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COUNCIL DIRECTIVE

of 16 December 1980

relating to the carbon dioxide emissions and the fuel consumption of motor vehicles

(80/1268/EEC)

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THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas the technical requirements which motor vehicles must satisfy pursuant to certain national laws relate *inter alia* to the method of measuring fuel consumption which must be used to indicate the fuel consumption of a vehicle type;

Whereas those requirements differ from one Member State to another; whereas this results in technical barriers to trade which must be eliminated by all Member States adopting the same requirements either in addition to or in place of their existing rules, in order in particular to allow the EEC type-approval procedure which was the subject of 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 (4), as last amended by Directive 80/1267/EEC (5), to be introduced in respect of each type of vehicle;

Whereas it is of paramount importance to establish a method of measuring fuel consumption by motor vehicles for inclusion in Community requirements;

Whereas a Community method of measuring fuel consumption is also necessary to ensure, in particular, that customers and users are supplied with objective and precise information;

Whereas the requirements of this Directive apply only to motor vehicles in international motor vehicle classification category M_1 as set out in Directive 70/156/EEC; whereas a method of measuring the fuel consumption of the other categories of motor vehicles will be established as soon as certain technical difficulties can be resolved,

HAS ADOPTED THIS DIRECTIVE:

Article 1

For the purpose of this Directive, 'vehicle' means any motor vehicle intended for use on the road, with or without bodywork, having at least four wheels and a maximum design speed exceeeding 25 km/h, with the exception of vehicles which run on rails and of agricultural tractors and machinery.

(1) OJ No C 104, 28. 4. 1980, p. 1.
(2) OJ No C 265, 13. 10. 1980, p. 76.
(3) OJ No C 182, 21. 7. 1980, p. 3.
(4) OJ No L 42, 23. 2. 1970, p. 1.
(5) See page 34 of this Official Journal.

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Article 2

No Member State may refuse to grant EC type-approval or national type-approval in respect of a vehicle, or refuse or prohibit the sale, registration, entry into service or use of a vehicle, on grounds relating to its carbon dioxide emissions or its fuel consumption if the emission and consumption figures have been determined in accordance with Annexes I and II and are set out in a document given to the vehicle owner at the time of purchase in the manner and form decided by each Member State.

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Article 3

Any amendments necessary for adapting the requirements of the Annexes to take account of technical progress shall be adopted in accordance with the procedure laid down in Article 13 of Directive 70/156/EEC.

Article 4

1. Member States shall bring into force the provisions necessary in order to comply with this Directive within 18 months of its notification. They shall forthwith inform the Commission thereof.

2. Member States shall ensure that the texts of the main provisions of national law which they adopt in the field covered by this Directive are communicated to the Commission.

Article 5

This Directive is addressed to the Member States.

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ANNEX I

DETERMINATION OF CO_2 EMISSIONS AND FUEL CONSUMPTION

1. SCOPE

This Directive applies to the carbon dioxide (CO_2) emissions and the fuel consumption of all motor vehicles of category M1.

2. APPLICATION FOR EC TYPE-APPROVAL

2.1. The application for EC type-approval pursuant to Article 3 (4) of Directive 70/156/EEC for a vehicle type with regard to CO_2 emissions and fuel consumption shall be submitted by the manufacturer.

2.2. A model for the information document is given in Annex II to Directive 70/220/EEC. When already available, the type-approval number will also be reported. When appropriate, copies of other type-approvals with the relevant data are provided to enable extension of approvals in accordance with point 11. At the request of the technical service in charge of the tests or the manufacturer, complementary technical information could be considered for specific vehicles which are particularly fuel efficient.

2.3. For the test described in point 6 of this Annex, a vehicle representative of the vehicle type to be approved will be submitted when the technical service responsible for the type-approval tests carries out the tests itself. During the test, the technical service will check that this vehicle conforms to the limit values applicable to that type, as described in Directive 70/220/EEC, as modified according to its last amendment.

