Directive 2005/55/EC of the European Parliament and of the Council of 28 September 2005 on the approximation of the laws of the Member States relating to the measures to be taken against the emission of gaseous and particulate pollutants from compression-ignition engines for use in vehicles, and the emission of gaseous pollutants from positive-ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles (Text with EEA relevance) (repealed)

ANNEX I

SCOPE, DEFINITIONS AND ABBREVIATIONS, APPLICATION FOR EC TYPE-APPROVAL, SPECIFICATIONS AND TESTS AND CONFORMITY OF PRODUCTION

1. SCOPE

This Directive applies to the gaseous and particulate pollutants from all motor vehicles equipped with compression-ignition engines and to the gaseous pollutants from all motor vehicles equipped with positive ignition engines fuelled with natural gas or LPG, and to compression-ignition and positive ignition engines as specified in Article 1 with the exception of those vehicles of category N_1, N_2 and M_2 for which type-approval has been granted under Council Directive 70/220/EEC of 20 March 1970 on the approximation of the laws of the Member States on measures to be taken against air pollution by emissions from motor vehicles[(1)].

2. DEFINITIONS AND ABBREVIATIONS

For the purposes of this Directive:

2.1. *'test cycle'* means a sequence of test points each with a defined speed and torque to be followed by the engine under steady state (ESC test) or transient operating conditions (ETC, ELR test);

2.2. *'approval of an engine (engine family)'* means the approval of an engine type (engine family) with regard to the level of the emission of gaseous and particulate pollutants;

2.3. *'diesel engine'* means an engine which works on the compression-ignition principle;

2.4. *'gas engine'* means an engine which is fuelled with natural gas (NG) or liquid petroleum gas (LPG);

2.5. *'engine type'* means a category of engines which do not differ in such essential respects as engine characteristics as defined in Annex II to this Directive;

2.6. *'engine family'* means a manufacturers grouping of engines which, through their design as defined in Annex II, Appendix 2 to this Directive, have similar exhaust emission characteristics; all members of the family must comply with the applicable emission limit values;

2.7. *'parent engine'* means an engine selected from an engine family in such a way that its emissions characteristics will be representative for that engine family;

2.8. *'gaseous pollutants'* means carbon monoxide, hydrocarbons (assuming a ratio of $CH_{1,85}$ for diesel, $CH_{2,525}$ for LPG and $CH_{2,93}$ for NG (NMHC), and an assumed molecule $CH_3O_{0,5}$ for ethanol-fuelled diesel engines), methane (assuming a ratio of CH_4 for NG) and oxides of nitrogen, the last named being expressed in nitrogen dioxide (NO_2) equivalent;

2.9. *'particulate pollutants'* means any material collected on a specified filter medium after diluting the exhaust with clean filtered air so that the temperature does not exceed 325 K (52 ^{o}C);

2.10. *'smoke'* means particles suspended in the exhaust stream of a diesel engine which absorb, reflect, or refract light;

2.11. *'net power'* means the power in EC kW obtained on the test bench at the end of the crankshaft, or its equivalent, measured in accordance with the EC method of

measuring power as set out in Council Directive 80/1269/EEC of 16 December 1980on the approximation of the laws of the Member States relating to the engine power of motor vehicles[(2)];

2.12. *'declared maximum power (P_{max})'* means the maximum power in EC kW (net power) as declared by the manufacturer in his application for type-approval;

2.13. *'per cent load'* means the fraction of the maximum available torque at an engine speed;

2.14. *'ESC test'* means a test cycle consisting of 13 steady state modes to be applied in accordance with Section 6.2 of this Annex;

2.15. *'ELR test'* means a test cycle consisting of a sequence of load steps at constant engine speeds to be applied in accordance with Section 6.2 of this Annex;

2.16. *'ETC test'* means a test cycle consisting of 1 800 second-by-second transient modes to be applied in accordance with Section 6.2 of this Annex;

2.17. *'engine operating speed range'* means the engine speed range, most frequently used during engine field operation, which lies between the low and high speeds, as set out in Annex III to this Directive;

2.18. *'low speed (n_{lo})'* means the lowest engine speed where 50 % of the declared maximum power occurs;

2.19. *'high speed (n_{hi})'* means the highest engine speed where 70 % of the declared maximum power occurs;

2.20. *'engine speeds A, B and C'* means the test speeds within the engine operating speed range to be used for the ESC test and the ELR test, as set out in Annex III, Appendix 1 to this Directive;

2.21. *'control area'* means the area between the engine speeds A and C and between 25 to 100 per cent load;

2.22. *'reference speed (n_{ref})'* means the 100 per cent speed value to be used for denormalising the relative speed values of the ETC test, as set out in Annex III, Appendix 2 to this Directive;

2.23. *'opacimeter'* means an instrument designed to measure the opacity of smoke particles by means of the light extinction principle;

2.24. *'NG gas range'* means one of the H or L range as defined in European Standard EN 437, dated November 1993;

2.25. *'self adaptability'* means any engine device allowing the air/fuel ratio to be kept constant;

2.26. *'recalibration'* means a fine tuning of an NG engine in order to provide the same performance (power, fuel consumption) in a different range of natural gas;

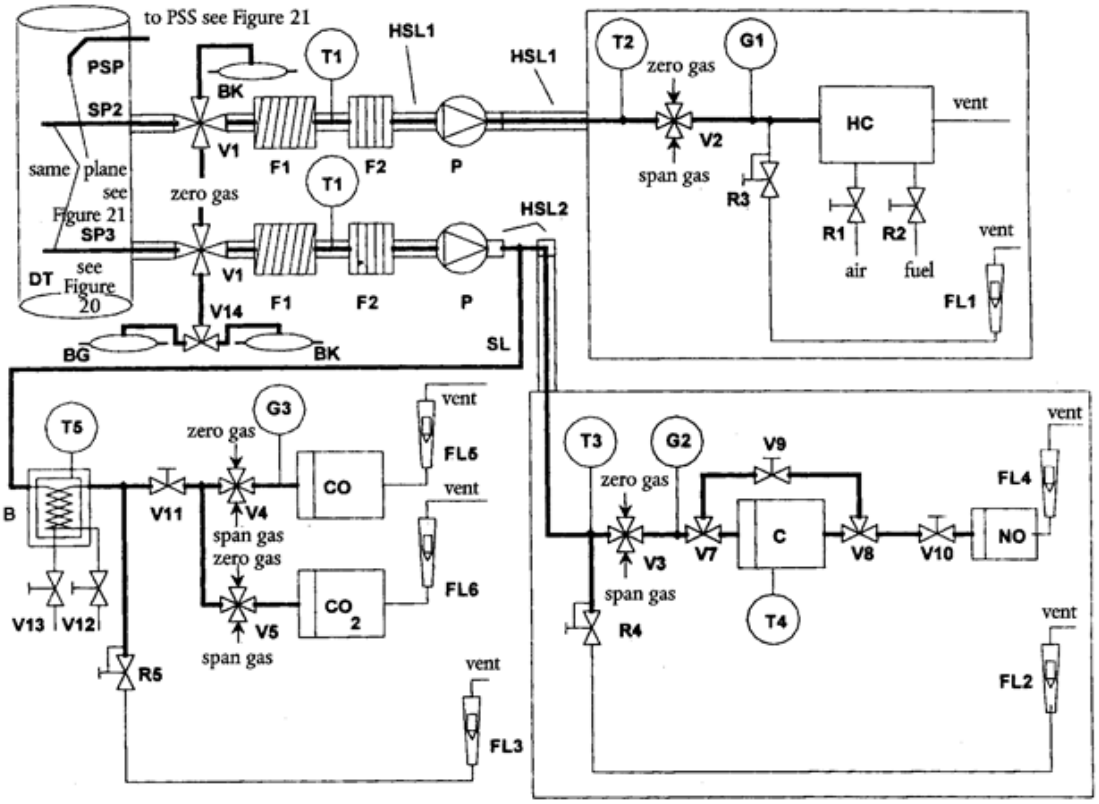
2.27. *'Wobbe Index (lower W_l; or upper W_u)'* means the ratio of the corresponding calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions:

$$W = H_{gas} \times \sqrt{\rho_{air}}\rho_{gas}$$

2.28. *'λ-shift factor (S_λ)'* means an expression that describes the required flexibility of the engine management system regarding a change of the excess-air ratio λ if the engine

is fuelled with a gas composition different from pure methane (see Annex VII for the calculation of S_λ);

