

Revision of OIML R126-1
Breath alcohol analysers
Requirements and test procedures
1st Committee draft – November 2004

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Requirements

1 Scope

This International recommendation applies to quantitative breath alcohol analysers which are instruments that automatically measure the mass concentration of alcohol in exhaled human breath.

However, for the purpose of this recommendation, only ethanol is considered as alcohol.

This Recommendation does not apply to instruments which do not indicate the result of measurement, but which only indicate whether the mass concentration of alcohol exceeds the allowed limits.

National authorities may require that breath alcohol analysers are equipped with special devices according to the national policy for fighting against alcoholism such as :

- device that detects the presence of alcohol in the upper respiratory tracts,
- prohibition of display or printing of results which do not represent the final measurement result,
- making mandatory a printing device,
- making the measurement impossible in case of no paper is detected in the printing device,
- requiring additional printed information.

National authorities may require that the breath alcohol analysers convert and display measurement result obtained in terms of ethanol content in the exhaled human breath either into physiological conditions or in terms of other quantities. This Recommendation does not cover the metrological performance of such devices.¹

The purpose of this Recommendation is to specify, the performance requirements of breath alcohol analysers, the tests procedures for type evaluation of breath alcohol analysers.

2 Terminology

2.1 Breath alcohol analyser

An instrument that measures within specified error limits and displays the breath alcohol mass concentration by analysing exhaled human breath.

2.2 Stationary breath alcohol analyser

An breath alcohol analyser intended only for use within buildings or places providing similar environmental conditions.

2.3 Mobile breath alcohol analyser

An breath alcohol analyser intended for use in mobile laboratory applications (e.g. in cars).

1 However it is advisable that national penal law defines offences in terms of alcohol in breath so that these instruments are more appropriately used

2.4 Portable breath alcohol analyser

A portable breath alcohol analyser is a hand-portable instrument that may be used outside buildings or mobile laboratories.

2.5 Deep lung air

Breath delivered from the mouth that originates from the alveoli of the lungs, normally referred to as end-expiratory breath.

2.6 Alveolar air

Air contained in the pulmonary alveoli.

2.7 Stand-by mode

The mode of the breath alcohol analyser in which only certain circuits are energised in order to conserve power and/or prolong component life, and to attain the measuring mode more rapidly than would be possible if starting from the un-powered state.

2.8 Measuring mode

The clearly marked mode in which the breath alcohol analyser can make measurements at the rate normally expected in service and in which it shall meet the performance requirements of this Recommendation.

2.9 Adjustment device

A device for adjusting the error(s) of the breath alcohol analyser when the instrument is in maintenance mode.

Note : Adjustment using a dry gas is possible provided that the difference of effect between wet and dry gases is known or can be automatically corrected.

2.10 Built-in adjustment checking facility

A checking facility which allows to verify, by involving all relevant internal elements, that the breath alcohol analyser is suitably adjusted.

2.11 Drift

The change in the indication which occurs during a stated period of time at a given mass concentration of ethanol in air.

2.12 Memory residual effect

The difference between the indications obtained with two inputs of gas of a given mass concentration when a gas of a specified higher mass concentration is injected between these two gas.

3 Metrological requirements

3.1 Rated operating conditions

3.1.1 Measuring range

The breath alcohol analyser shall be capable of measuring all mass concentrations in the range 0.00 mg/L to at least 1.50 mg/L. However, in normal operation, the breath alcohol analyser may indicate 0.00 mg/L for mass concentrations equal to or smaller than 0.05 mg/L. The greatest permissible value for the upper limit of the measuring range is 3.00 mg/L.

The breath alcohol analyser shall indicate when its upper limit of measurement is exceeded.

