
Formula of lambda calculation (7.2.2.g)				
Replacement of oxygen fuel cell (7.2.2.h)				
External power converter (7.2.2.i)				
Compatibility ancillary equipment (7.2.2.j)				
Temperature range (7.2.2.k)				
Specific conditions (7.2.2.l)				<i>Give details below in "remarks"</i>
Specifications of battery (7.2.2.m)				

Remarks:

Passed for	Class 00	Class 0	Class I	No

F Performance tests

F.1 Error curve (9.1, A.2)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:	

Concentration (mixtures E, F, G and/or H, and L ^(*))			Error	Maximum permissible error
Recommended reference value	Actual reference value	Indicated value		
% vol CO	% vol CO	% vol CO	% vol CO	% vol CO
0.5				
1.0				
3.5 / 5				
0.25				
% vol CO ₂	% vol CO ₂	% vol CO ₂	% vol CO ₂	% vol CO ₂
6				
10				
14				
3				
ppm vol HC	ppm vol HC	ppm vol HC	ppm vol HC	ppm vol HC
100				
300				
1 000				
40				
% vol O ₂	% vol O ₂	% vol O ₂	% vol O ₂	% vol O ₂
0.5				
10				
20.9				
0				

^(*) Mixture L only applicable for Class 0 and Class 00

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.2 Stability with time or drift (9.2, A.3)

It is suggested (but not mandatory) to combine this test with Test A.19 (see F.19)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

Warm-up time: h, min at reference conditions

Time following the warm-up time	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
0 min				
2 min (*)				
5 min (*)				
15 min (*)				
½ h				
1 h				
1½ h				
2 h				
2½ h				
3 h				
3½ h				
4 h				
Maximum error				
MPE				

() Only applicable when this test is combined with the test for the warm-up time in F.19*

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.3 Repeatability (9.3, A.4)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

Indication No.	% vol CO		% vol CO ₂		ppm vol HC		% vol O ₂	
	air	test gas	air	test gas	air	test gas	air	test gas
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
$\sigma^{(1)}$								
criterion ⁽²⁾								

Notes:
⁽¹⁾ Here, σ is the experimental standard deviation according to 5.13 of R 99-1 & 2
⁽²⁾ The criterion is one third of the modulus of the maximum permissible error on initial verification

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.4 Dry heat (40 °C) (9.4.1,a, A.5)

Date & Time	Start:	Observer:		
	Finish:	PEF:		
Ambient pressure:		hPa	Relative humidity: %	
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:	

Test gases A, C	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5 / 3.5	14	100 / 1 000		0.5
Actual	Gas A				
	Gas C				

Heating time:	h	min	Temperature (40°C):	°C
---------------	---	-----	---------------------	----

Time after heating up	Gas	Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
0 min	A				
	C				
½ h	A				
	C				
1 h	A				
	C				
1½ h	A				
	C				
2 h	A				
	C				
Maximum error					
MPE					

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.5 Cold (5 °C) (9.4.1,b A.6)

Date & Time	Start:	Observer:		
	Finish:	PEF:		
Ambient pressure:		hPa	Relative humidity: %	
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:	

Test gases A, C	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5 / 3.5	14	100 / 1 000		0.5
Actual	Gas A				
	Gas C				

Cooling-down time:	h	min	Temperature (5 °C):	°C
--------------------	---	-----	---------------------	----

Time after heating up	Gas	Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
0 min	A				
	C				
½ h	A				
	C				
1 h	A				
	C				
1½ h	A				
	C				
2 h	A				
	C				
Maximum error					
MPE					

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.6 Damp heat, steady state (30 °C, 85 % RH) (9.4.1.c, A.7)

Date & Time	Start:	Observer:		
	Finish:	PEF:		
Ambient pressure:		hPa		
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:	

Test gases A, C	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5 / 3.5	14	100 / 1 000		0.5
Actual	Gas A				
	Gas C				

Exposure time: h	min	Temperature (30 °C): °C	Relative humidity (85 %): %
------------------	-----	-------------------------	-----------------------------