3. GRANTING OF EC TYPE-APPROVAL

3.1. If the relevant requirements are satisfied, EC type-approval pursuant to Article 4 (3) of Directive 70/156/EEC shall be granted.

3.2. A model for the EC type-approval certificate is given in Annex II.

3.3. An approval number in accordance with Annex VII to Directive 70/156/EEC shall be assigned to each vehicle type approved. The same Member State shall not assign the same number to another vehicle type.

4. GENERAL REQUIREMENTS

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4.1. The CO_2 emissions are measured during the test cycle simulating the urban and extra-urban driving patterns as described in Appendix 1 of Annex III to Directive 70/220/EEC, as last amended.

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4.2. The results of the test must be expressed as carbon dioxide emissions in g/km rounded to the nearest whole number.

4.3. Fuel consumptions are calculated according to point 7 by the carbon balance method using the measured emissions of CO_2 and the other carbon related emissions (CO and HC). The results will be rounded to the first decimal place.

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4.4. **Test fuel**

4.4.1. Petrol and diesel vehicles

The appropriate reference fuels as defined in Annex IX to Directive 70/220/EEC, as last amended, must be used for testing.

4.4.2. LPG and NG-fuelled vehicles

For LPG and NG, that fuel must be used which is chosen by the manufacturer for the measurement of the net power in accordance with Annex I to Directive 80/1269/EEC. The chosen fuel shall be specified in the communication document as defined in Annex II.

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4.4.3. For the purpose of calculation mentioned in 4.3, the following fuel characteristics will be used:

(a) density: measured on the test fuel according to ISO 3675 or an equivalent method; for petrol and diesel the measured density at 15 °C will be used; for LPG and NG, a reference density will be used, as follows:

0,538 kg/l for LPG

0,654 kg/m³ for NG (1)

(b) hydrogen-carbon ratio: fixed values will be used, which are:

1,85 for petrol

1,86 for diesel

2,525 for LPG

4,00 for NG

2,93 for NG (NMHC).

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5. TEST CONDITIONS

5.1. **Test vehicle**

5.1.1. The vehicle must be presented in good mechanical condition. It must have been run in and driven at least 3 000 kilometres, but less than 15 000 kilometres, before the test.

5.1.2. The settings of the engine and of the vehicle controls must be those prescribed by the manufacturer. This requirement also applies, in particular to the idle settings, to the cold start device and to the exhaust gas pollutant emission control system.

5.1.3. The laboratory may check that vehicle performance is as specified by the manufacturer and that it is possible to use it in normal driving conditions, particularly cold and hot start.

5.1.4. Before the test, the vehicle must be stored in a room where the temperature remains between 293 and 303 K (20 and 30 °C). This conditioning period will last at least six hours and to a point where the temperature of the engine lube oil and the engine coolant are within ± 2 K of the room temperature. At the request of the manufacturer, the test may be conducted within a maximum of 30 hours after the vehicle has been used at normal temperature.

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At the manufacturer's request, positive ignition engined vehicles may be preconditioned according to the procedure prescribed in item 5.2.1 of Annex VI to Directive 70/220/EEC, as last amended. Compression ignition engined vehicles may be preconditioned according to the procedure described in item 5.3 of Annex III to the same Directive.

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5.1.5. Only the equipment necessary for the functioning of the vehicle during the test shall be in operation. If there is a manually controlled device on the carburettor inlet for air heating, it must be in the 'summer' position. In general, the auxiliary equipment required for the normal running of the vehicle must be in operation.

5.1.6. If the radiator fan is temperature controlled, it must be operating as it would normally on the vehicle. The passenger compartment heating system must not be operating, nor must the air conditioning system, although its compressor must be operating normally.

5.1.7. If a pressure charging device is fitted, it must be operating as it would normally.

5.2. **Lubricants**

All lubricants must be those recommended by the manufacturer of the vehicle and must be indicated on the test report.

(1) This is the mean value of the G20 and G23 reference fuels at 15 °C.

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5.3. **Tyres**

The tyres must be of one of the types specified as original equipment by the vehicle manufacturer, inflated to the pressure recommended for the test load and speeds (adjusted, where necessary, for test-bed operation under test conditions). The pressures used must be indicated in the test report.