2.29. *'defeat device'* means a device which measures, senses or responds to operating variables (e.g. vehicle speed, engine speed, gear used, temperature, intake pressure or any other parameter) for the purpose of activating, modulating, delaying or deactivating the operation of any component or function of the emission control system such that the effectiveness of the emission control system is reduced under conditions encountered during normal vehicle use unless the use of such a device is substantially included in the applied emission certification test procedures.



2.30. *'auxiliary control device'* means a system, function or control strategy installed to an engine or on a vehicle, that is used to protect the engine and/or its ancillary equipment against operating conditions that could result in damage or failure, or is used to facilitate engine starting. An auxiliary control device may also be a strategy or measure that has been satisfactorily demonstrated not to be a defeat device;

2.31. *'irrational emission control strategy'* means any strategy or measure that, when the vehicle is operated under normal conditions of use, reduces the effectiveness of the emission control system to a level below that expected on the applicable emission test procedures.

2.32. **Symbols and abbreviations**

2.32.1. *Symbols for test parameters*

Symbol	Unit	Term

A_P	m^2	Cross sectional area of the isokinetic sampling probe
A_T	m^2	Cross sectional area of the exhaust pipe
CE_E	—	Ethane efficiency
CE_M	—	Methane efficiency
C1	—	Carbon 1 equivalent hydrocarbon
conc	ppm/vol. %	Subscript denoting concentration
D_0	m^3/s	Intercept of PDP calibration function
DF	—	Dilution factor
D	—	Bessel function constant
E	—	Bessel function constant
E_Z	g/kWh	Interpolated NO_x emission of the control point
f_a	—	Laboratory atmospheric factor
f_c	s^{-1}	Bessel filter cut-off frequency
F_{FH}	—	Fuel specific factor for the calculation of wet concentration for dry concentration
F_S	—	Stoichiometric factor
G_{AIRW}	kg/h	Intake air mass flow rate on wet basis
G_{AIRD}	kg/h	Intake air mass flow rate on dry basis
G_{DILW}	kg/h	Dilution air mass flow rate on wet basis
G_{EDFW}	kg/h	Equivalent diluted exhaust gas mass flow rate on wet basis
G_{EXHW}	kg/h	Exhaust gas mass flow rate on wet basis
G_{FUEL}	kg/h	Fuel mass flow rate
G_{TOTW}	kg/h	Diluted exhaust gas mass flow rate on wet basis
H	MJ/m^3	Calorific value

H_{REF}	g/kg	Reference value of absolute humidity (10,71g/kg)
H_a	g/kg	Absolute humidity of the intake air
H_d	g/kg	Absolute humidity of the dilution air
HTCRAT	mol/mol	Hydrogen-to-Carbon ratio
i	—	Subscript denoting an individual mode
K	—	Bessel constant
k	m^{-1}	Light absorption coefficient
$K_{H,D}$	—	Humidity correction factor for NO_x for diesel engines
$K_{H,G}$	—	Humidity correction factor for NO_x for gas engines
K_V		CFV calibration function
$K_{W,a}$	—	Dry to wet correction factor for the intake air
$K_{W,d}$	—	Dry to wet correction factor for the dilution air
$K_{W,e}$	—	Dry to wet correction factor for the diluted exhaust gas
$K_{W,r}$	—	Dry to wet correction factor for the raw exhaust gas
L	%	Percent torque related to the maximum torque for the test engine
L_a	m	Effective optical path length
m		Slope of PDP calibration function
mass	g/h or g	Subscript denoting emissions mass flow (rate)
M_{DIL}	kg	Mass of the dilution air sample passed through the particulate sampling filters
M_d	mg	Particulate sample mass of the dilution air collected
M_f	mg	Particulate sample mass collected

$M_{f,p}$	mg	Particulate sample mass collected on primary filter
$M_{f,b}$	mg	Particulate sample mass collected on back-up filter
M_{SAM}		Mass of the diluted exhaust sample passed through the particulate sampling filters
M_{SEC}	kg	Mass of secondary dilution air
M_{TOTW}	kg	Total CVS mass over the cycle on wet basis
$M_{TOTW,i}$	kg	Instantaneous CVS mass on wet basis
N	%	Opacity
N_P	—	Total revolutions of PDP over the cycle
$N_{P,i}$	—	Revolutions of PDP during a time interval
n	min^{-1}	Engine speed
n_p	s^{-1}	PDP speed
n_{hi}	min^{-1}	High engine speed
n_{lo}	min^{-1}	Low engine speed
n_{ref}	min^{-1}	Reference engine speed for ETC test
p_a	kPa	Saturation vapour pressure of the engine intake air
p_A	kPa	Absolute pressure
p_B	kPa	Total atmospheric pressure
p_d	kPa	Saturation vapour pressure of the dilution air
p_s	kPa	Dry atmospheric pressure
p_1	kPa	Pressure depression at pump inlet
P(a)	kW	Power absorbed by auxiliaries to be fitted for test
P(b)	kW	Power absorbed by auxiliaries to be removed for test
P(n)	kW	Net power non-corrected

P(m)	kW	Power measured on test bed
Ω	—	Bessel constant
Q_s	m^3/s	CVS volume flow rate
q	—	Dilution ratio
r	—	Ratio of cross sectional areas of isokinetic probe and exhaust pipe
R_a	%	Relative humidity of the intake air
R_d	%	Relative humidity of the dilution air
R_f	—	FID response factor
ρ	kg/m^3	Density
S	kW	Dynamometer setting
S_i	m^{-1}	Instantaneous smoke value
S_λ		λ-shift factor
T	K	Absolute temperature
T_a	K	Absolute temperature of the intake air
t	s	Measuring time
t_e	s	Electrical response time
t_F	s	Filter response time for Bessel function
t_p	s	Physical response time
Δt	s	Time interval between successive smoke data (= 1/ sampling rate)
Δt_i	s	Time interval for instantaneous CFV flow
τ	%	Smoke transmittance
V_0	m^3/rev	PDP volume flow rate at actual conditions
W	—	Wobbe index
W_{act}	kWh	Actual cycle work of ETC
W_{ref}	kWh	Reference cycle work of ETC
WF	—	Weighting factor
WF_E	—	Effective weighting factor

X_0	m^3/rev	Calibration function of PDP volume flow rate
Y_i	m^{-1}	1 s Bessel averaged smoke value

2.32.2. *Symbols for chemical components*

CH_4	Methane
C_2H_6	Ethane
C_2H_5OH	Ethanol
C_3H_8	Propane
CO	Carbon monoxide
DOP	Di-octylphtalate
CO_2	Carbon dioxide
HC	Hydrocarbons
NMHC	Non-methane hydrocarbons
NO_x	Oxides of nitrogen
NO	Nitric oxide
NO_2	Nitrogen dioxide
PT	Particulates.