Time after heating up	Gas	Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
1 day	A				
	C				
2 days	A				
	C				
Maximum error					
MPE					

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.7 Atmospheric pressure (9.4.1.d, A.8)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:		Transducer:	
			O ₂ fuel cell:	

Test gases A, C	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5 / 3.5	14	100 / 1 000		0.5
Actual	Gas A				
	Gas C				

Pressure	Gas	Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Ambient: hPa	A				
	C				
High: hPa	A				
	C				
Low: hPa	A				
	C				
Ambient: hPa	A				
	C				
Maximum error					
MPE					

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.8 Voltage and frequency variations (9.4.1.e, A.9)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

F.8.1 Mains (AC) Voltage and frequency variations (A.9.1)

Mains voltage $f =$ Hz	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
$U_{nom} =$ V				
+ 10 %: V				
- 15 %: V				
Maximum error				
MPE				

Mains frequency $U =$ V	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
$f_{nom} =$ Hz				
+ 2 %: Hz				
- 2 %: Hz				
Maximum error				
MPE				

F.8.2 Battery voltage variation (A.9.2 and A.9.3)

Battery voltage		Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
U_{nom}	V DC				
Upper limit	V DC				
Lower limit	V DC				
Maximum error					
MPE					

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.9 Cross sensitivity (9.4.2, A.10)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:	Transducer:		O ₂ fuel cell:	

Test F.9.1.1 (A.10.1.1) Gas mixture in N ₂			Indication			
Recom- mended	Actual	Unit	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
a)	pure	N ₂ , dry				
b)	16	% vol CO ₂				
	6	% vol CO				
	10	% vol O ₂				
	5	% vol H ₂				
	0.3	% vol NO				
	2 000	ppm vol C ₆ H ₁₄				
	N ₂ , water saturated					
Maximum influence on zero indication						
Remarks:						

Test F.9.1.2 (A.10.1.2) All measurands in N ₂ Gases J, K		Indication					
		% vol CO	% vol CO ₂	ppm vol HC	Standard Water	Gas J % O ₂	Gas K % H ₂
Recommended reference value		3.5	14	1 000	saturation	10 %	5 %
a) Measurands in pure N ₂	Actual reference value						
	Indicated value single gas						
	Error						
b) All measurands together in N ₂	Actual reference value						
	Indicated values combined gas						
	Error						
Difference between the errors							
Maximum permissible difference							
Remarks:							

Passed for	Class 00	Class 0	Class I	No

F.10 Mechanical shock (*free fall, 9.5.a, A.11.1*)
 (*one fall over 25 mm on each bottom edge*)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Before shocks				
After shocks				
Maximum fault				
Criterion (*)				

(*) *The criterion is the modulus of the maximum permissible error on initial verification*

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.11 Vibrations (9.5.a, A.11.2)

(only applicable for hand-held instruments)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:	Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
before vibration				
after vibration				
Maximum fault				
Criterion (*)				

() The criterion is the modulus of the maximum permissible error on initial verification*

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.12 AC voltage dips, short interruptions and voltage variations (9.5.b, A.12)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

$f_n =$ Hz	Reduction to	Duration [cycles]	Indication			
			% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Test						
Without reduction	-	-				
Dips a	V					
	%					
Dips b	V					
	%					
Dips c	V					
	%					
Short interruptions	V					
	%					
Maximum fault						
Criterion (*)						

(*) The criterion is the modulus of the maximum permissible error on initial verification

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.13 Voltage bursts (9.5.c, A.13)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

Burst		Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without bursts					
Phase	+ kV				
	- kV				
Without bursts					
Neutral	+ kV				
	- kV				
Without bursts					
Protective earth	+ kV				
	- kV				
Without bursts					
Port 1 (*)	+ kV				
	- kV				
Without bursts					
Port 2 (*)	+ kV				
	- kV				
Without bursts					
Port 3 (*)	+ kV				
	- kV				
Without bursts					
Port 4 (*)	+ kV				
	- kV				
Without bursts					
Port 5 (*)	+ kV				
	- kV				
Without bursts					
Maximum fault					
Criterion (*)					