6. MEASUREMENT OF CO_2 AND CARBON-RELATED EMISSIONS

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6.1. **Test cycle**

The test cycle is described in Appendix 1 of Annex III to Directive 70/220/EEC, as last amended, including both Part I (urban driving) and Part II (extra-urban driving). All driving prescriptions contained in this Appendix will be applied for the CO_2 measurement.

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6.2. **Definition**

6.2.1. Reference mass

Mass of the vehicle in running order less the uniform mass of the driver of 75 kg and increased by a uniform mass of 100 kg.

6.3. **Dynamometer adjustments**

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6.3.1. The load and inertia adjustments of the dynamometer are determined as defined in Annex III to Directive 70/220/EEC, as last amended.

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6.4. **Calculation of emissions**

6.4.1. General provisions

6.4.1.1. Emissions of gaseous pollutants are calculated by means of the following equation:

$$M_i = \frac{V_{mix} \cdot Q_i \cdot C_i \cdot 10^{-6}}{d} \quad (1)$$

where:

M_i = mass emission of the pollutant i in grams per kilometre;

V_{mix} = volume of the diluted exhaust gas expressed in litres per test and corrected to standard conditions (273,2 K and 101,33 kPa);

Q_i = density of the pollutant i in grams per litre at normal temperature and pressure (273,2 K and 101,33 kPa);

C_i = concentration of the pollutant i in the diluted exhaust gas expressed in ppm and corrected by the amount of the pollutant i contained in the dilution air. If C_i is expressed in % volume, 10^{-6} factor is replaced by 10^{-2};

d = driven distance during the operating cycle in km.

6.4.1.2. Volume determination

6.4.1.2.1. Calculation of the volume when a variable dilution device with constant flow control by orifice or venturi is used. Record continuously the parameters showing the volumetric flow, and calculate the total volume for the duration of the test.

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6.4.1.2.2. Calculation of volume when a positive displacement pump is used. The volume of diluted exhaust gas in systems comprising a positive displacement pump is calculated with the following formula:

$$V = V_o \cdot N$$

where:

V = volume of the diluted exhaust gas expressed in litres per test (prior to correction);

V_o = volume of gas delivered by the positive displacement pump on testing conditions in litres per revolution;

N = number of revolutions per test.

6.4.1.2.3. Correction of the diluted exhaust-gas volume to standard conditions. The diluted exhaust-gas volume is corrected by means of the following formula:

$$V_{mix} = V \cdot K_1 \cdot \frac{P_p}{T_p} \quad (2)$$

in which:

$$K_1 = \frac{273,2}{101,33} = 2,6961 \ (K \cdot kPa^{-1}) \quad (3)$$

where:

P_p = absolute pressure at the inlet to the positive displacement pump in kPa;

T_p = average temperature of the diluted exhaust gas entering the positive displacement pump during the test (K).

6.4.1.3. Calculation of the corrected concentration of pollutants in the sampling bag

$$C_i = C_e - C_d \left(1 - \frac{1}{DF}\right) \quad (4)$$

where:

C_i = concentration of the pollutant i in the diluted exhaust gas, expressed in ppm or % volume and corrected by the amount of i contained in the dilution air;

C_e = measured concentration of pollutant i in the diluted exhaust gas, expressed in ppm, or % volume;

C_d = measured concentration of pollutant i in the air used for dilution, expressed in ppm, or % volume;

DF = dilution factor.

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The dilution factor is calculated as follows:

For petrol and diesel:

$$DF = \frac{13,4}{C_{CO_2} + (C_{HC} + C_{CO})10^{-4}}$$

For LPG:

$$DF = \frac{11,9}{C_{CO_2} + (C_{HC} + C_{CO})10^{-4}}$$

For NG:

$$DF = \frac{9,5}{C_{CO_2} + (C_{HC} + C_{CO})10^{-4}}$$

where:

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C_{CO_2} = concentration of CO_2 in the diluted exhaust gas contained in the sampling bag, expressed in % volume;

C_{HC} = concentration of HC in the diluted exhaust gas contained in the sampling bag, expressed in ppm carbon equivalent;

C_{CO} = concentration of CO in the diluted exhaust gas contained in the sampling bag, expressed in ppm.