3.1.2 Climatic and mechanical conditions and electrical supply

	Stationary	Mobile	Portable
Ambient temperature	See D 11, 10.1, level 1	See D 11, 10.1, level 2	See D 11, 10.1, level 3
Ambient humidity	N/A	See D 11, 10.2.1, level 1	See D 11, 10.2.1, level 2
Random vibrations	N/A	See D 11, 11.1.1, level 2	See D 11, 11.1.1, level 2
Voltage	Mains: See D 11, 13.2, level 1 Battery operated: See D 11, 13.1 and 14.1	See D 11, 14.2.1, level 1 Battery operated: See D 11, 14.1	See D 11, 14.1

3.1.3 Gases present in the exhaled air

The instruments' error shall not be affected by more than 0.1 mg/L in the presence of gases in the exhaled air due to medicines or exposure of the person to solvents or industrial products.

3.1.4 The breath alcohol analyser shall indicate whether the conditions of exhalation (e.g.: continuity and flow) have complied with the values specified for this type by the manufacturer in order to ensure a representative measurement.

These conditions, specified by the manufacturer, shall comply with the following values:

- minimum exhaled volume: no greater than 1 L,
- minimum pressure: no greater than 25 hPa,
- minimum flowrate: no greater than 0.20 L/s

3.2 Maximal permissible errors

The following MPE shall apply within the measuring range and the conditions set forth in 3.1 and 3.2 above

3.2.1 Maximum permissible errors for type examination and initial verification

The maximum permissible errors, positive or negative, on each individual indication shall be :

0.020 mg/L or 5 % of the true value of mass concentration, whichever the greater, for all mass concentrations less than or equal to 1 mg/L;

10 % of the true value of mass concentration for all mass concentrations greater than 1 mg/L.

- 3.2.2** Recommended maximum permissible errors for breath alcohol analysers in service
- 0,030 mg/L for all mass concentrations less than or equal to 0.400 mg/L;
 - 7.5 % of the true value of mass concentration for all mass concentrations greater than 0.400 mg/L and less than or equal to 1 mg/L;
 - 20 % of the true value of mass concentration for all mass concentrations greater than 1 mg/L.

3.3 Other influence factors and disturbances

3.3.1 Disturbances

The significant fault, as defined in D 11, 3.10, is equal to the maximum permissible error applicable to type evaluation, for the following disturbances:

	Stationary	Mobile	Portable
Radiated radiofrequency, electromagnetic fields	See D 11, 12.1.1, level 3	See D 11, 12.1.1, level 3	See D 11, 12.1.1, level 3
Conducted radiofrequency field	See D 11, 12.1.2, level 3	See D 11, 12.1.2, level 3	N/A
Electrostatic discharges	See D 11, 12.2, level 3	See D 11, 12.2, level 3	See D 11, 12.2, level 3
Bursts on supply lines	See D 11, 13.5, level 2	N/A	N/A
Dips and short interruptions	See D 11, 13.4, level 1 Battery operated: N/A	N/A	N/A
Electrical transient conduction along supply lines	N/A	See D 11, 14.2.2, level IV	N/A
Mechanical shocks	See D 11, 11.2, level 1	See D 11, 11.2, level 2	See D 11, 11.2, level 2
Dry heat	N/A	See D 11, 10.1.1, level 4	See D 11, 10.1.1, level 4

3.4 Repeatability

3.4.1 Experimental standard deviation

The experimental standard deviation is given by the formula :

$$s = \sqrt{\frac{\sum_{i=1}^n (Y_i - \bar{Y})^2}{n - 1}}$$

where :

n = the number of measurements made at a given mass concentration ;

Y_i = the ith measurement (out of n) for the given mass concentration ;

\bar{Y} = the arithmetic mean of the n values.

3.4.2 Requirements

The experimental standard deviation for all mass concentrations less than or equal to 1 mg/L shall be less than 0.007 mg/L ;

The experimental standard deviation for all mass concentrations greater than 1 mg/L shall be less than 1.75 % of the true value of mass concentration.

3.5 Drift

3.5.1 Zero drift

The zero drift shall be less than 0.010 mg/L in 4 hours under reference conditions.

