

## COMMISSION DIRECTIVE 98/77/EC

of 2 October 1998

adapting to technical progress Council Directive 70/220/EEC on the approximation of the laws of the Member States relating to measures to be taken against air pollution by emissions from motor vehicles

(Text with EEA relevance)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Council Directive 70/220/EEC of 20 March 1970 on the approximation of the laws of the Member States relating to measures to be taken against air pollution by emissions from motor vehicles<sup>(1)</sup>, as last amended by Directive 96/69/EC of the European Parliament and of the Council<sup>(2)</sup>,

Whereas Directive 70/220/EEC is one of the separate directives under the type-approval procedure laid down by Council 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<sup>(3)</sup>, as amended by Commission Directive 98/14/EC<sup>(4)</sup>;

Whereas Article 13(2) of Directive 70/156/EEC lays down that the procedure of Article 13 shall also apply to the introduction of provisions on the type-approval of separate technical units into the separate directives;

Whereas to provide a harmonised basis to guarantee that replacement catalytic converters, intended to be fitted on vehicles of category M<sub>1</sub> and N<sub>1</sub> not equipped with on-board diagnostic systems, are of sufficient quality, it is appropriate to introduce into Directive 70/220/EEC new technical requirements for the EC type-approval of replacement catalytic converters as a separate technical unit; whereas these technical requirements are in accordance with the technical requirements adopted by the United Nations Economic Commission for Europe in its Regulation No 103 relating to the approval of replacement catalytic converters for power-driven vehicles<sup>(5)</sup>;

Whereas in the light of technical progress it is appropriate to introduce into Directive 70/220/EEC new technical requirements for the EC type-approval of vehicles which can be fuelled with liquefied petroleum gas (LPG) or natural gas (NG); whereas the use of LPG and NG for

the propulsion of vehicles permit to achieve very low levels of noxious emissions and should then benefit by the EC type-approval system; whereas these technical requirements are in accordance with the technical requirements adopted by the United Nations Economic Commission for Europe in its Regulation No 83 relating to the approval of vehicles with regard to their emission of pollutants<sup>(6)</sup>;

Whereas it is appropriate to clarify the methods regarding the measurement of vehicle rolling resistance;

Whereas the measures provided for in this Directive are in accordance with the opinion of the Committee for Adaptation to Technical Progress established by Directive 70/156/EEC,

HAS ADOPTED THIS DIRECTIVE:

*Article 1*

Article 1 of Directive 70/220/EEC is replaced by the following Article:

*'Article 1*

For the purposes of this Directive:

- "vehicle" means any vehicle as defined in Annex II Section A to Directive 70/156/EEC,
- "automotive LPG or NG equipment" means any assembly of automotive LPG or NG components designed to be fitted on one or more given types of motor vehicle, which can be approved as a separate technical unit as defined in Article 4(1)(d) of Directive 70/156/EEC,
- "replacement catalytic converter" means a catalytic converter or an assembly of catalytic converters intended to replace an original equipment catalytic converter on a vehicle approved according to Directive 70/220/EEC, which can be approved as a separate technical unit as defined in Article 4(1)(d) of Directive 70/156/EEC.'

<sup>(1)</sup> OJ L 76, 6. 4. 1970, p. 1.

<sup>(2)</sup> OJ L 282, 1. 11. 1996, p. 64.

<sup>(3)</sup> OJ L 42, 23. 2. 1970, p. 1.

<sup>(4)</sup> OJ L 91, 25. 3. 1998, p. 1.

<sup>(5)</sup> Economic Commission for Europe Regulation No 103 (E/ECE/324-E/ECE/TRANS/505/Rev.2/Add.102).

<sup>(6)</sup> Economic Commission for Europe Regulation No 83 (E/ECE/324-E/ECE/TRANS/505/Rev.1/Add.82 as amended).

*Article 2*

The Annexes to Directive 70/220/EEC are amended in accordance with the Annex to this Directive.

*Article 3*

1. With regards to new replacement catalytic converters intended to be fitted on EC-approved vehicles which are not equipped with on-board diagnostic systems (OBD), Member States:

(1) with effect from 1 January 1999, may not:

- refuse to grant EC type-approval pursuant to Article 4(1) of Directive 70/156/EEC, or
- prohibit their sale or installation on a vehicle, if they comply with the requirements of Directive 70/220/EEC as amended by this Directive;

(2) with effect from 1 October 1999 subject to the provision of Article 7(2) of Directive 70/156/EEC shall refuse the sale or installation on a vehicle of a replacement catalytic converter(s), if it is not of a type in respect of which a type-approval has been granted in compliance with Directive 70/220/EEC, as amended by this Directive.

2. With regard to new vehicles fuelled with LPG or NG or which can be fuelled with either petrol or LPG, or NG on grounds relating to air pollution by emissions, Member States:

(1) with effect from 1 January 1999 may not:

- refuse to grant EC type-approval pursuant to Article 4(1) of Directive 70/156/EEC, or
- refuse to grant national type-approval, or
- prohibit the registration, sale or entry into service if they comply with the requirements of Directive 70/220/EEC as amended by this Directive;

(2) with effect from 1 October 1999, shall refuse the registration, sale or entry into service of new vehicles which do not comply with the provision of Directive 70/220/EEC as amended by this Directive.