2.32.3. *Abbreviations*

CFV	Critical flow venturi
CLD	Chemiluminescent detector
ELR	European load response test
ESC	European steady state cycle
ETC	European transient cycle
FID	Flame ionisation detector
GC	Gas chromatograph
HCLD	Heated chemiluminescent detector
HFID	Heated flame ionisation detector
LPG	Liquefied petroleum gas
NDIR	Non-dispersive infrared analyser
NG	Natural gas
NMC	Non-methane cutter

3. APPLICATION FOR EC TYPE-APPROVAL

3.1. Application for EC type-approval for a type of engine or engine family as a separate technical unit

3.1.1. The application for approval of an engine type or engine family with regard to the level of the emission of gaseous and particulate pollutants for diesel engines and with regard to the level of the emission of gaseous pollutants for gas engines shall be submitted by the engine manufacturer or by a duly accredited representative.

3.1.2. It shall be accompanied by the undermentioned documents in triplicate and the following particulars:

3.1.2.1. A description of the engine type or engine family, if applicable, comprising the particulars referred to in Annex II to this Directive which conform to the requirements of Articles 3 and 4 of Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers[(3)].

3.1.3. An engine conforming to the 'engine type' or 'parent engine' characteristics described in Annex II shall be submitted to the technical service responsible for conducting the approval tests defined in Section 6.

3.2. Application for EC type-approval for a vehicle type in respect of its engine

3.2.1. The application for approval of a vehicle with regard to emission of gaseous and particulate pollutants by its diesel engine or engine family and with regard to the level of the emission of gaseous pollutants by its gas engine or engine family shall be submitted by the vehicle manufacturer or a duly accredited representative.

3.2.2. It shall be accompanied by the undermentioned documents in triplicate and the following particulars:

3.2.2.1. A description of the vehicle type, of the engine-related vehicle parts and of the engine type or engine family, if applicable, comprising the particulars referred to in Annex II, along with the documentation required in application of Article 3 of Directive 70/156/EEC.

3.3. Application for EC type-approval for a vehicle type with an approved engine

3.3.1. The application for approval of a vehicle with regard to emission of gaseous and particulate pollutants by its approved diesel engine or engine family and with regard to the level of the emission of gaseous pollutants by its approved gas engine or engine family shall be submitted by the vehicle manufacturer or a duly accredited representative.

3.3.2. It shall be accompanied by the undermentioned documents in triplicate and the following particulars:

3.3.2.1. a description of the vehicle type and of engine-related vehicle parts comprising the particulars referred to in Annex II, as applicable, and a copy of the EC Type-Approval Certificate (Annex VI) for the engine or engine family, if applicable, as a separate technical unit which is installed in the vehicle type, along with the documentation required in application of Article 3 of Directive 70/156/EEC.

4. EC TYPE-APPROVAL

4.1. Granting of a universal fuel EC type-approval

A universal fuel EC type-approval is granted subject to the following requirements.

4.1.1. In the case of diesel fuel the parent engine meets the requirements of this Directive on the reference fuel specified in Annex IV.

4.1.2. In the case of natural gas the parent engine should demonstrate its capability to adapt to any fuel composition that may occur across the market. In the case of natural gas there are generally two types of fuel, high calorific fuel (H-gas) and low calorific fuel (L-gas), but with a significant spread within both ranges; they differ significantly in their energy content expressed by the Wobbe Index and in their λ-shift factor (S_λ). The formulae for the calculation of the Wobbe index and S_λ are given in Sections 2.27 and 2.28. Natural gases with a λ-shift factor between 0,89 and 1,08 ($0,89 \leq S_\lambda \leq 1,08$) are considered to belong to H-range, while natural gases with a λ-shift factor between 1,08 and 1,19 ($1,08 \leq S_\lambda \leq 1,19$) are considered to belong to L-range. The composition of the reference fuels reflects the extreme variations of S_λ.

The parent engine shall meet the requirements of this Directive on the reference fuels G_R (fuel 1) and G_{25} (fuel 2), as specified in Annex IV, without any readjustment to the fuelling between the two tests. However, one adaptation run over one ETC cycle without measurement is permitted after the change of the fuel. Before testing, the parent engine shall be run-in using the procedure given in paragraph 3 of Appendix 2 to Annex III.

4.1.2.1. On the manufacturer's request the engine may be tested on a third fuel (fuel 3) if the λ-shift factor (S_λ) lies between 0,89 (i.e. the lower range of G_R) and 1,19 (i.e. the upper range of G_{25}) for example when fuel 3 is a market fuel. The results of this test may be used as a basis for the evaluation of the conformity of the production.

4.1.3. In the case of an engine fuelled with natural gas which is self-adaptive for the range of H-gases on the one hand and the range of L-gases on the other hand, and which switches between the H-range and the L-range by means of a switch, the parent engine shall be tested on the relevant reference fuel as specified in Annex IV for each range, at each position of the switch. The fuels are G_R (fuel 1) and G_{23} (fuel 3) for the H-range of gases and G_{25} (fuel 2) and G_{23} (fuel 3) for the L-range of gases. The parent engine shall meet the requirements of this Directive at both positions of the switch without any readjustment to the fuelling between the two tests at each position of the switch. However, one adaptation run over one ETC cycle without measurement is permitted after the change of the fuel. Before testing the parent engine shall be run-in using the procedure given in paragraph 3 of Appendix 2 to Annex III.

4.1.3.1. At the manufacturer's request the engine may be tested on a third fuel instead of G_{23} (fuel 3) if the λ-shift factor (S_λ) lies between 0,89 (i.e. the lower range of G_R) and 1,19 (i.e. the upper range of G_{25}), for example when fuel 3 is a market fuel. The results of this test may be used as a basis for the evaluation of the conformity of the production.

4.1.4. In the case of natural gas engines, the ratio of the emission results ‘r’ shall be determined for each pollutant as follows:

$$r = \frac{\text{emission result on reference fuel 2}}{\text{emission result on reference fuel 1}}$$

or,

$$ra = \frac{\text{emission result on reference fuel 2}}{\text{emission result on reference fuel 3}}$$

and,

$$rb = \frac{\text{emission result on reference fuel 1}}{\text{emission result on reference fuel 3}}$$

4.1.5. In the case of LPG the parent engine should demonstrate its capability to adapt to any fuel composition that may occur across the market. In the case of LPG there are variations in C_3/C_4 composition. These variations are reflected in the reference fuels. The parent engine should meet the emission requirements on the reference fuels A and B as specified in Annex IV without any readjustment to the fuelling between the two tests. However, one adaptation run over one ETC cycle without measurement is permitted after the change of the fuel. Before testing, the parent engine shall be run-in using the procedure defined in paragraph 3 of Appendix 2 to Annex III.