3.5.2 Drift at 0.40 mg/L

3.5.2.1 Short-term drift: the drift at 0.40 mg/L shall be less than 0.010 mg/L in 4 hours under reference conditions.

3.5.2.2 Long-term drift: the drift at 0.40 mg/L shall be less than 0.020 mg/L in two months under reference conditions.

3.6 Memory and residual effect

3.6.1 Memory effect

The memory effect shall be less than 4% in relative value when the test is conducted according to Annex A.

3.7 Small changes in mass concentration

The error in the result obtained with a gas having a mass concentration which is 0.10 mg/L less than that of another gas previously injected shall be less than the maximum permissible error for the lower mass concentration.

4 Technical requirements

4.1 Unit of measurement

The breath alcohol analyser shall display the mass concentration in milligram per litre of exhaled breath (mg/L).

4.2 Scale interval

The scale interval is 0.01 mg/L in normal operation. Nevertheless, during metrological testing or manual calibration it shall be possible to increase the scale interval to 0.001 mg/L.

4.3 Display

The result of measurement shall be displayed digitally by means of aligned figures. The display in normal operation shall consist on the display in metrological testing mode rounded down to 0.01 mg/L (e.g. a measured value of 0.427 mg/L shall be displayed as 0.42 mg/L in normal operation).

The height of the figures on the display shall be equal to at least :

5 mm for illuminated displays,

10 mm in all other cases.

The name of the unit of measurement or its symbol shall appear at the immediate vicinity of the measurement indication. The characters used shall be at least 3 mm high.

4.4 Printing device

The breath alcohol analyser may be equipped with printing devices which print at least :

- the result of the measurement,
- the symbol of the unit in which the result is expressed.

In normal operation, the printed result shall not differ from the indicated one displayed by the indicating device.

If the symbol of the unit is pre-printed, the paper shall be especially prepared for the printing device.

Printouts shall remain readable for one month, even when exposed to daylight or equivalent lighting.

The printing device shall be equipped with an automatic checking facility to verify if the printed data are the displayed one. At least the following shall be checked :

- presence of paper;
- the electronic control circuits.

4.5 Measuring conditions

At least before each measurement, the instrument shall automatically adjust or check the zero indication with a tolerance of 0.005 mg/L, using a purge with ambient air. When this adjustment is not possible or this check gives negative results, the instrument shall indicate an alarm and shall not allow any further measurement.

The breath alcohol analyser shall indicate its readiness to start a measurement and shall not perform measurements when it is not ready. When after a period of time the instrument is not anymore ready to perform measurements, it shall indicate it.

When a measurement result is nil, it shall not be possible to confuse such a result with the zero indication prior to measurement.

Optionally, the breath alcohol analyser may be equipped with a function which automatically detects whether the measuring result is affected by the presence of alcohol in the upper respiratory tracts. Examples of compliance are given in Annex B.

When a measurement result is nil, it shall not be possible to confuse such a result with the zero indication prior to measurement.

The user shall not have access to the maintenance mode nor to the adjustment device

4.6 Checking operations

When powered on, the instruments shall automatically check their correct operation (e.g.: checksums, watchdogs, etc.). When any defect or an error signal is detected, the instrument shall indicate an alarm and shall not allow any further measurement.

4.7 Markings and sealings

The breath alcohol analyser shall be marked indelibly and irremovably with the following information:

- type approval mark
- manufacturer's name
- denomination of the instrument
- serial number
- measurement range
- stationery, mobile or portable
- ambient temperature range
- power supply range

Appropriate sealings shall protect the integrity of the instruments.

5 Type evaluation

Manufacturers shall provide technical documentation, a user manual for the breath alcohol analyser and the description of the adjustment procedure. Other information may be provided such as information on performance tests, on calibrations that support a determination whether the design of the breath alcohol analyser meets the requirements of this Recommendation.

The technical documentation shall include:

- a list of the electronic sub-assemblies with their essential characteristics
- a description of the electronic devices with drawings, diagrams
- a description of the software and its characteristics and operation
- mechanical drawings
- a plan for sealings and markings.

Type evaluation consists in assessing the compliance of the breath alcohol analyser with each requirement of this Recommendation, including the performance tests described in Annex A.