(*) The criterion is the modulus of the maximum permissible error on initial verification

(*) Description of the ports:
 Port 1:
 Port 2:
 Port 3:
 Port 4:
 Port 5:

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.14 Transient conduction (road vehicle battery: 9.5.d, A.14)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:	Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

<i>U_n</i> =	V	Indication			
Transient ⁽¹⁾		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without transients					
Pulse 2a	+	V			
	-	V			
Without transients					
Pulse 2b	+	V			
	-	V			
Without transients					
Pulse 3a	+	V			
	-	V			
Without transients					
Pulse 3b	+	V			
	-	V			
Without transients					
Pulse 4	+	V			
	-	V			
Without pulses					
Maximum fault					
Criterion ⁽²⁾					

⁽¹⁾ Pulses according to ISO 7637-2

⁽²⁾ The criterion is the modulus of the maximum permissible error on initial verification

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.15 Electrostatic discharge (9.5.e, A.15)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

F.15.1 Direct application on the instrument

F.15.1.1 Contact mode (6 kV) for instrument with ground terminal

Discharge	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
without discharge				
+ 2 kV				
+ 4 kV				
+ 6 kV				
without discharge				
- 2 kV				
- 4 kV				
- 6 kV				
without discharge				
Maximum fault				
Criterion (*)				

() The criterion is the modulus of the maximum permissible error on initial verification*

In case the instrument fails this test, indicate the test point(s):

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.15.1.2 Air mode (8 kV) for instrument without ground terminal				
Discharge	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
without discharge				
+ 2 kV				
+ 4 kV				
+ 6 kV				
+ 8 kV				
without discharge				
- 2 kV				
- 4 kV				
- 6 kV				
- 8 kV				
without discharge				
Maximum fault				
Criterion (*)				
<i>(*) The criterion is the modulus of the maximum permissible error on initial verification</i>				
In case the instrument fails this test, indicate the test point(s):				
Remarks:				

Passed for	Class 00	Class 0	Class I	No

F.15.2 Indirect application on object (plane) near the instrument: contact mode (6 kV)

F.15.2.1 Horizontal plane under the instrument				
Discharge	indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
without discharge				
+ 2 kV				
+ 4 kV				
+ 6 kV				
without discharge				
- 2 kV				
- 4 kV				
- 6 kV				
without discharge				
Maximum fault				
Criterion (*)				
<i>(*) The criterion is the modulus of the maximum permissible error on initial verification</i>				
In case the instrument fails this test, indicate the test point(s):				
Remarks:				

Passed for	Class 00	Class 0	Class I	No

F.15.2.2 Vertical plane on 0.1 m distance				
Discharge	indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
without discharge				
+ 2 kV				
+ 4 kV				
+ 6 kV				
without discharge				
- 2 kV				
- 4 kV				
- 6 kV				
without discharge				
Maximum fault				
Criterion (*)				
(*) <i>The criterion is the modulus of the maximum permissible error on initial verification</i>				
In case the instrument fails this test, indicate the test point(s) and the orientation(s) of the plane:				
Remarks:				

Passed for	Class 00	Class 0	Class I	No

F.16 Surges (9.5.f, A.16)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

F.16.1 On AC mains power lines (A.16)

	Angle	Voltage and Polarity	Number of surges	Indication			
				% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without surges							
Line to line	0 °						
	90 °						
	180 °						
	270 °						
Line to earth	0 °						
	90 °						
	180 °						
	270 °						
Maximum fault							
Criterion (*)							
<i>(*) The criterion is the modulus of the maximum permissible error on initial verification</i>							
Action of checking facility:							
Remarks:							

Passed for	Class 00	Class 0	Class I	No

F.16.2 On signal, data and control lines (A.16)
(including connections for external batteries)