4.1.5.1. The ratio of emission results 'r' shall be determined for each pollutant as follows:

$$r = \frac{\text{emission result on reference fuel B}}{\text{emission result on reference fuel A}}$$

4.2. Granting of a fuel range restricted EC type-approval

Fuel range restricted EC type-approval is granted subject to the following requirements:

4.2.1. Exhaust emissions approval of an engine running on natural gas and laid out for operation on either the range of H-gases or on the range of L-gases

The parent engine shall be tested on the relevant reference fuel, as specified in Annex IV, for the relevant range. The fuels are G_R (fuel 1) and G_{23} (fuel 3) for the H-range of gases and G_{25} (fuel 2) and G_{23} (fuel 3) for the L-range of gases. The parent engine shall meet the requirements of this Directive without any readjustment to the fuelling between the two tests. However, one adaptation run over one ETC cycle without measurement is permitted after the change of the fuel. Before testing the parent engine shall be run-in using the procedure defined in paragraph 3 of Appendix 2 to Annex III.

4.2.1.1. At the manufacturer's request the engine may be tested on a third fuel instead of G_{23} (fuel 3) if the λ-shift factor (S_λ) lies between 0,89 (i.e. the lower range of G_R) and 1,19 (i.e. the upper range of G_{25}), for example when fuel 3 is a market fuel. The results of this test may be used as a basis for the evaluation of the conformity of the production.

4.2.1.2. The ratio of emission results 'r' shall be determined for each pollutant as follows:

$$r = \frac{\text{emission result on reference fuel 2}}{\text{emission result on reference fuel 1}}$$

or,

$$ra = \frac{\text{emission result on reference fuel 2}}{\text{emission result on reference fuel 3}}$$

and,

$$rb = \frac{\text{emission result on reference fuel 1}}{\text{emission result on reference fuel 3}}$$

4.2.1.3. On delivery to the customer the engine shall bear a label (see paragraph 5.1.5) stating for which range of gases the engine is approved.

4.2.2. Exhaust emissions approval of an engine running on natural gas or LPG and laid out for operation on one specific fuel composition

4.2.2.1. The parent engine shall meet the emission requirements on the reference fuels G_R and G_{25} in the case of natural gas, or the reference fuels A and B in the case of LPG, as specified in Annex IV. Between the tests fine-tuning of the fuelling system is allowed. This fine-tuning will consist of a recalibration of the fuelling database, without any alteration to either the basic control strategy or the basic structure of the database. If

necessary the exchange of parts that are directly related to the amount of fuel flow (such as injector nozzles) is allowed.

4.2.2.2. At the manufacturer's request the engine may be tested on the reference fuels G_R and G_{23}, or on the reference fuels G_{25} and G_{23}, in which case the type-approval is only valid for the H-range or the L-range of gases respectively.

4.2.2.3. On delivery to the customer the engine shall bear a label (see paragraph 5.1.5) stating for which fuel composition the engine has been calibrated.

4.3. Exhaust emissions approval of a member of a family

4.3.1. With the exception of the case mentioned in paragraph 4.3.2, the approval of a parent engine shall be extended to all family members without further testing, for any fuel composition within the range for which the parent engine has been approved (in the case of engines described in paragraph 4.2.2) or the same range of fuels (in the case of engines described in either paragraphs 4.1 or 4.2) for which the parent engine has been approved.

4.3.2. Secondary test engine

In case of an application for type-approval of an engine, or a vehicle in respect of its engine, that engine belonging to an engine family, if the technical service determines that, with regard to the selected parent engine the submitted application does not fully represent the engine family defined in Annex I, Appendix 1, an alternative and if necessary an additional reference test engine may be selected by the technical service and tested.

4.4. Type-approval certificate

A certificate conforming to the model specified in Annex VI shall be issued for approval referred to under Sections 3.1, 3.2 and 3.3.

5. ENGINE MARKINGS

5.1. The engine approved as a technical unit must bear:

5.1.1. the trademark or trade name of the manufacturer of the engine;

5.1.2. the manufacturer's commercial description;

5.1.3. the EC type-approval number preceded by the distinctive letter(s) or number(s) of the country granting EC type-approval[(4)];

5.1.4. in case of an NG engine one of the following markings to be placed after the EC type approval number:

— H in case of the engine being approved and calibrated for the H-range of gases;

— L in case of the engine being approved and calibrated for the L-range of gases;

— HL in case of the engine being approved and calibrated for both the H-range and L-range of gases;

— H_t in case of the engine being approved and calibrated for a specific gas composition in the H-range of gases and transformable to another specific gas in the H-range of gases by fine tuning of the engine fuelling;

— L_t in case of the engine being approved and calibrated for a specific gas composition in the L-range of gases and transformable to another specific gas in the L-range of gases after fine tuning of the engine fuelling;

— HL_t in the case of the engine being approved and calibrated for a specific gas composition in either the H-range or the L-range of gases and transformable to another specific gas in either the H-range or the L-range of gases by fine tuning of the engine fuelling.

5.1.5. Labels

In the case of NG and LPG fuelled engines with a fuel range restricted type approval, the following labels are applicable:

5.1.5.1. Content

The following information must be given:

In the case of paragraph 4.2.1.3, the label shall state

‘ONLY FOR USE WITH NATURAL GAS RANGE H’. If applicable, ‘H’ is replaced by ‘L’.

In the case of paragraph 4.2.2.3, the label shall state

‘ONLY FOR USE WITH NATURAL GAS SPECIFICATION …’ or ‘ONLY FOR USE WITH LIQUEFIED PETROLEUM GAS SPECIFICATION …’, as applicable. All the information in the appropriate table(s) in Annex IV shall be given with the individual constituents and limits specified by the engine manufacturer.

The letters and figures must be at least 4 mm in height.
Note:

If lack of space prevents such labelling, a simplified code may be used. In this event, explanatory notes containing all the above information must be easily accessible to any person filling the fuel tank or performing maintenance or repair on the engine and its accessories, as well as to the authorities concerned. The site and content of these explanatory notes will be determined by agreement between the manufacturer and the approval authority.

5.1.5.2. Properties

Labels must be durable for the useful life of the engine. Labels must be clearly legible and their letters and figures must be indelible. Additionally, labels must be attached in such a manner that their fixing is durable for the useful life of the engine, and the labels cannot be removed without destroying or defacing them.

5.1.5.3. Placing

Labels must be secured to an engine part necessary for normal engine operation and not normally requiring replacement during engine life. Additionally, these labels must be located so as to be readily visible to the average person after the engine has been completed with all the auxiliaries necessary for engine operation.

5.2. In case of an application for EC type-approval for a vehicle type in respect of its engine, the marking specified in Section 5.1.5 shall also be placed close to fuel filling aperture.

5.3. In case of an application for EC type-approval for a vehicle type with an approved engine, the marking specified in Section 5.1.5 shall also be placed close to the fuel filling aperture.

6. SPECIFICATIONS AND TESTS

6.1. General

6.1.1. *Emission control equipment*

6.1.1.1. The components liable to affect the emission of gaseous and particulate pollutants from diesel engines and the emission of gaseous pollutants from gas engines shall be so designed, constructed, assembled and installed as to enable the engine, in normal use, to comply with the provisions of this Directive.

6.1.2. *Functions of emission control equipment*

6.1.2.1. The use of a defeat device and/or an irrational emission control strategy is forbidden.

6.1.2.2. An auxiliary control device may be installed to an engine, or on a vehicle, provided that the device:

— operates only outside the conditions specified in paragraph 6.1.2.4, or

— is activated only temporarily under the conditions specified in paragraph 6.1.2.4 for such purposes as engine damage protection, air-handling device protection, smoke management, cold start or warming-up, or

— is activated only by on-board signals for purposes such as operational safety and limp-home strategies.