Annex A

PERFORMANCE TESTS

A.1 General

This annex defines the program of performance tests intended to verify that the breath alcohol analyser operates as intended in a specified environment and under specified conditions. Each test indicates, where appropriate the reference conditions for determining the intrinsic error.

Different kinds of tests apply :

- Accuracy tests (including repeatability, drift and memory and residual effect),
- Influence factors,
- Disturbances tests.

The tests specified in this Recommendation constitute minimum test procedures. Further tests may be undertaken, if necessary, in order to clarify issues of compliance of the breath alcohol analyser with the requirements of this document.

A.2 Tests facilities

- A.2.1** The apparatus used by the laboratory for testing the breath alcohol analyser shall deliver test gases having appropriate mass concentrations of ethanol with a flowrate between 0.2 L/s and 1 L/s during a minimum time of 5 s.
- A.2.2** The apparatus used by the laboratory shall be able to determine the true value of the mass concentration with an uncertainty less or equal than one fourth of the maximum permissible error (calculated with $k = 2$).
- A.2.3** Taking into account of the testing apparatus, the tests shall be conducted with the maximum frequency allowed by the breath alcohol analyser.
- A.2.4** The breath alcohol analyser may be completely calibrated, if necessary by the manufacturer before type approval testing begins. Thereafter no adjustment shall be carried out until all type approval testing is complete. This does not apply to self-calibration (semi-automatic adjustment) on command by the user as required by the manufacturer in the user manual.
- A.2.5** This Recommendation permits the use of reference gases produced by simplified means for some tests. Such means may consists in the use of dry gases or wet gases generated by simple test means (e.g. the absence of CO₂ in test gases, constant mass concentration during injection). The completed test reports shall indicate when such alternative tests means have been implemented.

A.3 Characteristic reference values of the test gas

Unless otherwise specified, the test gas injected continuously into the breath alcohol analyser shall be characterised by the following parametric values :

- delivered volume : $3 \text{ L} \pm 0.3 \text{ L}$,
- total duration of injection (into breath analyser) : $5 \text{ s} \pm 1 \text{ s}$,
- relative humidity of the gas : at least 95 % ,
- gas temperature : $34 \text{ }^\circ\text{C} \pm 0.5 \text{ }^\circ\text{C}$,
- carrier gas : pure air with volumetric fraction of CO₂ of : $5 \% \pm 1 \%$,

Note : Other gases may be used provided that :

- their influence, if any, on test results can be taken into consideration and corrected,
- if dry gases are used, the correlation with wet gases shall be established,

for cases involving dry gases in containers :

- variations of atmospheric pressure and variation of the compressibility factor between filling and usage conditions are taken into account,
- the quality of the containers, gas regulators and the manner by which it is delivered to the breath alcohol analyser, should be taken into account to minimize contamination and a change in the composition of ethanol throughout its use cycle.

Test reports shall indicate when other gases were used and how their equivalence with reference gases was established.

A.4 Reference conditions

- Ambient temperature : $20\text{ °C} \pm 5\text{ °C}$,
- Relative humidity : $60\% \pm 15\%$,
- Atmospheric pressure : 86 kPa to 106 kPa,
- Power voltage : nominal voltage (V_{nom}),
- Power frequency : nominal frequency (F_{nom})
- Total fraction by volume of hydrocarbons (as methane equivalent) in the environment : $2 \cdot 10^{-6}$.

During each test, the temperature and the relative humidity shall not vary by more than 5 °C and 10 % respectively within the reference range.

A.5 Accuracy tests

A.5.1 Maximum permissible errors and repeatability

Compliance with maximum permissible errors requirement defined in 3.2.1 and repeatability requirement defined in 3.4 shall be verified at least at the following nominal scale values :

Test gas n°	Mass concentration (mg/L)
1	0.00 to 0.05
2	0.15
3	0.25
4	0.40
5	0.70
6	0.95
7	1.50
8	upper value if appropriate

For type approval, at least 20 measurements shall be made consecutively at each gas concentration.

For each test gas, each of the 20 measurements shall comply with the maximum permissible error requirement.