*Article 4*

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 31 December 1998 they shall forthwith inform the Commission thereof.

When Member States adopt these provisions, they shall contain a reference to this Directive or shall be accompanied by such reference at the occasion of their official publication. The procedure for such reference shall be adopted by the Member States.

2. Member States shall communicate to the Commission the texts of the main procedure of the national law that they adopt in the field governed by this Directive.

*Article 5*

This Directive shall enter into force on the 20th day following its publication in the *Official Journal of the European Communities*.

*Article 6*

This Directive is addressed to the Member States.

Done at Brussels, 2 October 1998.

*For the Commission*

Martin BANGEMANN

*Member of the Commission*

## ANNEX

## AMENDMENTS TO THE ANNEXES TO DIRECTIVE 70/220/EEC

*List of Annexes*

1. The list of Annexes is amended as follows:

‘ANNEX IX a: Specifications of gaseous reference fuels’

‘ANNEX XII: EC type-approval for a vehicle fuelled by LPG or natural gas with regards to its emissions’

‘ANNEX XIII: EC type-approval of replacement catalytic converter as separate technical unit

*Appendix 1: Information document*

*Appendix 2: EC type-approval certificate*

*Appendix 3: EC type-approval mark’.*

*Annex I*

2. The following paragraphs are inserted at the end of Section 1:

‘This Directive also applies to:

- the EC type-approval procedure for replacement catalytic converters as separate technical units intended to be fitted on vehicles of category M<sub>1</sub> and N<sub>1</sub>,
- the EC type-approval procedure of automotive LPG or NG equipment as a separate technical unit intended to be fitted on vehicles of category M<sub>1</sub> and N<sub>1</sub>, with regard to its emissions.’

3. Point 2.4 shall be read as follows:

‘2.4. “Gaseous pollutants” means the exhaust gas emissions of carbon monoxide, oxides of nitrogen, expressed in nitrogen dioxide (NO<sub>2</sub>) equivalent, and hydrocarbons assuming ratio of:

- C<sub>1</sub>H<sub>1.85</sub> for petrol,
- C<sub>1</sub>H<sub>1.86</sub> for diesel,
- C<sub>1</sub>H<sub>2.525</sub> for LPG,
- CH<sub>4</sub> for NG.’

4. Points 2.17 to 2.21 are added to read as follows:

‘2.17. “original equipment catalytic converter” means a catalytic converter or an assembly of catalytic converters covered by the type-approval delivered for the vehicle and whose types are indicated in the document in Annex II to this Directive.

2.18. “replacement catalytic converter” means a catalytic converter or an assembly of catalytic converters for which approval can be obtained according to Annex XIII to this Directive, other than those defined in point 2.17.

2.19. “automotive LPG or NG equipment” means any assembly of automotive LPG or NG components designed to be fitted on one or more given types of motor vehicles, which can be approved as a separate technical unit.

2.20. “family of vehicles” means a group of vehicle types identified by a parent vehicle for the purpose of Annex XII.

2.21. “fuel requirement by the engine” means the type of fuel normally used by the engine:

- petrol,
- LPG (liquefied petroleum gas),
- NG (natural gas),
- both petrol and LPG,
- both petrol and NG,
- diesel fuel.’

5. Point 5.1.2 is modified to read as follows:

'5.1.2. Inlet orifices of petrol tanks.'

6. A new point 5.2.2 is added as follows:

'5.2.2. Positive-ignition engine powered vehicles fuelled with LPG or NG only shall be subjected to the following tests:

- type I (simulating the average tailpipe emissions after a cold start),
- type II (carbon monoxide emissions at idling speed),
- type III (emissions of crankcase),
- type V (durability of pollution control devices).'

7. Points 5.3.1.2.1.1 and 5.3.1.2.1.2 are added as follows:

'5.3.1.2.1.1. Vehicles that are fuelled with LPG or NG shall be tested in the type I test for variations in the composition of LPG or NG, as set out in Annex XII. Vehicles that can be fuelled either with petrol or with LPG or NG shall be tested in the type I test on both fuels, of which the fuelling on LPG or NG has to be performed for variation in the composition of LPG or NG, as set out in Annex XII.

5.3.1.2.1.2. Notwithstanding the requirement of point 5.3.1.2.1.1, vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the test type I as vehicles that can only run on a gaseous fuel.'

8. A new point 5.3.1.4.2 is added as follows:

'5.3.1.4.2. When the tests are performed with gaseous fuels, the resulting mass of gaseous emissions shall be less than the limits for petrol-engined vehicles in the above table.'

9. New points 5.3.2.1.1 and 5.3.2.1.2 are added as follows:

'5.3.2.1.1. Vehicles which can be fuelled either with petrol or with LPG or NG shall be tested in the test type II on both fuels.