6.1.2.3. An engine control device, function, system or measure that operates during the conditions specified in Section 6.1.2.4 and which results in the use of a different or modified engine control strategy to that normally employed during the applicable emission test cycles will be permitted if, in complying with the requirements of Sections 6.1.3 and/or 6.1.4, it is fully demonstrated that the measure does not reduce the effectiveness of the emission control system. In all other cases, such devices shall be considered to be a defeat device.

6.1.2.4. For the purposes of point 6.1.2.2, the defined conditions of use under steady state and transient conditions are:

— an altitude not exceeding 1 000 metres (or equivalent atmospheric pressure of 90 kPa),

— an ambient temperature within the range 283 to 303 K (10 to 30 °C),

— engine coolant temperature within the range 343 to 368 K (70 to 95 °C).

6.1.3. *Special requirements for electronic emission control systems*

6.1.3.1. *Documentation requirements*

The manufacturer shall provide a documentation package that gives access to the basic design of the system and the means by which it controls its output variables, whether that control is direct or indirect.

The documentation shall be made available in two parts:

(a) the formal documentation package, which shall be supplied to the technical service at the time of submission of the type-approval application, shall include a full description of the system. This documentation may be brief, provided that it exhibits evidence that all outputs permitted by a matrix obtained from the range of control of the individual unit inputs have been identified. This information shall be attached to the documentation required in Annex I, Section 3;

(b) additional material that shows the parameters that are modified by any auxiliary control device and the boundary conditions under which the device operates. The additional material shall include a description of the fuel system control logic, timing strategies and switch points during all modes of operation.

The additional material shall also contain a justification for the use of any auxiliary control device and include additional material and test data to demonstrate the effect on exhaust emissions of any auxiliary control device installed to the engine or on the vehicle.

This additional material shall remain strictly confidential and be retained by the manufacturer, but be made open for inspection at the time of type-approval or at any time during the validity of the type-approval.

6.1.4. To verify whether any strategy or measure should be considered a defeat device or an irrational emission control strategy according to the definitions given in Sections 2.29 and 2.31, the type-approval authority and/or the technical service may additionally request a NO_x screening test using the ETC which may be carried out in combination with either the type-approval test or the procedures for checking the conformity of production.

6.1.4.1. As an alternative to the requirements of Appendix 4 to Annex III the emissions of NO_x during the ETC screening test may be sampled using the raw exhaust gas and the technical prescriptions of ISO DIS 16183, dated 15 October 2000, shall be followed.

6.1.4.2. In verifying whether any strategy or measure should be considered a defeat device or an irrational emission control strategy according to the definitions given in Sections 2.29 and 2.31, an additional margin of 10 %, related to the appropriate NO_x limit value, shall be accepted.

6.1.5. Transitional provisions for extension of type-approval

6.1.5.1. This section shall only be applicable to new compression-ignition engines and new vehicles propelled by a compression-ignition engine that have been type-approved to the requirements of row A of the tables in Section 6.2.1.

6.1.5.2. As an alternative to Sections 6.1.3 and 6.1.4, the manufacturer may present to the technical service the results of a NO_x screening test using the ETC on the engine conforming to the characteristics of the parent engine described in Annex II, and taking into account the provisions of Sections 6.1.4.1 and 6.1.4.2. The manufacturer shall also provide a written statement that the engine does not employ any defeat device or irrational emission control strategy as defined in Section 2 of this Annex.

6.1.5.3. The manufacturer shall also provide a written statement that the results of the NO_x screening test and the declaration for the parent engine, as referred to in Section 6.1.4, are also applicable to all engine types within the engine family described in Annex II.

6.2. Specifications concerning the emission of gaseous and particulate pollutants and smoke

For type approval to row A of the tables in Section 6.2.1, the emissions shall be determined on the ESC and ELR tests with conventional diesel engines including those fitted with electronic fuel injection equipment, exhaust gas recirculation (EGR), and/or oxidation catalysts. Diesel engines fitted with advanced exhaust aftertreatment systems including the NO_x catalysts and/or particulate traps, shall additionally be tested on the ETC test.

For type approval testing to either row B1 or B2 or row C of the tables in Section 6.2.1 the emissions shall be determined on the ESC, ELR and ETC tests.

For gas engines, the gaseous emissions shall be determined on the ETC test.

The ESC and ELR test procedures are described in Annex III, Appendix 1, the ETC test procedure in Annex III, Appendices 2 and 3.

The emissions of gaseous pollutants and particulate pollutants, if applicable, and smoke, if applicable, by the engine submitted for testing shall be measured by the methods described in Annex III, Appendix 4. Annex V describes the recommended analytical systems for the gaseous pollutants, the recommended particulate sampling systems, and the recommended smoke measurement system.

Other systems or analysers may be approved by the Technical Service if it is found that they yield equivalent results on the respective test cycle. The determination of system equivalency shall be based upon a 7 sample pair (or larger) correlation study between the system under consideration and one of the reference systems of this Directive. For particulate emissions only the full flow dilution system is recognised as the reference system. 'Results' refer to the specific cycle emissions value. The correlation testing shall be performed at the same laboratory, test cell, and on the same engine, and is preferred to be run concurrently. The equivalency criterion is defined as a ± 5 % agreement of the sample pair averages. For introduction of a new system into the Directive the determination of equivalency shall be based upon the calculation of repeatability and reproducibility, as described in ISO 5725.

6.2.1. Limit values

The specific mass of the carbon monoxide, of the total hydrocarbons, of the oxides of nitrogen and of the particulates, as determined on the ESC test, and of the smoke opacity, as determined on the ELR test, shall not exceed the amounts shown in Table 1.

TABLE 1

Limit values — ESC and ELR tests

Row	**Mass of carbon monoxide(CO) g/kWh**	**Mass of hydrocarbons(HC) g/kWh**	**Mass of nitrogen oxides(NO_x) g/kWh**	**Mass of particulates(PT) g/kWh**		**Smoke[1]**
A (2000)	2,1	0,66	5,0	0,10	0,13[a]	0,8
B1 (2005)	1,5	0,46	3,5	0,02		0,5
B2 (2008)	1,5	0,46	2,0	0,02		0,5
C (EEV)	1,5	0,25	2,0	0,02		0,15

a For engines having a swept volume of less than 0,75 dm^3 per cylinder and a rated power speed of more than 3 000 min^{-1}.

For diesel engines that are additionally tested on the ETC test, and specifically for gas engines, the specific masses of the carbon monoxide, of the non-methane hydrocarbons, of the methane (where applicable), of the oxides of nitrogen and of the particulates (where applicable) shall not exceed the amounts shown in Table 2.

TABLE 2

Limit values — ETC tests

Row	Mass of carbon monoxide(CO) g/kWh	Mass of non-methane hydrocarbons(NMHC) g/kWh	Mass of methane(CH_4)[a] g/kWh	Mass of nitrogen oxides(NO_x) g/kWh	Mass of particulates(PT)[b] g/kWh	
A (2000)	5,45	0,78	1,6	5,0	0,16	0,21[c]
B1 (2005)	4,0	0,55	1,1	3,5	0,03	
B2 (2008)	4,0	0,55	1,1	2,0	0,03	
C (EEV)	3,0	0,40	0,65	2,0	0,02	

a For NG engines only.

b Not applicable for gas fuelled engines at stage A and stages B1 and B2.

c For engines having a swept volume of less than 0,75 dm^3 per cylinder and a rated power speed of more than 3 000 min^{-1}.