A.5.2 Drift

At least 10 initial measurements shall be made with each test gases n° 1 and n° 4 to verify the drift specifications defined in 3.5. Then 10 additional measurements are made using the same respective gases at the conclusion of the times intervals specified in 3.5.

For each drift test, the deviation between the mean value of the two series of measurements (initial and additional) shall fulfil the appropriate requirements in 3.5.

Other tests provided for in this recommendation for type approval may be performed during the drift tests.

A.5.3 Memory and residual effect

A.5.3.1 Memory effect

The breath alcohol analyser shall be subjected to an initial test that includes 10 measurements using test gas n° 4. The mean value of these 10 measurements is calculated.

Then, the breath alcohol analyser shall be subjected 10 times to the following cycle :

- one measurement using test gas n° 8 or the upper use defined test gases limit of the measuring range, whichever the greater,
- one measurement using test gas n°4.

The mean value of these 10 measurements with test gas n° 4 during the cycle is calculated.

For the mass concentration at 0.40 mg/L, the difference between two calculated mean values shall be less than the limit specified in 3.5.2.1.

A.5.3.2 Small changes in mass concentration

The breath alcohol analyser shall be subjected to 10 measurements using test gas n° 4. The mean value of these 10 measurements is calculated.

Then the breath alcohol analyser is subjected to 5 measurements using test gas n° 3. The mean value of these 5 measurements is calculated.

The difference between these two mean values shall comply with the requirement specified in 3.7.

A.6 Influence factors in the parameters which characterise the test gases

For these tests, the values of the parameters that are not specified shall be those defined in A.3. The values of the parameters to be varied are specified in A.6.1 to A.6.4. For each test, 10 measurements using test gas n° 4 shall be performed. Each of this 10 measurements shall fulfilled the maximum permissible error requirement defined in 3.2.1.

A.6.1 Influence of delivered volume

- First test : delivered volume : $1.5 \text{ L} \pm 0.3 \text{ L}$
- Second test : delivered volume : $4.5 \text{ L} \pm 0.3 \text{ L}$

A.6.2 Influence of the duration of exhalation

- Total duration of each injection : $15 \text{ s} \pm 1 \text{ s}$

A.6.3 Influence of mass concentration of CO₂

- Mass concentration by volume of CO₂ : 10 %

A.6.4 Influence of interruption in the flow breath

- First test : the injection of gas normally required for the reference conditions specified in A.3 shall be stopped $1\text{ s} \pm 0.5\text{ s}$ after the start of injection.
- Second test : the injection of gas normally required at least 15 s (see A.6.2) shall be stopped $6\text{ s} \pm 1\text{ s}$ after the start of injection.

A.7 Physiological influence factors

The breath alcohol analyser shall be tested according to the following procedure :

- determination of the indication for a dry test gas having an ethanol content of $0.4\text{ mg/L} \pm 5\%$ without any interfering substance.
- determination of the indication for the same test gas with one and only one of the interfering substances listed in the following table at the indicated mass concentration :

Interfering substance	Nominal value for vapour mass concentration mg/L ($\pm 5\%$)
Acetone	0.5
Acetaldehyde	0.15
Methanol	0.1
Isopropanol	0.1
Carbon monoxide	0.2
Toluene	0.2

If the variation of the indication is not more than the maximum value defined in 3.1.3, the breath alcohol analyser has passed the test for the interfering substance concerned. If the variation is more than the value defined in 3.1.3 and if no signal is given, the breath alcohol analyser has failed. If a signal is given, another test shall be performed with the same interfering substance at a mass concentration 5 times smaller. In that case the variation shall not be more than a fifth of the maximum value defined in 3.1.3.

This test shall be performed at least 5 times for each of the interfering substance. Each time, the requirement of 3.1.3 shall be fulfilled.

National responsible bodies may decide to test the influence of other compounds.

A.8 Physical influence factors

The effect of each influence factor shall be determined separately and influence factors not under investigation shall remain at their reference values as specified in A.4.