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6.4.1.4. Example

6.4.1.4.1. Data

6.4.1.4.1.1. Ambient conditions:

ambient temperature: 23 °C = 296,2 °K,

barometric pressure: P_B = 101,33 kPa.

6.4.1.4.1.2. Volume measured and reduced to standard conditions

$$V = 51\,961\ l$$

6.4.1.4.1.3. Analyser readings:

	Diluted exhaust	Dilution air
HC (1)	92 ppm	3,0 ppm
CO	470 ppm	0 ppm
CO_2	1,6 % volume	0,03 % volume

(1) In ppm carbon equivalent.

6.4.1.4.2. Calculation

6.4.1.4.2.1. Dilution factor (DF) (see formula 5)

$$DF = \frac{13,4}{C_{CO_2} + (C_{CH} + C_{CO})\ 10^{-4}}$$

$$DF = \frac{13,4}{1,6 + (92 + 470)\ 10^{-4}}$$

$$DF = 8,091$$

6.4.1.4.2.2. Calculation of the corrected concentration of pollutants in the sampling bag:

HC mass emissions (see formulae 4 and 1)

$$C_i = C_e - C_d \left(1 - \frac{1}{DF}\right) \quad (4)$$

$$C_{HC} = 92 - 3 \left(1 - \frac{1}{8,091}\right)$$

$$C_{HC} = 89,371\ ppm$$

$$M_{HC} = C_{HC} \cdot V_{mix} \cdot Q_{HC} \cdot \frac{1}{d} \cdot 10^{-6} \quad (1)$$

$$Q_{HC} = 0,619$$

$$M_{HC} = 89,371 \cdot 51\,961 \cdot 0,619 \cdot 10^{-6} \cdot \frac{1}{d}$$

$$M_{HC} = \frac{2,88}{d}\ g/km$$

CO mass emissions (see formula 1)

$$M_{CO} = C_{CO} \cdot V_{mix} \cdot Q_{CO} \cdot \frac{1}{d} \cdot 10^{-6} \quad (1)$$

$$Q_{CO} = 1,25$$

$$M_{CO} = 470 \cdot 51\,961 \cdot 1,25 \cdot 10^{-6} \cdot \frac{1}{d}$$

$$M_{CO} = \frac{30,5}{d}\ g/km$$

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CO_2 mass emissions (see formula 1)

$$C_i = C_e - C_d \left(1 - \frac{1}{DF}\right) \quad (4)$$

$$C_{CO_2} = 1,6 - 0,03 \left(1 - \frac{1}{8,091}\right)$$

$$C_{CO_2} = 1,573 \text{ \% volume}$$

$$Q_{CO_2} = 1,964$$

$$M_{CO_2} = C_{CO_2} \cdot V_{mix} \cdot Q_{CO_2} \cdot 10^{-2} \cdot \frac{1}{d} \quad (1)$$

$$M_{CO_2} = 1,573 \cdot 51\,961 \cdot 1,964 \cdot 10^{-2} \cdot \frac{1}{d}$$

$$M_{CO_2} = \frac{1\,605,27}{d} \text{ g/km}$$

6.4.2. Special provisions relating to vehicles equipped with compression ignition engines

HC measurements for compression-ignition engines

The average HC concentration used in determining the HC mass emissions from compression-ignition engines is calculated with the aid of the following formula:

$$C_e = \frac{\int_{t_1}^{t_2} C_{HC} \cdot dt}{t_2 - t_1}$$

where:

$\int_{t_1}^{t_2} C_{HC} \cdot dt$ – integral of the recording of the heated FID over the test duration ($t_2 - t_1$);

C_e = HC concentration of the diluted exhaust sample as calculated from the integrated HC trace, in ppm carbon equivalent.