5.3.2.1.2. Notwithstanding the requirement of point 5.3.2.1.1 above, vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the type II test as vehicles that can only run on a gaseous fuel.'

10. New points 5.3.3.1.1 and 5.3.3.1.2. are added as follows:

'5.3.3.1.1. Vehicles that can be fuelled either with petrol or with LPG or NG should be tested in the type III test on petrol only.

5.3.3.1.2. Notwithstanding the requirement of point 5.3.3.1.1, vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the type III test as vehicles that can only run on a gaseous fuel.'

11. Point 5.3.4.1 is amended to read:

'5.3.4.1. ... having a compression-ignition engine, and the vehicles fuelled with LPG or NG.

5.3.4.1.1. Vehicles that can be fuelled either with petrol or with LPG or NG should be tested in the type IV test on petrol only.'

12. A new point 5.3.5.1.1 is added as follows:

'5.3.5.1.1. Vehicles that can be fuelled either with petrol or with LPG or NG should be tested in the type V test on petrol only.'

13. A new point 5.3.8 is inserted:

‘5.3.8. Approval of a replacement catalytic converter.

5.3.8.1. The test must be carried out only for replacement catalytic converter intended to be fitted on EC type-approved vehicles which are not equipped with on OBD, according to Annex XIII.’

*Annex II (information document)*

14. Point 3.2.2 shall read as follows:

‘3.2.2. Fuel: Diesel oil/Petrol/LPG/NG (‘)

15. Points 3.2.15 and 3.2.16 are added as follows:

‘3.2.15. LPG fuelling system: yes/no (‘)

3.2.15.1. Approval number according to Directive 70/221/EEC (‘):

3.2.15.2. Electronic engine management control unit for LPG fuelling:

3.2.15.2.1. Make(s): .....

3.2.15.2.2. Type(s): .....

3.2.15.2.3. Emission-related adjustment possibilities: .....

3.2.15.3. Further documentation:

3.2.15.3.1. Description of the safeguarding of the catalyst at switch-over from petrol to LPG or back: .....

3.2.15.3.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc.): .....

3.2.15.3.3. Drawing of the symbol: .....

3.2.16. NG fuelling system: yes/no (‘)

3.2.16.1. Approval number according to Directive 70/221/EEC (‘): .....

3.2.16.2. Electronic engine management control unit for NG fuelling:

3.2.16.2.1. Make(s): .....

3.2.16.2.2. Type(s): .....

3.2.16.2.3. Emission-related adjustment possibilities: .....

3.2.16.3. Further documentations: .....

3.2.16.3.1. Description of the safeguarding of the catalyst at switch-over from petrol to NG or back: .....

3.2.16.3.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc.): .....

3.2.16.3.3. Drawing of the symbol: .....

(‘) Delete where not applicable.

(‘) When this Directive will be amended to cover tanks for gaseous fuels.’

*Annex III (type I test)*

16. Point 1 shall read as follows:

'1. Introduction

This Annex describes the procedure for the type I test defined in 5.3.1 of Annex I. When the reference fuel to be used is LPG or NG, the provisions of Annex XII shall apply additionally.'

17. A new point 3.2.1 is added as follows:

'3.2.1. Vehicles that are fuelled either with petrol or with LPG or NG shall be tested according to Annex XII with the appropriate reference fuel(s) as defined in Annex IX a.'

18. Point 5.3.1.1 is added as follows:

'5.3.1.1. For positive-ignition engined vehicles fuelled with LPG or NG or so equipped that they can be fuelled with either petrol or LPG or NG, between the tests on the first gaseous reference fuel and the second gaseous reference fuel, the vehicle shall be preconditioned before the test on the second reference fuel. This preconditioning is done on the second reference fuel by driving a preconditioning cycle consisting of one part one (urban part) and two times part two (extra-urban part) of the test cycle described in Appendix 1 to this Annex. On the manufacturer's request and with the agreement of the technical service this preconditioning cycle may be extended. The dynamometer setting shall be the one indicated in points 5.1 and 5.2 of this Annex.'

19. Point 6.2.3 is added as follows:

'6.2.3. In the case of the use of LPG or NG as a fuel it is permissible that the engine is started on petrol and switched to LPG or NG after a predetermined period of time which cannot be changed by the driver.'

20. Point 8.2 is amended to read as follows:

'In the case of carbon monoxide (CO):  $d = 1.25 \text{ g/l}$

In the case of hydrocarbons:

for petrol ( $\text{CH}_{1.85}$ )  $d = 0.619 \text{ g/l}$

for diesel ( $\text{CH}_{1.86}$ )  $d = 0.619 \text{ g/l}$

for LPG ( $\text{CH}_{2.525}$ )  $d = 0.649 \text{ g/l}$

for NG ( $\text{CH}_4$ )  $d = 0.714 \text{ g/l}$

In the case of nitrogen oxides ( $\text{NO}_x$ ):  $d = 2.05 \text{ g/l}$ .'