6.2.2. Hydrocarbon measurement for diesel and gas fuelled engines

6.2.2.1. A manufacturer may choose to measure the mass of total hydrocarbons (THC) on the ETC test instead of measuring the mass of non-methane hydrocarbons. In this case, the limit for the mass of total hydrocarbons is the same as shown in Table 2 for the mass of non-methane hydrocarbons.

6.2.3. Specific requirements for diesel engines

6.2.3.1. The specific mass of the oxides of nitrogen measured at the random check points within the control area of the ESC test must not exceed by more than 10 per cent the values interpolated from the adjacent test modes (reference Annex III, Appendix 1, Sections 4.6.2 and 4.6.3).

6.2.3.2. The smoke value on the random test speed of the ELR must not exceed the highest smoke value of the two adjacent test speeds by more than 20 per cent, or by more than 5 per cent of the limit value, whichever is greater.

7. INSTALLATION ON THE VEHICLE

7.1. The engine installation on the vehicle shall comply with the following characteristics in respect to the type-approval of the engine:

7.1.1. intake depression shall not exceed that specified for the type-approved engine in Annex VI;

7.1.2. exhaust back pressure shall not exceed that specified for the type-approved engine in Annex VI;

7.1.3. the exhaust system volume shall not differ by more than 40 % of that specified for the type-approved engine in Annex VI;

7.1.4. power absorbed by the auxiliaries needed for operating the engine shall not exceed that specified for the type-approved engine in Annex VI.

8. ENGINE FAMILY

8.1. Parameters defining the engine family

The engine family, as determined by the engine manufacturer, may be defined by basic characteristics which must be common to engines within the family. In some cases there may be interaction of parameters. These effects must also be taken into consideration to ensure that only engines with similar exhaust emission characteristics are included within an engine family.

In order that engines may be considered to belong to the same engine family, the following list of basic parameters must be common:

8.1.1. Combustion cycle:
— 2 cycle
— 4 cycle

8.1.2. Cooling medium:
— air
— water
— oil

8.1.3. For gas engines and engines with aftertreatment:
— number of cylinders

(other diesel engines with fewer cylinders than the parent engine may be considered to belong to the same engine family provided the fuelling system meters fuel for each individual cylinder)

8.1.4. Individual cylinder displacement:
— engines to be within a total spread of 15 %

8.1.5. Method of air aspiration:
— naturally aspirated
— pressure charged
— pressure charged with charge air cooler

8.1.6. Combustion chamber type/design:
— pre-chamber
— swirl chamber
— open chamber

8.1.7. Valve and porting — configuration, size and number:
— cylinder head
— cylinder wall
— crankcase

8.1.8. Fuel injection system (diesel engines):
— pump-line-injector
— in-line pump
— distributor pump
— single element
— unit injector

8.1.9. Fuelling system (gas engines):
— mixing unit
— gas induction/injection (single point, multi-point)
— liquid injection (single point, multi-point)

8.1.10. Ignition system (gas engines)

8.1.11. Miscellaneous features:
— exhaust gas recirculation
— water injection/emulsion
— secondary air injection
— charge cooling system

8.1.12. Exhaust aftertreatment:
— 3-way-catalyst
— oxidation catalyst
— reduction catalyst
— thermal reactor
— particulate trap

8.2. Choice of the parent engine

8.2.1. Diesel engines

The parent engine of the family shall be selected using the primary criteria of the highest fuel delivery per stroke at the declared maximum torque speed. In the event that two or more engines share this primary criteria, the parent engine shall be selected using the secondary criteria of highest fuel delivery per stroke at rated speed. Under certain circumstances, the approval authority may conclude that the worst case emission rate of the family can best be characterised by testing a second engine. Thus, the approval authority may select an additional engine for test based upon features which indicate that it may have the highest emission level of the engines within that family.

If engines within the family incorporate other variable features which could be considered to affect exhaust emissions, these features shall also be identified and taken into account in the selection of the parent engine.

8.2.2. Gas engines

The parent engine of the family shall be selected using the primary criteria of the largest displacement. In the event that two or more engines share this primary criteria, the parent engine shall be selected using the secondary criteria in the following order:
— the highest fuel delivery per stroke at the speed of declared rated power;
— the most advanced spark timing;
— the lowest EGR rate;
— no air pump or lowest actual air flow pump.

Under certain circumstances, the approval authority may conclude that the worst case emission rate of the family can best be characterised by testing a second engine. Thus, the approval authority may select an additional engine for test based upon features which indicate that it may have the highest emission level of the engines within that family.

9. PRODUCTION CONFORMITY

9.1. Measures to ensure production conformity must be taken in accordance with the provisions of Article 10 of Directive 70/156/EEC. Production conformity is checked on the basis of the description in the type-approval certificates set out in Annex VI to this Directive.

Sections 2.4.2 and 2.4.3 of Annex X to Directive 70/156/EEC are applicable where the competent authorities are not satisfied with the auditing procedure of the manufacturer.

9.1.1. If emissions of pollutants are to be measured and an engine type-approval has had one or several extensions, the tests will be carried out on the engine(s) described in the information package relating to the relevant extension.

9.1.1.1. Conformity of the engine subjected to a pollutant test:

After submission of the engine to the authorities, the manufacturer shall not carry out any adjustment to the engines selected.

9.1.1.1.1. Three engines are randomly taken in the series. Engines that are subject to testing only on the ESC and ELR tests or only on the ETC test for type approval to row A of the tables in Section 6.2.1 are subject to those applicable tests for the checking of production conformity. With the agreement of the authority, all other engines type approved to row A, B1 or B2, or C of the tables in Section 6.2.1 are subjected to testing either on the ESC and ELR cycles or on the ETC cycle for the checking of the production conformity. The limit values are given in Section 6.2.1 of this Annex.

9.1.1.1.2. The tests are carried out according to Appendix 1 to this Annex, where the competent authority is satisfied with the production standard deviation given by the manufacturer, in accordance with Annex X to Directive 70/156/EEC, which applies to motor vehicles and their trailers.

The tests are carried out according to Appendix 2 to this Annex, where the competent authority is not satisfied with the production standard deviation given by the manufacturer, in accordance with Annex X to Directive 70/156/EEC, which applies to motor vehicles and their trailers.

At the manufacturer's request, the tests may be carried out in accordance with Appendix 3 to this Annex.

9.1.1.1.3. On the basis of a test of the engine by sampling, the production of a series is regarded as conforming where a pass decision is reached for all the pollutants and non-conforming where a fail decision is reached for one pollutant, in accordance with the test criteria applied in the appropriate Appendix.

When a pass decision has been reached for one pollutant, this decision may not be changed by any additional tests made in order to reach a decision for the other pollutants.

If no pass decision is reached for all the pollutants and if no fail decision is reached for one pollutant, a test is carried out on another engine (see Figure 2).

If no decision is reached, the manufacturer may at any time decide to stop testing. In that case a fail decision is recorded.

9.1.1.2. The tests will be carried out on newly manufactured engines. Gas fuelled engines shall be run-in using the procedure defined in paragraph 3 of Appendix 2 to Annex III.

9.1.1.2.1. However, at the request of the manufacturer, the tests may be carried out on diesel or gas engines which have been run-in more than the period referred to in Section 9.1.1.2, up to a maximum of 100 hours. In this case, the running-in procedure will be conducted by the manufacturer who shall undertake not to make any adjustments to those engines.