6.5. **Interpretation of the results**

6.5.1. The CO_2 value adopted as the type-approval value shall be the value declared by the manufacturer if the value measured by the technical service does not exceed the declared value by more than 4 %. The measured value can be lower without any limitations.

6.5.2. If the measured value of CO_2 exceeds the manufacturer's declared CO_2 value by more than 4 %, then another test is run on the same vehicle.

When the average of the two test results does not exceed the manufacturer's declared value by more than 4 %, then the value declared by the manufacturer is taken as the type-approval value.

6.5.3. If the average still exceeds the declared value by more than 4 %, a final test is run on the same vehicle.

The average of the three test results is taken as the type-approval value.

7. CALCULATION OF FUEL CONSUMPTIONS

7.1. The fuel consumptions are calculated from the emissions of hydrocarbons, carbon monoxide and carbon dioxide calculated in accordance with paragraph 6.

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7.2. The fuel consumption, expressed in litres per 100 km (in the case of petrol, LPG or diesel) or in m^3 per 100 km (in the case of NG), is calculated by means of the following formulae: (1)

(a) for vehicles with a positive ignition engine fuelled with petrol:

►C2 $FC = (0,1154/D) \times [(0,866 \times THC) + (0,429 \times CO) + (0,273 \times CO_2)]$ ◄

(b) for vehicles with a positive ignition engine fuelled with LPG:

$FC_{norm} = (0,1212/0,538) \times [(0,825 \times THC) + (0,429 \times CO) + (0,273 \times CO_2)]$

If the composition of the fuel used for the test differs from the composition that is assumed for the calculation of the normalised consumption, on the manufacturer's request a correction factor *cf* may be applied as follows:

$FC_{norm} = (0,1212/0,538) \times cf \times [(0,825 \times THC) + (0,429 \times CO) + (0,273 \times CO_2)]$

The correction factor *cf*, which may be applied, is determined as follows:

$cf = 0,825 + 0,0693 \times n_{actual}$

where:

n_{actual} = the actual H/C ratio of the fuel used

(c) for vehicles with a positive ignition engine fuelled with NG:

$FC_{norm} = (0,1336/0,654) \times [(0,749 \times THC) + (0,429 \times CO) + (0,273 \times CO_2)]$

(d) for vehicles with a compression ignition engine:

$FC = (0,1155/D) \times [(0,866 \times THC) + (0,429 \times CO) + (0,273 \times CO_2)]$

In these formulae:

FC = the fuel consumption in litre per 100 km (in the case of petrol, LPG or diesel) or in m^3 per 100 km (in the case of NG)

THC = the measured emission of total hydrocarbons in g/km

CO = the measured emission of carbon monoxide in g/km

CO_2 = the measured emission of carbon dioxide in g/km

D = the density of the test fuel at 15 °C.

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8. AMENDMENTS TO APPROVALS

8.1. In the case of amendments to approvals granted pursuant to this Directive the provisions of Article 5 of Directive 70/156/EEC shall apply.

9. CONFORMITY OF PRODUCTION FOR CO_2 EMISSIONS

9.1. As a general rule, measures to ensure the conformity of production with regard to CO_2 emissions from vehicles is checked on the basis of the description in the type-approval certificate set out in Annex II to this Directive and in accordance with the provisions of Article 10 of Directive 70/156/EEC.

If the authority is not satisfied with the auditing procedure of the manufacturer, then points 2.4.2 and 2.4.3 of Annex X to Directive 70/156/EEC shall apply.

9.1.1. If a vehicle type has had one or several extensions, the tests will be carried out on the vehicle(s) described in the information package which accompanied the first type-approval application.

9.1.1.1. Conformity of the vehicle for the CO_2 test.

(1) Repeat for petrol and gaseous fuel in the case of a vehicle that can run either on petrol or on a gaseous fuel. 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 as vehicles which can only run a gaseous fuel.

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9.1.1.1.1. Three vehicles are randomly taken in the series and are tested as described in paragraph 6 of this Annex.