21. In Annex III, Appendix 3, point 5.1.1.2.8, the definition of the factor  $K_R$  and the table are amended to read as follows:

— ' $\dots K_R =$  temperature correction factor of rolling resistance, taken to be equal to:  $8,64 \times 10^{-3}/^\circ\text{C}$  or the manufacturer's correction factor that is approved by the authority'

— ' $\dots$  and for each speed the coefficients a and b are shown in the following table:

V (km/h)	a	b
20	$7,24 \times 10^{-5}$	0,82
40	$1,59 \times 10^{-4}$	0,54
60	$1,96 \times 10^{-4}$	0,33
80	$1,85 \times 10^{-4}$	0,23
100	$1,63 \times 10^{-4}$	0,18
120	$1,57 \times 10^{-4}$	0,14'

22. In Annex III, Appendix 5, point 3.1.3.5.2 is amended to read as follows:

'3.1.3.5.2. ... less than 3 % by volume for petrol and diesel, less than 2,2 % by volume for LPG and less than 1,5 % by volume for NG.'

23. In Annex III, Appendix 6, point 2.3 is amended to read as follows:

'2.3. ...  
— methane and purified air  $1,00 < R_f < 1,15$   
or  
 $1,00 < R_f < 1,05$  for NG-fuelled vehicles  
...'

24. In Annex III, Appendix 8, point 1.3 shall read as follows:

'.....

The dilution factor is calculated as follows:

$$DF = \frac{13,4}{C_{CO_2} + (C_{HC} + C_{CO}) 10^{-4}} \quad \text{for petrol and diesel fuel (5a)}$$

$$DF = \frac{11,9}{C_{CO_2} + (C_{HC} + C_{CO}) 10^{-4}} \quad \text{for LPG (5b)}$$

$$DF = \frac{9,5}{C_{CO_2} + (C_{HC} + C_{CO}) 10^{-4}} \quad \text{for natural gas (5c)}$$

'.....'

25. In Annex III, Appendix 8, point 1.5.2.3, the value of  $Q_{HC}$  is amended to read as follows:

' $Q_{HC} = 0.619$  in the case of petrol or diesel

$Q_{HC} = 0.649$  in the case of LPG

$Q_{HC} = 0.714$  in the case of NG'

*Annex IV (type II test)*

26. A new point 2.2.1 is added as follows:

'2.2.1. Vehicles that are fuelled either with petrol or with LPG or NG shall be tested with the reference fuel(s) used for the type I test.'

*Annex VII (type V test)*

27. Point 3 shall read as follows:

'3. FUEL

The durability test is conducted with a suitable commercially available fuel.'

## Annex IX a

28. A new Annex IXa is added as follows:

## ANNEX IX a

## SPECIFICATIONS OF GASEOUS REFERENCE FUELS

## 1. Technical data of the LPG reference fuels

		Fuel A	Fuel B	Test method
Composition	% vol.			ISO 7941
C3	% vol.	30 ± 2	85 ± 2	
C4	% vol.	balance	balance	
< C3, > C4	% vol.	max. 2 %	max. 2 %	
Olefins	% vol.	9 ± 3	12 ± 3	
Evaporative residue	ppm	max. 50	max. 50	NFM 41-015
Water content		none	none	visual inspection
Sulphur content	ppm mass (*)	max. 50	max. 50	EN 24260
Hydrogen sulphide		none	none	
Copper corrosion	rating	class 1	class 1	ISO 625 1 (**)
odour		characteristic	characteristic	
MON		min. 89	min. 89	EN 589 Annex B

(\*) Value to be determined at standard conditions (293,2 K (20 °C) and 101,3 kPa).

(\*\*) This method may not accurately determine the presence of corrosive materials if the sample contains corrosion inhibitors or other chemicals which diminish the corrosivity of the sample to the copper strip. Therefore, the addition of such compounds for the sole purpose of biasing the test method is prohibited.

## 2. Technical data of NG reference fuels

Reference fuel G <sub>20</sub>					
Characteristics	Units	Basis	Limits		Test Method
			Minimum	Maximum	
Composition:					
Methane		100	99	100	
Balance	% mole	—	—	1	ISO 6974
[Inerts + C <sub>2</sub> /C <sub>2</sub> +]					
N <sub>2</sub>					
Sulphur content	mg/m <sup>3</sup> (*)	—	—	50	ISO 6326-5

**Reference fuel G<sub>25</sub>**

Characteristics	Units	Basis	Limits		Test method
			Minimum	Maximum	
Composition:					
Methane		86	84	88	
Balance	% mole	—	—	1	ISO 6974
[Inerts + C <sub>2</sub> /C <sub>2</sub> +]					
N <sub>2</sub>		14	12	16	
Sulphur content	mg/m <sup>3</sup> (*)	—	—	50	ISO 6326-5

(\*) Value to be determined as standard conditions (293,2 K (20 °C) and 101,3 kPa).

The Wobbe Index is the ratio of the calorific value of gas per unit volume and the square root of its relative density under the same reference conditions:

$$\text{Wobbe Index} = H_{\text{gas}} \sqrt{\rho_{\text{air}}} / \sqrt{\rho_{\text{gas}}}$$

with

$H_{\text{gas}}$  = calorific value of the fuel in MJ/m<sup>3</sup> at 0°C

$\rho_{\text{air}}$  = density of air at 0°C

$\rho_{\text{gas}}$  = density of fuel at 0°C

The Wobbe Index is said to be gross or net according to whether the calorific value is the gross or net calorific value.'