Surge applied on	Voltage and Polarity	Number of surges	Indication			
			% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without surges						
Line 1 (*)						
Line 2 (*)						
Line 3 (*)						
Line 4 (*)						
Line 5 (*)						
Maximum fault						
Criterion (*)						
<i>(*) The criterion is the modulus of the maximum permissible error on initial verification</i>						
(*) Description of the ports: Line 1: Line 2: Line 3: Line 4: Line 5:						
Action of checking facility:						
Remarks:						

Passed for	Class 00	Class 0	Class I	No

F.17 Radio frequency immunity (9.5.g, A.17)

F.17.1 Radiated fields (A.17.1)

Date & Time	Start:	Observer:			
	Finish:	PEF:			
Ambient temperature:	°C	Ambient pressure:	hPa	Relative humidity:	%
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:		

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

80 MHz to 2 GHz, 10 V/m, 80 % AM, 1 kHz sine wave		Indication			
Polarization	Facing EUT	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without field					
Vertical	Front				
	Right				
	Left				
	Rear				
Horizontal	Front				
	Right				
	Left				
	Rear				
Maximum fault					
Criterion (*)					

(*) The criterion is the modulus of the maximum permissible error on initial verification

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.17.2 Conducted fields (9.5.h, A.17.2)

Date & Time	Start:	Observer:			
	Finish:	PEF:			
Ambient temperature:	°C	Ambient pressure:	hPa	Relative humidity:	%
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:		

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

0.15 MHz to 80 MHz, 10 V/m 80 % AM, 1 kHz sine wave	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without field				
Port:				
Port:				
Port:				
Port:				
Port:				
Port:				
Port:				
Maximum fault				
Criterion (*)				

() The criterion is the modulus of the maximum permissible error on initial verification*

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.18 Mains frequency magnetic fields (9.5.h, A.18)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:	Transducer:		O ₂ fuel cell:

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

30 A/m f= Hz	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Without field				
With field (direction with maximum effect)				
Maximum fault				
Criterion (*)				

() The criterion is the modulus of the maximum permissible error on initial verification*

Direction of field with maximum effect

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.19 Warm-up time (9.6.a, A.19)

It is suggested (but not mandatory) to combine this test with Test A.3 (see F.2)

Date & Time	Start:	Observer:			
	Finish:	PEF:			
Ambient temperature:	°C	Ambient pressure:	hPa	Relative humidity:	%
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:		

Warm-up time, prescribed by manufacturer:
The instrument has an automatic warm-up lockout: <input type="checkbox"/> Yes <input type="checkbox"/> No

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

		Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Reference conditions <i>(not necessary if combined with test A.3)</i>	after 0 min				
	after 2 min				
	after 5 min				
	after 15 min				
	Max. difference				
	Criterion (*)				
5 °C	after 0 min				
	after 2 min				
	after 5 min				
	after 15 min				
	Max. difference				
	Criterion (*)				

() The criterion is the modulus of the maximum permissible error on initial verification*

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.20 Response time (9.6.b, A.20)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas B	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0
Actual					

	Indicated / calculated value			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Air				
Final value				
95 % of final value				N/A
Final value + 0.1 %	N/A	N/A	N/A	

	Time after switch from air to test gas			
	CO	CO ₂	HC	O ₂
Time until 95 % of final value				N/A
Time until final value + 0.1 %	N/A	N/A	N/A	
Criterion	15 s	15 s	15 s	60 s

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.21 Low flow (9.5.2.c, A.21)

Date & Time	Start:	Observer:			
	Finish:	PEF:			
Ambient temperature:	°C	Ambient pressure:	hPa	Relative humidity:	%
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:		

Test gas A	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0.5
Actual					

Flow	l/min	Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Nominal					
Low (*)					

(*) Low flow indication:

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.22 Leakage (9.6.d, A.22)

Date & Time	Start:	Observer:			
	Finish:	PEF:			
Ambient temperature:	°C	Ambient pressure:	hPa	Relative humidity:	%
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:		

Test gas B	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	100		0
Actual					

Position of the artificial adjustable leakage:

Leakage	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Leak closed				
With leakage				
Difference				
Criterion				