9.1.1.2.2. When the manufacturer asks to conduct a running-in procedure in accordance with Section 9.1.1.2.1, it may be carried out on:

— all the engines that are tested, or
— the first engine tested, with the determination of an evolution coefficient as follows:
— the pollutant emissions will be measured at zero and at 'x' hours on the first engine tested,
— the evolution coefficient of the emissions between zero and

'

x

'

hours will be calculated for each pollutant:

emissions 'x' hours/emissions zero hours

It may be less than one.

The subsequent test engines will not be subjected to the running-in procedure, but their zero hour emissions will be modified by the evolution coefficient.

In this case, the values to be taken will be:
— the values at 'x' hours for the first engine,
— the values at zero hour multiplied by the evolution coefficient for the other engines.

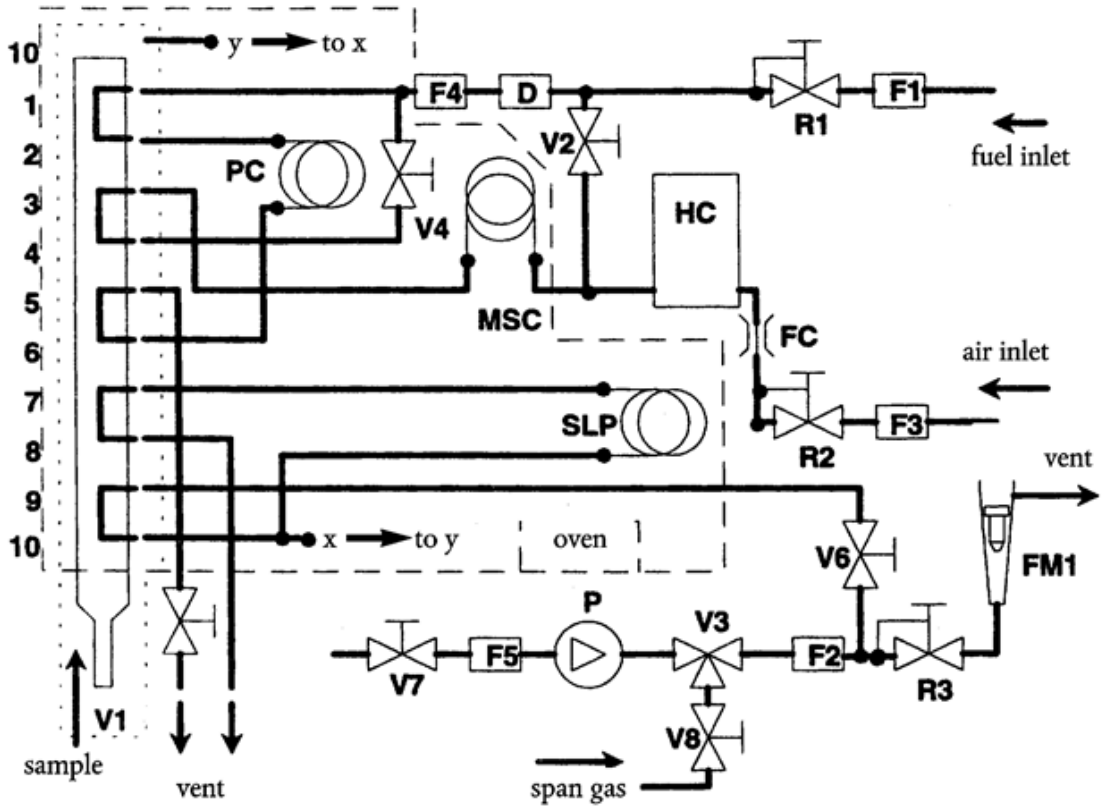
9.1.1.2.3. For diesel and LPG fuelled engines, all these tests may be conducted with commercial fuel. However, at the manufacturer's request, the reference fuels described in Annex IV may be used. This implies tests, as described in Section 4 of this Annex, with at least two of the reference fuels for each gas engine.

9.1.1.2.4. For NG fuelled engines, all these tests may be conducted with commercial fuel in the following way:
— for H marked engines with a commercial fuel within the H-range ($0{,}89 \leq S_\lambda \leq 1{,}00$),
— for L marked engines with a commercial fuel within the L-range ($1{,}00 \leq S_\lambda \leq 1{,}19$),
— for HL marked engines with a commercial fuel within the extreme range of the λ-shift factor ($0{,}89 \leq S_\lambda \leq 1{,}19$).

However, at the manufacturer's request, the reference fuels described in Annex IV may be used. This implies tests, as described in Section 4 of this Annex.

9.1.1.2.5. In the case of dispute caused by the non-compliance of gas fuelled engines when using a commercial fuel, the tests shall be performed with a reference fuel on which the parent engine has been tested, or with the possible additional fuel 3 as referred to in paragraphs 4.1.3.1 and 4.2.1.1 on which the parent engine may have been tested. Then, the result has to be converted by a calculation applying the relevant factor(s) 'r', 'ra' or 'rb' as described in paragraphs 4.1.4, 4.1.5.1 and 4.2.1.2. If r, ra or rb are less than 1 no correction shall take place. The measured results and the calculated results must demonstrate that the engine meets the limit values with all relevant fuels (fuels 1, 2 and, if applicable, fuel 3 in the case of natural gas engines and fuels A and B in the case of LPG engines).

9.1.1.2.6. Tests for conformity of production of a gas fuelled engine laid out for operation on one specific fuel composition shall be performed on the fuel for which the engine has been calibrated.


10
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fuel inlet
V2
PC
V4
HC
MSC
FC
air inlet
SLP
F3
R2
vent
x
to y
oven
V6
FM1
P
V3
F5
F2
V7
R3
V1
V8
sample
vent
span gas

Appendix 1

PROCEDURE FOR PRODUCTION CONFORMITY TESTING WHEN STANDARD DEVIATION IS SATISFACTORY

1. This Appendix describes the procedure to be used to verify production conformity for the emissions of pollutants when the manufacturer's production standard deviation is satisfactory.

2. With a minimum sample size of three engines the sampling procedure is set so that the probability of a lot passing a test with 40 % of the engines defective is 0,95 (producer's risk = 5 %) while the probability of a lot being accepted with 65 % of the engines defective is 0,10 (consumer's risk = 10 %).

3. The following procedure is used for each of the pollutants given in Section 6.2.1 of Annex I (see Figure 2):

Let:

L	=	the natural logarithm of the limit value for the pollutant;
χ_i	=	the natural logarithm of the measurement for the i-th engine of the sample;
s	=	an estimate of the production standard deviation (after taking the natural logarithm of the measurements);
n	=	the current sample number.

4. For each sample the sum of the standardised deviations to the limit is calculated using the following formula:

$$\frac{1}{s}\sum_{i=1}^{n}(L-\chi_i)$$

5. Then:

— if the test statistic result is greater than the pass decision number for the sample size given in Table 3, a pass decision is reached for the pollutant;

— if the test statistic result is less than the fail decision number for the sample size given in Table 3, a fail decision is reached for the pollutant;

— otherwise, an additional engine is tested according to Section 9.1.1.1 of Annex I and the calculation procedure is applied to the sample increased by one more unit.