*Annex IX*

29. A new point 1.8.1 is added to the appendix of Annex IX:

'1.8.1. In the case of vehicles fuelled with LPG or NG:

1.8.1.1. Repeat the table for all reference gases of LPG or NG, showing if results are measured or calculated. In the case of vehicles designed to run either on petrol or on LPG or NG: repeat for petrol and all reference gases of LPG or NG.

1.8.1.2. Approval number of the parent vehicle, if the vehicle is a member of a family:

1.8.1.3. Ratios "r" of emission results for the family in the case of gaseous fuel, for each pollutant.'

*Annex XII*

30. A new Annex XII is added to read as follows:

*ANNEX XII***EC TYPE-APPROVAL FOR A VEHICLE FUELLED BY LPG OR NATURAL GAS WITH REGARD TO ITS EMISSIONS****1. INTRODUCTION**

This Annex describes the special requirements that apply in the case of an approval of a vehicle that runs on LPG or natural gas, or that can run either on unleaded petrol or LPG or natural gas, in so far as the testing on LPG or natural gas is concerned.

In the case of LPG and natural gas there is on the market a large variation in fuel composition, requiring the fuelling system to adapt its fuelling rates to these compositions. To demonstrate this capability, the vehicle has to be tested in the test type I on two extreme reference fuels and demonstrate the self-adaptability of the fuelling system. Whenever the self adaptability of a fuelling system has been demonstrated on a vehicle, such a vehicle may be considered as a parent of a family. Vehicles that comply with the requirements of members of that family, if fitted with the same fuelling system, need to be tested on only one fuel.

## 2. DEFINITIONS

For the purpose of this Annex:

- 2.1. A parent vehicle means a vehicle that is selected to act as the vehicle on which the self adaptability of a fuelling system is going to be demonstrated, and to which the members of a family refer. It is possible to have more than one parent vehicle in a family.
- 2.2. A member of the family is a vehicle that shares the following essential characteristics with its parent(s):
  - 2.2.1. (a) It is produced by the same vehicle manufacturer.
  - (b) It is subject to the same emission limits.
  - (c) If the gas fuelling system has a central metering for the whole engine:

It has a certified power output between 0,7 and 1,15 times that of the engine of the parent vehicle.

If the gas fuelling system has an individual metering per cylinder:

It has a certified power output per cylinder between 0,7 and 1,15 times that of the engine of the parent vehicle.
  - (d) If fitted with a catalyst system, it has the same type of catalyst i.e. three-way, oxidation, de NOx.
  - (e) It has a gas fuelling system (including the pressure regulator) from the same system manufacturer and of the same type: induction, vapour injection (single point, multipoint), liquid injection (single point, multipoint).
  - (f) This gas fuelling system is controlled by an ECU of the same type and technical specification, containing the same software principles and control strategy.
- 2.2.2. With regard to requirement (c): in the case where a demonstration shows two gas fuelled vehicles could be members of the same family with the exception of their certified power output, respectively P1 and P2 ( $P1 < P2$ ), and both are tested as if they were parent vehicles, the family relation will be considered valid for any vehicle with a certified power output between  $0,7 * P1$  and  $1,15 * P2$ .

## 3. GRANTING OF AN EC TYPE-APPROVAL

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

- 3.1. Exhaust emissions approval of a parent vehicle:

The parent vehicle 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 C3/C4 composition. 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 Wobbe index. These variations are reflected in the reference fuels.

- 3.1.1. The parent vehicle(s) shall be tested in the test type I on the two extreme reference fuels of Annex IXa.

3.1.1.1. If the transition from one fuel to another is in practice aided through the use of a switch, this switch shall not be used during type approval. In such a case on the manufacturer's request and with the agreement of the technical service the pre-conditioning cycle referred to in point 5.3.1 of Annex III may be extended.

3.1.2. The vehicle(s) is (are) considered to conform if, with both reference fuels, the vehicle complies with the emission limits.

3.1.3. The ratio of emission results "r" should be determined for each pollutant as follows:

$$r = \frac{\{\text{emission result on one reference fuel}\}}{\{\text{emission result on the other reference fuel}\}}$$

3.2. Exhaust emissions approval of a member of the family:

For a member of the family a test of type I shall be performed with one reference fuel. This reference fuel may be either reference fuel. The vehicle is considered to comply if the following requirements are met:

3.2.1. The vehicle complies with the definition of a family member as defined under point 2.2.

3.2.2. The test results for each pollutant will be multiplied with its factor "r" (see point 3.1.3), if r is greater than 1,0. If r is smaller than 1,0, its value will be taken as 1. The results of these multiplications shall be taken as the final emission result. On the manufacturer's request the test type I may be performed on reference fuel 2 or on both reference fuels, so that no correction is needed.