The tests shall be carried out using test gas n° 4. At least 5 measurements shall be performed in each test condition.

For each test condition and each measurement, the maximum permissible error requirement specified in 3.2.1 shall be fulfilled. Nevertheless, in the test at the extreme value of hydrocarbons in the environment, it is acceptable that the breath alcohol analyser gives no result.

A.8.1 Dry heat

The tests consists of exposure of the breath analyser to a temperature defined below according to type of breath alcohol analyser under “free air” conditions for a two hours period after the breath alcohol analyser reached temperature stability.

	Stationary	Mobile	Portable
Temperature	30 °C	40 °C	55 °C
Duration	2 hours		
Number of cycle	1		

A.8.2 Cold

The tests consists of exposure of the breath analyser to a temperature defined below according to type of breath alcohol analyser under “free air” conditions for a two hours period after the breath alcohol analyser reached temperature stability.

	Stationary	Mobile	Portable
Temperature	5 °C	- 10 °C	- 25 °C
Duration	2 hours		
Number of cycle	1		

A.8.3 Damp heat, steady-state (non condensing)

The tests consists of exposure of the breath alcohol analyser to the specified high level of temperature and the specified constant relative humidity during the time defined below according to the severity level.

The error of the breath alcohol analyser is determined one time per day and at the end of the test after a recovery period of one hour.

	Mobile	Portable
Temperature	30 °C	40 °C
Humidity	85 % rel	93 % rel
Duration	2 days	4 days

A.8.4 Random vibrations

This test is applicable to mobile and portable breath alcohol analysers. During the test, the breath alcohol analyser is powered off. The test consists of exposure to the vibration level hereafter defined:

- Total frequency range : 10 Hz to 150 Hz
- Total RMS level : 7 m.s⁻²
- ASD level 10 Hz- 20 Hz : 1 m².s⁻³
- ASD level 20 Hz- 150 Hz : - 3 dB/octave

The breath alcohol analyser shall, in turn, be tested in three mutually perpendicular axes mounted on a rigid fixture by its normal mounting means so that the gravitational force actes in the same direction as it would be in normal use.

The duration of the test shall be minimum two minutes per axis.

The error of the breath alcohol analyser is determined after the test has been carried out.

A.8.5 Power voltage variations

The error of the breath alcohol analyser is determined in the following conditions:

- when the instrument is powered on at the upper limit of the voltage, if applicable
- when the instrument is powered on at the lower limit of the voltage.

	Stationary (AC mains voltage)	Stationary (DC mains voltage)	Stationary or portable or mobile (internal battery)
Upper limit	Nominal frequency + 10%	Defined by the manufacturer	N/A
Lower limit	Nominal frequency – 15 %	Defined by the manufacturer	Limit where the instrument ceases to operate in the MPE

For breath alcohol analysers powered from external 12 V road vehicle batteries, the upper and lower limits are defined hereafter:

- Upper limit: 16 V
- Lower limit: limit where the instrument ceases to operate in the MPE

A.9 Disturbances tests

The tests shall be carried out using test gas n° 4. At least 5 measurements shall be performed in each test condition except if the test method requires otherwise.

For each disturbance and each measurement, the difference between the error of indication during the test and the error of indication under reference conditions shall not exceed the significant fault value specified in 3.3.1, except if it is specified another way or the breath alcohol analyser shall not give any result.

The error of the instrument is generally determined during the disturbance except for mechanical shocks and dry heat.

A.9.1 Radiated, radio frequency, electromagnetic fields

The breath alcohol analyser shall be exposed to electromagnetic field strength as specified hereafter:

- Frequency range: from 26 MHz to 2000 MHz
- Modulation: 80 % AM, 1 kHz, sine wave
- Field strength: 10 V/m

This test includes the susceptibility to electromagnetic fields of general origin and to those specifically caused by digital radio telephones.

A.9.2 Conducted radio-frequency fields

This test doesn't apply if the breath alcohol analyser has no mains or other input ports. Otherwise it shall be conducted on supply lines and on all connexion cables if the instrument is composed of several elements connected together. For that connexion cables, the test shall be performed at each extremity of the cables if both of the elements are part of the instrument.