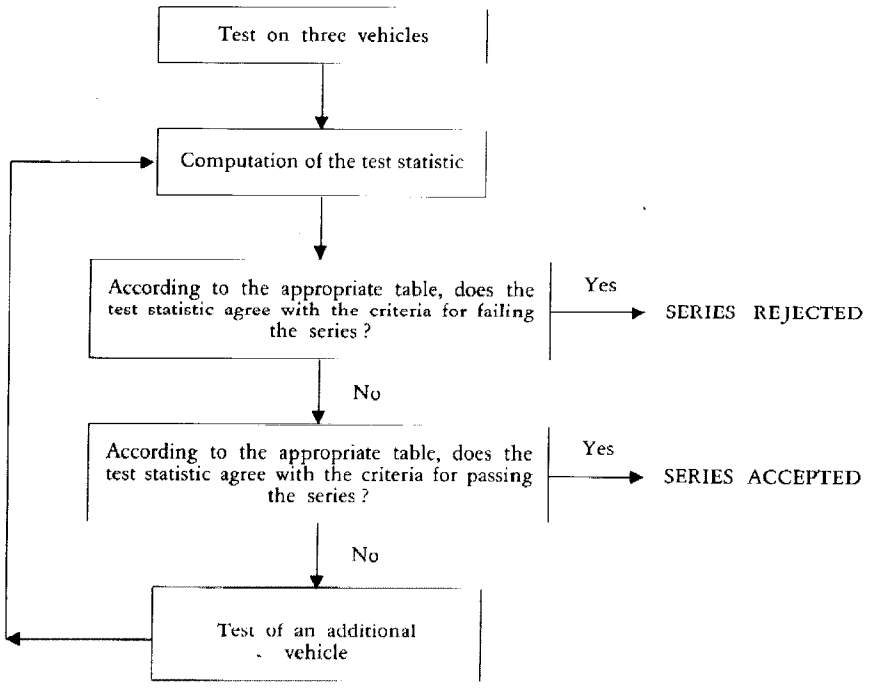
9.1.1.1.2. If the authority is satisfied with the production standard deviation given by the manufacturer, according to Annex X to Directive 70/156/EEC, the tests are carried out according to point 9.2 of this Annex.

If the authority is not satisfied with the production standard deviation given by the manufacturer according to Annex X to Directive 70/156/EEC, the tests are carried out according to point 9.3 of this Annex.

9.1.1.1.3. The production of a series is regarded as conforming or non-conforming, on the basis of tests on the three sampled vehicles, once a pass or fail decision is reached for CO_2, according to the test criteria applied in the appropriate table.

If no pass decision and/or no fail decision is reached for CO_2, a test is carried out on an additional vehicle (see Figure I/8).

FIGURE I/8



9.1.1.2. Notwithstanding the requirements of point 5.1.1 of this Annex, the tests will be carried out on vehicles which have not travelled any distance.

9.1.1.2.1. However, at the request of the manufacturer, the tests will be carried out on vehicles which have been run-in a maximum of 15 000 km.

In this case, the running-in procedure will be conducted by the manufacturer who shall undertake not to make any adjustments to those vehicles.

9.1.1.2.2. If the manufacturer asks to conduct a running-in procedure ('x' km, where $x < 15\,000$ km), it may be carried out as follows:

— the emission of CO_2 will be measured at zero and at 'x' km on the first tested vehicle (which can be the type-approval vehicle),

— the evolution coefficient of the emission between zero and 'x' km will be calculated as follows:

$$EC = \frac{\text{Emissions 'x' km}}{\text{Emissions zero km}}$$

It may be less than one,

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— the following vehicles will not be subjected to the running-in procedure, but their zero km emissions will be modified by the evolution coefficient, EC.

In this case, the values to be taken will be:

— the value at 'x' km for the first vehicle,

— the values at zero km multiplied by the evolution coefficient for the following vehicles.

9.1.1.2.3. As an alternative to this procedure, the car manufacturer can use a fixed evolution coefficient EC of 0,92 and multiply all values of CO_2 measured at zero km by this factor.