3.2.3. The vehicle shall comply with the emission limits valid for the relevant category for both measured and calculated emissions.

#### 4. GENERAL CONDITIONS

4.1. Tests for conformity of production may be performed with a commercial fuel of which the C3/C4 ratio lies between those of the reference fuels in the case of LPG, or of which the Wobbe index lies between those of the extreme reference fuels in the case of NG. In that case a fuel analysis needs to be present.<sup>7</sup>

#### *Annex XIII*

31. A new Annex XIII is added to read as follows:

#### *ANNEX XIII*

#### **EC TYPE-APPROVAL OF REPLACEMENT CATALYTIC CONVERTER AS SEPARATE TECHNICAL UNIT**

##### 1. SCOPE

This Annex applies to the EC type-approval, as separate technical units within the meaning of Article 4(1)(d) of Directive 70/156/EEC, of catalytic converters to be fitted on one or more given types of motor vehicles of categories M<sub>1</sub> and N<sub>1</sub> <sup>(1)</sup> as replacement parts <sup>(2)</sup>.

##### 2. DEFINITIONS

For the purpose of this Annex:

2.1. "Original equipment catalytic converter", see point 2.17 of Annex I.

<sup>(1)</sup> As defined in Annex II Section A to Directive 70/156/EEC.

<sup>(2)</sup> This Annex does not apply to replacement catalytic converters intended to be fitted on vehicles of categories M<sub>1</sub> and N<sub>1</sub> equipped with an on-board diagnostic (OBD) system.

- 2.2. "Replacement catalytic converter", see point 2.18 of Annex I.
- 2.3. "Type of catalytic converter" means catalytic converters which do not differ in such essential aspects as:
  - 2.3.1. number of coated substrates, structure and material;
  - 2.3.2. type of catalytic activity (oxidising, three-way, etc.);
  - 2.3.3. volume, ratio of frontal area and substrate length;
  - 2.3.4. catalyst material content;
  - 2.3.5. catalyst material ratio;
  - 2.3.6. cell density;
  - 2.3.7. dimensions and shape;
  - 2.3.8. thermal protection.
- 2.4. "Vehicle type", see point 2.1 of Annex I.
- 2.5. "Approval of a replacement catalytic converter" means the approval of a converter intended to be fitted as a replacement part on one or more specific types of vehicles with regard to the limitation of pollutant emissions, noise level and effect on vehicle performance.

### 3. APPLICATION FOR EC TYPE-APPROVAL

- 3.1. An application for EC type-approval pursuant to Article 3(4) of Directive 70/156/EEC of a type of replacement catalytic converter shall be submitted by the manufacturer.
- 3.2. A model for the information document is given in Appendix 1 to this Annex.
- 3.3. The following must be submitted to the technical service responsible for the type-approval test:
  - 3.3.1. Vehicle(s) of a type approved in accordance with Directive 70/220/EEC equipped with a new original catalytic converter. This (these) vehicle(s) shall be selected by the applicant with the agreement of the technical service. It (they) shall comply with the requirements of Section 3 of Annex III to this Directive.

The test vehicle(s) shall have no emission control system defects; any excessively worn out or malfunctioning emission-related original part shall be repaired or replaced. The test vehicle(s) shall be tuned properly and set to manufacturer's specification prior to emission testing.

- 3.3.2. One sample of the type of the replacement catalytic converter. This sample shall be clearly and indelibly marked with the applicant's trade name or mark and its commercial designation.

### 4. GRANTING OF EC TYPE-APPROVAL

- 4.1. If the relevant requirements are satisfied, EC type-approval pursuant to Article 4(3) of Directive 70/156/EEC shall be granted.
- 4.2. A model for the EC type-approval certificate is given in Appendix 2 to this Annex.
- 4.3. An approval number in accordance with Annex VII to Directive 70/156/EEC shall be assigned to each type of replacement catalytic converter approved. The same Member State shall not assign the same number to another replacement catalytic converter type. The same type-approval number may cover the use of that replacement catalytic converter type on a number of different vehicle types.

### 5. EC TYPE-APPROVAL MARKING

- 5.1. Every replacement catalytic converter conforming to the type approved under this Directive as a separate technical unit shall bear an EC type-approval mark.

- 5.2. This mark shall consist of a rectangle surrounding the letter "e" followed by the distinguishing number or letters of the Member State which has granted the EC type-approval:

1	for Germany	12	for Austria
2	for France	13	for Luxembourg
3	for Italy	17	for Finland
4	for the Netherlands	18	for Denmark
5	for Sweden	21	for Portugal
6	for Belgium	23	for Greece
9	for Spain	IRL	for Ireland
11	for the United Kingdom		

It must also include in the vicinity of the rectangle the "base approval number" contained in point 4 of the type-approval number referred to in Annex VII to Directive 70/156/EEC, preceded by the two figures indicating the sequence number assigned to the most recent major technical amendment to Directive 70/220/EEC on the date EC component type-approval was granted. In this Directive, the sequence number is 00.