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.23 HC residue (9.6.e, A.23)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:	Transducer:		O ₂ fuel cell:

Test gas I	% vol CO	ppm vol HC
Recommended	3.5	1 000
Actual		

Details of the specially adjusted engine:

Exhaust gas:	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	> 5		> 800		
Actual (measured)					

Time	Temp °C	Measurand	Indication			
			% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
		Ambient air				
		Exhaust gas (> 5 min)				
		HC residue check	N / A	N / A	N / A	N / A
		Test gas				
Error						
MPE						

Error message during HC residue check routine? Yes No

Measurements possible during HC residue check routine? Yes No

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.24 Filter unit (9.6.f, A.24)

Date & Time	Start:	Observer:			
	Finish:	PEF:			
Ambient temperature:	°C	Ambient pressure:	hPa	Relative humidity:	%
Serial no.:	Instrument:	Transducer:	O ₂ fuel cell:		

Test gas D	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	3.5	14	1 000		0
Actual					

Time	Measurand	Indication			
		% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
	Ambient air				
	Exhaust gas (> 30 min)				
	HC residue check	N / A	N / A	N / A	N / A
	Test gas				
Error (last measurement):					
MPE					
Response time during test:					

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.25 Water separator (9.6.g, A.25)

Date & Time	Start:		Observer:		
	Finish:		PEF:		
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %	
Serial no.:	Instrument:		Transducer:		O ₂ fuel cell:

Test gas D	% vol CO	% vol CO ₂	ppm vol HC	ppm vol C ₃ H ₈	% vol O ₂
Recommended	0.5	14	1 000		0
Actual					

F.25.1 High temperature (40 °C) with wet gas: water saturated N₂ / ambient air (A.25.1)

Temperature: °C	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Test gas				
30 minutes wet gas				
Test gas				
Error				
MPE				

Response time after 30 min wet gas:

	Indicated / calculated value (oxygen-free gas)			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Air				
Final value				
95 % of final value				N/A
Final value + 0.1 %	N/A	N/A	N/A	

	Time after switch from air to test gas			
	CO	CO ₂	HC	O ₂
Time until 95 % of final value				N/A
Time until final value + 0.1 %	N/A	N/A	N/A	

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.25.2 Low ambient temperature with exhaust gas (A.25.2)

Temperature: °C	Indication			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Test gas				
30 minutes exhaust gas				
Test gas				
Error				
MPE				

Response time after 30 min wet gas:

	indicated / calculated value (oxygen-free gas)			
	% vol CO	% vol CO ₂	ppm vol HC	% vol O ₂
Air				
Final value				
95 % of final value				N/A
Final value + 0.1 %	N/A	N/A	N/A	

	Time after switch from air to test gas			
	CO	CO ₂	HC	O ₂
Time until 95 % of final value				N/A
Time until final value + 0.1 %	N/A	N/A	N/A	

Remarks:

Passed for	Class 00	Class 0	Class I	No

F.26 Propane/Hexane factor (PEF) (9.6.h A.26)

Date & Time	Start:		Observer:	
	Finish:		PEF:	
Ambient temperature: °C		Ambient pressure: hPa		Relative humidity: %
Serial no.:	Instrument:		Transducer:	
			O ₂ fuel cell:	

Test gas	ppm vol propane ^(a)		ppm vol n-hexane ^(c)	
Recommended	200	2 000	100	1 000
Actual				
Actual as HC ^(b)				
Indication as HC				
Error (HC) ^{(b)+(d)}				
MPE ^(*)				
1/2 MPE ^(*)				
Difference errors ^(e)	200 ppm propane / 100 ppm vol n-hexane			
	2 000 ppm propane / 1 000 ppm vol n-hexane			
Formula for the calculation of PEF:				
Calculated PEF for high concentration:				
Calculated PEF for low concentration:				
Calculated mean value of PEF				
Notes: ^(a) , ^(b) , ^(c) , ^(d) , and ^(e) refer to steps in A.26 ^(*) whatever is applicable				
Remarks:				

Passed for	Class 00	Class 0	Class I	No