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9.1.1.2.4. The reference fuels described in Annex IX and Annex IXa to Directive 70/220/EEC, as last amended, shall be used for testing.

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9.2. Conformity of production when manufacturer's statistical data is available

9.2.1. The following sections describe the procedure to be used to verify the CO_2 conformity of production requirements when the manufacturer's production standard deviation is satisfactory.

9.2.2. With a minimum sample size of three the sampling procedure is set so that the probability of a lot passing a test with 40 % of the production defective is 0,95 (producer's risk = 5 %), while the probability of a lot being accepted with 65 % of the production defective is 0,1 (consumer's risk = 10 %).

9.2.3. The following procedure is used (see Figure I/8).

Let L be the natural logarithm of the CO_2 type-approval value:

x_i = the natural logarithm of the measurement for the i-th vehicle of the sample;

s = an estimate of the production standard deviation (after taking the natural logarithm of the measurements);

n = the current sample number.

9.2.4. Compute for the sample, the test statistic quantifying the sum of the standardized deviations to the limit and defined as:

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

9.2.5. Then:

— if the test statistic is greater than the pass decision number for the sample size given in Table I/ - /9.2.5, a pass decision is reached,

— if the test statistic is less than the fail decision number for the sample size given in Table I/ - /9.2.5, a fail decision is reached,

— otherwise, an additional vehicle is tested according to point 6 of this Annex and the procedure is applied to the sample with one unit more.

TABLE I/ - /9.2.5

Sample size (cumulative number of vehicles tested)	Pass Decision No	Fail Decision No
(a)	(b)	(c)
3	3,327	− 4,724
4	3,261	− 4,790
5	3,195	4,856
6	3,129	− 4,922
7	3,063	− 4,988
8	2,997	− 5,054
9	2,931	− 5,120
10	2,865	− 5,185
11	2,799	− 5,251
12	2,733	− 5,317
13	2,667	− 5,383

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Sample size (cumulative number of vehicles tested)	Pass Decision No	Fail Decision No
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

9.3. Conformity of production when manufacturer's statistical data is unsatisfactory or unavailable.

9.3.1. The following sections describe the procedure to be used to verify the CO_2 conformity of production requirements when the manufacturer's evidence of production standard deviation is either unsatisfactory or unavailable.

9.3.2. With a minimum sample size of three the sampling procedure is set so that the probability of a lot passing a test with 40 % of the production defective is 0,95 (producer's risk = 5 %), while the probability of a lot being accepted with 65 % of the production defective is 0,1 (consumer's risk = 10 %).

9.3.3. The measurement of CO_2 is considered to be log normally distributed and should first be transformed by taking the natural logarithms. Let m_0 and m denote the minimum and maximum sample sizes respectively ($m_0 = 3$ and $m = 32$) and let n denote the current sample number.

9.3.4. If the natural logarithms of the measurements in the series are x_1, x_2, ..., x_j and L is the natural logarithm of the CO_2 type-approval value, then define:

$$d_j = x_j - L$$

$$\bar{d}_n = \frac{1}{n}\sum_{j=1}^{n} d_j$$

and:

$$V_n^2 = \frac{1}{n}\sum_{j=1}^{n} (d_j - \bar{d}_n)^2$$

9.3.5. Table I/ - /9.3.5 shows values of the pass (A_n) and fail (B_n) decision numbers against current sample number. The test statistic is the ratio $\bar{d}_n/V_n$ and shall be used to determine whether the series has passed or failed as follows:

for $m_0 \leq n \leq m$:

— 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 $A_n < \bar{d}_n/V_n < B_n$.

9.3.6. Remarks

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

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

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

$$\left(n = 2,\ 3, \ldots;\ \bar{d}_1 = d_1;\ V1 = 0\right)$$

TABLE I/ - /9.3.5

Sample size (cumulative number of vehicles tested) n	Pass Decision No A_n	Fail Decision No B_n
(a)	(b)	(c)
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	0,0948
30	– 0,02892	0,07493
31	►C1 0,00449 ◄	0,05629
32	►C1 0,03876 ◄	0,03876

10. SPECIAL PROVISIONS

10.1. In the future, vehicles with special fuel efficient technologies may be offered which could be submitted to complementary testing programmes. These would be specified at a later stage which can be claimed by the manufacturer in order to demonstrate the advantages of the solution.