- 5.3. The approval mark referred to in point 5.2 shall be clearly legible and indelible.
- 5.4. Appendix 3 to this Annex gives examples of arrangements of the approval mark and approval data referred to above.

## 6. REQUIREMENTS

### 6.1. General requirements

- 6.1.1. The replacement catalytic converter shall be designed, constructed and capable of being mounted so as to enable the vehicle to comply with the provisions of this Directive which it was originally in compliance with and that pollutant emissions are effectively limited throughout the normal life of the vehicle under normal conditions of use.
- 6.1.2. The installation of the replacement catalytic converter shall be at the exact position of the original equipment catalytic converter, and the position on the exhaust line of the oxygen probe(s), if applicable, shall not be modified.
- 6.1.3. If the original equipment catalytic converter includes thermal protection, the replacement catalytic converter shall include equivalent protection.
- 6.1.4. The replacement catalytic converter shall be durable, that is, designed, constructed and capable of being mounted so that reasonable resistance to the corrosion and oxidation phenomena to which it is exposed is obtained, having regard to the conditions of use of the vehicle.

### 6.2. Requirements regarding emissions

The vehicle(s) indicated in point 3.3.1 of this Annex, equipped with a replacement converter of the type for which approval is requested, shall be subjected to a Type I test under the conditions described in the corresponding Annex to this Directive in order to compare its performance with the original catalytic converter according to the procedure described below.

#### 6.2.1. Determination of the basis for comparison

The vehicle(s) shall be fitted with a new original catalytic converter (see point 3.3.1) which shall be run in with 12 extra urban cycles (type I test part 2).

After this preconditioning, the vehicle(s) shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20 and 30 °C). This conditioning shall be carried out for at least six hours and continue until the engine oil and coolant temperature are within  $\pm 2$  K of the temperature of the room. Subsequently three type I tests shall be made.

#### 6.2.2. Exhaust gas test with replacement catalytic converter

The original equipment catalytic converter of the test vehicle(s) shall be replaced by the replacement catalytic converter (see point 3.3.2) which shall be run in with 12 extra urban cycles (type I test part 2).

After this preconditioning, the vehicle(s) shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20 and 30 °C). This conditioning shall be carried out for at least six hours and continue until the engine oil and coolant temperature are within  $\pm 2$  K of the temperature of the room. Subsequently three type I tests shall be made.

#### 6.2.3. Evaluation of the emission of pollutants of vehicles equipped with replacement catalytic converters

The test vehicle(s) with the original equipment catalytic converter shall comply with the limit values according to the type-approval of the vehicle(s) including, if applicable, the deterioration factors applied during the type-approval of the vehicle(s).

The requirements regarding emissions of the vehicle(s) equipped with the replacement catalytic converter shall be deemed to be fulfilled if the results meet for each regulated pollutant (CO, HC+NO<sub>x</sub> and particulates) the following conditions:

$$M \leq 0,85 S + 0,4 G \quad (1)$$

$$M \leq G \quad (2)$$

where:

M mean value of the emissions of one pollutant (CO or particulates) or the sum of two pollutants (HC + NO<sub>x</sub>) obtained from the three type I tests with the replacement catalytic converter.

S mean value of the emissions of one pollutant (CO or particulates) or the sum of two pollutants (HC + NO<sub>x</sub>) obtained from the three type I tests with the original catalytic converter.

G limit value of the emissions of one pollutant (CO or particulates) or of the sum of two pollutants (HC + NO<sub>x</sub>) according to the type-approval of the vehicle(s) divided by, if applicable, the deterioration factors determined in accordance with point 6.4.

Where approval is applied for different types of vehicles from the same car manufacturer, and provided that these different types of vehicle are fitted with the same type of original equipment catalytic converter, the type I test may be limited to at least two vehicles selected after agreement with the technical service responsible for approval.

#### 6.3. Requirements regarding noise and exhaust back-pressure

The replacement catalytic converter shall satisfy the technical requirements of Annex II to Directive 70/157/EEC.

#### 6.4. Requirements regarding durability

The replacement catalytic converter shall comply with the requirements of point 5.3.5 of Annex I to this Directive, i.e. type V test or deterioration factors from the following table for the results of the type I tests.

Table XIII.6.4

Engine category	Deterioration factors		
	CO	HC + NO <sub>x</sub>	Particulates
Positive ignition	1,2	1,2	—
Compression ignition	1,1	1,0	1,2

### 7. MODIFICATION OF THE TYPE AND AMENDMENTS TO APPROVALS

In the case of modification of the type approved pursuant to this Directive, the provisions of Article 5 of Directive 70/156/EEC shall apply.

## 8. CONFORMITY OF PRODUCTION

Measures to ensure the conformity of production shall be taken in accordance with the provisions laid down in Article 10 of Directive 70/156/EEC.

### 8.2. Special provisions

8.2.1. The checks referred to in point 2.2 of Annex X to Directive 70/156/EEC shall include compliance with the characteristics as defined under point 2.3 to this Annex.