TABLE 3

Pass and fail decision numbers of Appendix 1 sampling planMinimum sample size: 3

Cumulative number of engines tested (sample size)	**Pass decision number A_n**	**Fail decision number B_n**
3	3,327	– 4,724
4	3,261	– 4,79
5	3,195	– 4,856
6	3,129	– 4,922

7	3,063	– 4,988
8	2,997	– 5,054
9	2,931	– 5,12
10	2,865	– 5,185
11	2,799	– 5,251
12	2,733	– 5,317
13	2,667	– 5,383
14	2,601	– 5,449
15	2,535	– 5,515
16	2,469	– 5,581
17	2,403	– 5,647
18	2,337	– 5,713
19	2,271	– 5,779
20	2,205	– 5,845
21	2,139	– 5,911
22	2,073	– 5,977
23	2,007	– 6,043
24	1,941	– 6,109
25	1,875	– 6,175
26	1,809	– 6,241
27	1,743	– 6,307
28	1,677	– 6,373
29	1,611	– 6,439
30	1,545	– 6,505
31	1,479	– 6,571
32	– 2,112	– 2,112

Appendix 2

PROCEDURE FOR PRODUCTION CONFORMITY TESTING WHEN STANDARD DEVIATION IS UNSATISFACTORY OR UNAVAILABLE

1. This Appendix describes the procedure to be used to verify production conformity for the emissions of pollutants when the manufacturer's production standard deviation is either unsatisfactory or unavailable.

2. With a minimum sample size of three engines the sampling procedure is set so that the probability of a lot passing a test with 40 % of the engines defective is 0,95 (producer's risk = 5 %) while the probability of a lot being accepted with 65 % of the engines defective is 0,10 (consumer's risk = 10 %).

3. The values of the pollutants given in Section 6.2.1 of Annex I are considered to be log normally distributed and should be transformed by taking their natural logarithms. Let m_0 and m denote the minimum and maximum sample size respectively ($m_0 = 3$ and $m = 32$) and let n denote the current sample number.

4. If the natural logarithms of the values measured in the series are $\chi_1, \chi_2, \ldots \chi_i$ and L is the natural logarithm of the limit value for the pollutant, then, define

$$d_i = \chi_i - L$$

and

$$\bar{d}_n = \frac{1}{n}\sum_{i=1}^{n} d_i$$

$$v_2^n = \frac{1}{n}\sum_{i=1}^{n}\left(d_i - \bar{d}_n\right)^2$$

5. Table 4 shows values of the pass (A_n) and fail (B_n) decision numbers against current sample number. The test statistic result is the ratio:

$$\bar{d}_n / V_n$$

and shall be used to determine whether the series has passed or failed as follows:

for $m_0 \leq n < m$:

— pass the series if

$$\bar{d}_n / v_n \leq A_n$$

,

— fail the series if

$$\bar{d}_n / v_n \geq B_n$$

,

— take another measurement if

$$A_n < \bar{d}_n / v_n < B_n$$

.

6. Remarks

The following recursive formulae are useful for calculating successive values of the test statistic:

$$\bar{d}_n = \left(1 - \frac{1}{n}\right)\bar{d}_{n-1} + \frac{1}{n}d_n$$

$$V_2^n = \left(1 - \frac{1}{n}\right)V_2^{n-1} + \left(\bar{d}_n - d_n\right)^2 n - 1$$

$\left(n = 2, 3, \ldots; \bar{d}_1 = d_1; V_1 = 0\right)$

TABLE 4

Pass and fail decision numbers of Appendix 2 sampling planMinimum sample size: 3

Cumulative number of engines tested (sample size)	**Pass decision number A_n**	**Fail decision number B_n**
3	- 0,80381	16,64743
4	- 0,76339	7,68627
5	- 0,72982	4,67136
6	- 0,69962	3,25573
7	- 0,67129	2,45431
8	- 0,64406	1,94369
9	- 0,6175	1,59105
10	- 0,59135	1,33295
11	- 0,56542	1,13566
12	- 0,5396	0,9797
13	- 0,51379	0,85307
14	- 0,48791	0,74801
15	- 0,46191	0,65928
16	- 0,43573	0,58321
17	- 0,40933	0,51718
18	- 0,38266	0,45922
19	- 0,3557	0,40788
20	- 0,3284	0,36203
21	- 0,30072	0,32078
22	- 0,27263	0,28343
23	- 0,2441	0,24943
24	- 0,21509	0,21831
25	- 0,18557	0,1897
26	- 0,1555	0,16328
27	- 0,12483	0,1388
28	- 0,09354	0,11603
29	- 0,06159	0,09480
30	- 0,02892	0,07493

31	- 0,00449	0,05629
32	- 0,03876	0,03876

Appendix 3

PROCEDURE FOR PRODUCTION CONFORMITY TESTING AT MANUFACTURER'S REQUEST

1. This Appendix describes the procedure to be used to verify, at the manufacturer's request, production conformity for the emissions of pollutants.

2. With a minimum sample size of three engines the sampling procedure is set so that the probability of a lot passing a test with 30 % of the engines defective is 0,90 (producer's risk = 10 %) while the probability of a lot being accepted with 65 % of the engines defective is 0,10 (consumer's risk = 10 %).

3. The following procedure is used for each of the pollutants given in Section 6.2.1 of Annex I (see Figure 2):

   Let:

L	=	the limit value for the pollutant,
x_i	=	the value of the measurement for the i-th engine of the sample,
n	=	the current sample number.

4. Calculate for the sample the test statistic quantifying the number of non-conforming engines, i.e. $x_i \geq L$.

5. Then:

   — if the test statistic is less than or equal to the pass decision number for the sample size given in Table 5, a pass decision is reached for the pollutant;

   — if the test statistic is greater than or equal to the fail decision number for the sample size given in Table 5, a fail decision is reached for the pollutant;

   — otherwise, an additional engine is tested according to Section 9.1.1.1 of Annex I and the calculation procedure is applied to the sample increased by one more unit.

   In Table 5 the pass and fail decision numbers are calculated by means of the International Standard ISO 8422/1991.

TABLE 5

Pass and fail decision numbers of Appendix 3 sampling planMinimum sample size: 3

Cumulative number of engines tested (sample size)	**Pass decision number**	**Fail decision number**
3	—	3
4	0	4
5	0	4
6	1	5
7	1	5
8	2	6
9	2	6

10	3	7
11	3	7
12	4	8
13	4	8
14	5	9
15	5	9
16	6	10
17	6	10
18	7	11
19	8	9

(**1**) OJ L 76, 6.4.1970, p. 1. Directive as last amended by Commission Directive 2003/76/EC (OJ L 206, 15.8.2003, p. 29).

(**2**) OJ L 375, 31.12.1980, p. 46. Directive as last amended by Commission Directive 1999/99/EC (OJ L 334, 28.12.1999, p. 32).

(**3**) OJ L 42, 23.2.1970, p. 1. Directive as last amended by Commission Directive 2004/104/EC (OJ L 337, 13.11.2004, p. 13).

(**4**) 1 = Germany, 2 = France, 3 = Italy, 4 = Netherlands, 5 = Sweden, 6 = Belgium, 7 = Hungary, 8 = Czech Republic, 9 = Spain, 11 = United Kingdom, 12 = Austria, 13 = Luxembourg, 17 = Finland, 18 = Denmark, 20 = Poland, 21 = Portugal, 23 = Greece, 24 = Ireland, 26 = Slovenia, 27 = Slovakia, 29 = Estonia, 32 = Latvia, 36 = Lithuania, 49 = Cyprus, 50 = Malta.