11. EXTENSION OF APPROVAL

11.1. The type-approval can be extended to vehicles from the same type or from a different type differing with regard to the following characteristics of Annex II if the CO_2 emissions measured by the technical service do not exceed by more than 4 % the type-approval value:

11.1.1. Mass.

11.1.2. Maximum authorized mass.

11.1.3. Type of bodywork: saloon, estate, coupé.

▼M2

11.1.4. Overall gear ratios.

11.1.5. Engine equipment and accessories.

▼M2

ANNEX II

MODEL

(maximum format: A4 (210 × 297 mm))

EC TYPE-APPROVAL CERTIFICATE

STAMP OF ADMINISTRATION

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 80/1268/EEC, as last amended by Directive 93/116/EC.

Type-approval number :

Reason for extension :

Section I

0.1. Make (trade name of manufacturer) :

0.2. Type and general commercial description(s) :

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 (3) :

0.5. Name and address of manufacturer :

0.6. In the case of components and separate technical units, location and method of affixing of the EC type-approval mark :

0.7. Address(es) of assembly plant(s) :

Section II

1. Additional information (where applicable) : see addendum

2. Technical service responsible for carrying out the tests :

3. Date of test report :

4. No 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.

▼M2

Addendum

to EC type-approval certificate No : .....

concerning the type approval of a vehicle with regard to Directive 80/1268/EEC (CO_2 emissions and fuel consumption) as last amended by Directive 93/116/EC.

1. Additional information

1.1. Mass of the vehicle in running order : .....

1.2. Maximum mass : .....

1.3. Type of bodywork : saloon, estate, coupé (1)

1.4 Drive wheels : front, rear, 4 × 4 (1)

1.5. Engine : .....

1.5.1. Engine displacement : .....

1.5.2. Fuel supply system : carburettor/injection (1)

1.5.3. Fuel recommended by the manufacturer : .....

1.5.4. Maximum power : ..... kW at ..... min^{-1}

1.5.5. Pressure charging device : yes/no (1)

1.5.6. Ignition system : diesel/conventional or electronic ignition (1)

1.6. Transmission : .....

1.6.1. Type of gearbox : manual/automatic (1)

1.6.2. Number of gear ratios : .....

1.6.3. Total gear ratios (including the rolling circumferences of the tyres under load) : road speeds per 1 000 min^{-1} km/h

First gear : ..... Fourth gear : .....

Second gear : ..... Fifth gear : .....

Third gear : ..... Overdrive : .....

1.6.4. Final drive ratio : .....

1.6.5. Tyres : .....

Type : ..... Dimensions : .....

Rolling circumference under load : .....

►(3) 1.7. Test results (4)

1.7.1. CO_2 mass emissions

1.7.1.1. CO_2 mass emissions (urban conditions): ..... g/km

1.7.1.2. CO_2 mass emissions (extra-urban conditions): ..... g/km

1.7.1.3. CO_2 mass emissions (combined): ..... g/km

1.7.2. Fuel consumptions

1.7.2.1. Fuel consumption (urban conditions): ..... l/100 km (5)

1.7.2.2. Fuel consumption (extra-urban conditions): ..... l/100 km (5)

1.7.2.3. Fuel consumption (combined): ..... l/100 km (5) ◄

2. Remarks : .....

(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 documentation by the symbol '?' (e.g. ABC ? ?123 ? ?).

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

►(2) (4) Repeat for petrol and gaseous fuel in the case of a vehicle that can run either on petrol or on a gaseous fuel. 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 as vehicles which can only run a gaseous fuel.

(5) For vehicles fuelled with NG, the unit "/100 km" is replaced by "m^3/100 km". ◄

►(1) (2) M3