8.2.2. For the application of point 2.4.4 of Annex X to Directive 70/156/EEC, the tests described in point 6.2 of this Annex (requirements regarding emissions) may be carried out. In this case, the holder of the approval may ask, as an alternative, to use as a basis for comparison not the original equipment catalytic converter, but the replacement catalytic converter which was used during the type-approval tests (or another sample that has been proven to conform to the approved type). Emissions values measured with the sample under verification shall then on average not exceed by more than 15 % the mean values measured with the sample used for reference.

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*Appendix 1***Information document No... relating to the EC type-approval of replacement catalytic converters (Directive 70/220/EEC as last amended by Directive ...)**

The following information, if applicable, must be supplied in triplicate and include a list of contents. Any drawings must be supplied in appropriate scale and sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, must show sufficient detail.

If the system, components or separate technical units have electronic controls, information concerning their performance must be supplied.

## 0. GENERAL

- 0.1. Make (trade name of manufacturer): .....
- 0.2. Type: .....
- 0.5. Name and address of manufacturer: .....
- 0.7. In the case of components and separate technical units, location and method of affixing of the EC approval mark: .....
- 0.8. Address(es) of assembly plant(s): .....

## 1. DESCRIPTION OF THE DEVICE

- 1.1. Make and type of the replacement catalytic converter: .....
- 1.2. Drawings of the replacement catalytic converter, identifying in particular all the characteristics referred to in Section 2.3 of this Annex: .....
- 1.3. Description of the vehicle type or types for which the replacement catalytic converter is intended: .....
- 1.3.1. Number(s) and/or symbol(s) characterising the engine and vehicle type(s): .....
- 1.4. Description and drawings showing the position of the replacement catalytic converter relative to the engine exhaust manifold(s): .....

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Appendix 2

Model

(Maximum format: A4 (210 mm × 297 mm))

EC TYPE-APPROVAL CERTIFICATE



Communication concerning the

- type-approval (1),
— extension of type-approval (1),
— refusal of type-approval (1),
— withdrawal of type-approval (1),

of a type of vehicle/component/separate technical unit (1) with regard to Directive .....,
as last amended by Directive .....

Type-approval number: .....

Reason for extension: .....

SECTION I

- 0.1. Make (trade name of manufacturer): .....
0.2. Type: .....
0.3. Means of identification of type if marked on the vehicle/component/separate technical unit (1) (2): .....
0.3.1. Location of that marking: .....
0.4. Category of vehicle (1) (3): .....
0.5. Name and address of manufacturer: .....
0.7. In the case of components and separate technical units, location and method of affixing of the EC approval mark: .....
0.8. Address(es) of assembly plant(s): .....

(1) Delete where not applicable.

(2) If the means of identification of type contains characters not relevant to describe the vehicle, component or separate technical unit types covered by this type-approval certificate such characters shall be represented in the document by the symbol: "2" (e.g. ABC??123??).

(3) As defined in Annex II Section A to Directive 70/156/EEC.

## SECTION II

1. Additional information (where applicable): See addendum
2. Technical service responsible for carrying out the tests: .....
3. Date of test report: .....
4. Number of test report: .....
5. Remarks (if any): See addendum
6. Place: .....
7. Date: .....
8. Signature: .....
9. The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

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*Addendum*

to EC type-approval certificate No ...

concerning the separate technical unit type-approval of replacement catalytic converters for motor vehicles with regard to Directive 70/220/EEC as last amended by Directive ...

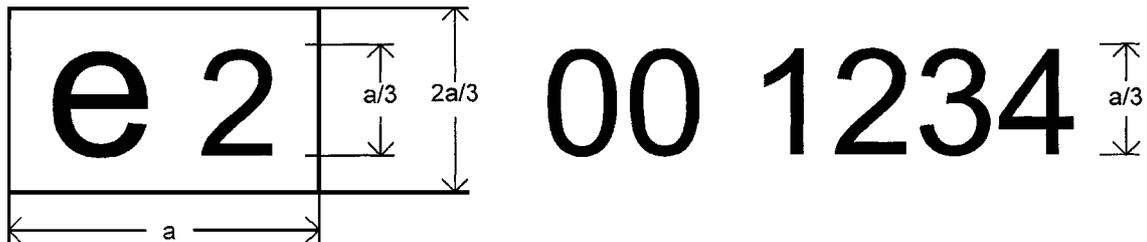
1. Additional information
  - 1.1. Make and type of the replacement catalytic converter: .....
  - 1.2. Vehicle type(s) for which the catalytic converter type qualifies as replacement part: .....
  - 1.3. Type(s) of vehicle(s) on which the replacement catalytic converter has been tested: .....
5. Remarks: .....

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*Appendix 3***Model for the EC type-approval marks**

(see point 5.2 of this Annex)

$$a \geq 8 \text{ mm}$$



The above approval mark affixed to a component of a replacement catalytic converter shows that the type concerned has been approved in France (e 2), pursuant to this Directive. The first two digits of the approval number (00) refer to the sequence number assigned to the most recent amendments made to Directive 70/220/EEC. The following four digits (1234) are those allocated by the approval authority to the replacement catalytic converter as the base approval number.'

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