The test conditions are the following:

- Frequency range: from 0,15 MHz to 26 MHz
- Modulation: 80 %AM, 1 kHz, sine wave
- RF amplitude (50 Ω): 10 V

A.9.3 Electrostatic discharges

Contact discharges are the preferred test method. Nevertheless, air discharges shall be used where contact discharges cannot be applied (e.g. non conductive surfaces).

Both types of application shall be performed:

- Direct application
- Indirect application

The discharges shall be applied on each surface accessible in normal operation.

At least ten successive discharges shall be applied with a time interval between discharges of at least ten seconds on each point of application. The number of points of application on each surface will depend on the size of the instrument and shall be specified in the test report.

The test conditions are the following:

- Test voltage for contact discharge: 6 kV
- Test voltage for air discharge: 8 kV

A.9.4 Bursts on supply lines

This test is only applicable to breath alcohol analyser powered from AC mains or DC mains.

The test consists of exposure to bursts of voltage spikes of 1 kV. Each spike shall have a rise time of 5 ns and a half amplitude duration of 50 ns. The burst length shall be 15 ms and the burst period (repetition time interval) shall be 300 ms.

At least ten positive and ten negative bursts randomly phased shall be applied.

A.9.5 AC mains voltage dips, short interruptions and voltage variations

The mains voltage reductions shall be repeated 10 times with an interval of at least 10 seconds.

The test conditions are the following:

	Test a	Test b
Reduction	30 %	60 %
Duration	0.5 cycles	5 cycles

The error of the breath alcohol analyser is determined for each configuration of testing.

For voltage interruption, the test conditions are the following:

- Interruption: > 95 %
- Duration: 250 cycles

A.9.6 Electrical transient conduction along supply lines

This test shall be applied to breath alcohol analyser powered from external 12 V road vehicle batteries.

The test conditions are the following:

	Test pulse 1	Test pulse 2		Test pulse 3		Test pulse 4
		2a	2b	3a	3b	
Level	- 100 V	+ 50 V	+ 10 V	- 150 V	+ 100 V	- 7 V
Minimum number of pulses or test time	5000 pulses	5000 pulses		1 hours		1 pulse

A.9.7 Mechanical shocks

The breath alcohol analyser is placed on a rigid surface in the position in which it is normally used, is tilted on one bottom edge and is then allowed to fall freely onto the test surface. The height of fall given below is that of the opposite edge.

	Stationary	Mobile and portable
Height of fall	25 mm	50 mm
Number of fall	1	1

A.9.8 Dry heat test

The error of the breath alcohol is determined in reference condition prior to the test.

Then, the breath alcohol analyser is powered off and exposed to a high temperature of 70 °C during six hours.

After a recovery period of one hour, the error of the breath alcohol analyser is determined and the default is calculated.

Annex B

Examples of detection of alcohol in upper respiratory tracks

B.1 Plateau method

Under development

B.2 Two measurements cycle

The measuring cycle shall have two measurements.

The breath alcohol analyser shall be able to memorize that constitute the offence of driving or working under influence of alcohol hereafter called “the legal value”.

The measuring cycle can be stopped after the first measurement if the concentration value is less than the legal value. In that case, the result of measurement shall be displayed and printed, if necessary.

If one of the two measurements is less than the legal value and the other one more than or equal to the legal value, the smallest result shall be displayed and printed (if necessary). There is no need of a comparison between the two results.

If both of the two measurements are more than or equal to the legal value, it is necessary to calculate the ratio :

$$R = \left| 1 - \frac{C_2}{C_1} \right| / t$$
, where t is the time difference between the end of the first breath and the end of the second breath.

If R is less than 0.03 min^{-1} , the smallest value of C1 and C2 shall be displayed and printed (if necessary).

If R is more than or equal to 0.03 min^{-1} , the measuring cycle shall be cancelled and the breath alcohol analyser shall display a warning message to specify that the cycle is not valid and that a new one shall start.