

COMMISSION OF THE EUROPEAN COMMUNITIES

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94/312 (COD)

Proposal for a
EUROPEAN PARLIAMENT AND COUNCIL DIRECTIVE
amending Directive 88/77/EEC 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 diesel engines for use in vehicles

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. BACKGROUND

Directive 91/542/EEC lowered the limit values set in Directive 88/77/EEC for the exhaust emissions of Commercial Vehicles powered by diesel engines in two stages to be implemented in 1992/3 and 1995/6. These are generally referred to as "EURO 1" and "EURO 2" standards. For the 1992/3 stage the Directive provided for an exemption for the particulate emissions of small diesel engines (≤ 85 kW), allowing the limit value of 0.36 g/kWh respectively to be multiplied by a factor 1.7 thereby rendering it less severe for this category of vehicles.

Article 5(2) of Directive 91/542 committed the Commission to report to Council, before the end of 1993, on progress made regarding:

- the availability of techniques for controlling air-polluting emissions from diesel engines, particularly those of equal to or less than 85 kW, and
- a new statistical method for monitoring production conformity.

This Article stipulated also that, if necessary, the Commission should propose to the Council an "upwards" revision of the limit value for particulate emissions envisaged for the second stage ("EURO 2"). This was in recognition of the fact that the "EURO 2" standard represented an ambitious target which would need to be reviewed in the light of technological developments. The Council committed itself to take a decision on the basis of this proposal before end of September 1994.

2. COMMISSION FINDINGS

The Commission consulted experts from the Member States, industry and consumer and environmental organizations represented in its "Motor Vehicles Emissions Group" (MVEG) on both subjects. Following these consultations the Commission has come to the following conclusions:

2.1. Possibilities for small diesel engines to meet the "EURO 2" particulate standard for 1995/6

2.1.1 Application to small diesel engines

Small diesel engines have a lower mass and volume than conventional heavy duty engines of an equivalent power output. They have found widespread application on small trucks or vans belonging to the lower range of this vehicle category. Their transmission is often derived from cars, or in any case is a simple (max. 5 speed) and light transmission, due to the low maximum torque of the engine. Such vehicles are usually available for a total mass from around 3.5 tons and up to 6 - 7.5 tons.

These vehicles types have very important operational advantages, especially on short distance or in city use, over a conventional truck, since :

- the unloaded weight is relatively low, giving good fuel economy (and low emissions);
- the size of the vehicle is small;
- loading and unloading, due to the low floor height, is very easy;
- vehicle costs can be contained since many vehicle mechanical components such as the engine and transmission are derived from cars thus inducing advantages of economies of scale.

2.1.2 Emission characteristics of small diesel engines

The specific emissions of diesel engines (in mass per unit of energy, i.e. g/kWh) are not independent from engine size. Engines with a cylinder volume of less than 0.7 dm³ typically show in the test procedure prescribed by this Directive considerably higher particulate emissions than those having a higher cylinder volume. This trend was explained by the industry by a number of factors:

- particulate emissions are produced in part by incomplete combustion that can take place in some parts of the cylinder "dead volume" (i.e. volume between piston, first ring and liner). This volume is proportionally more important when cylinder size is small;
- a number of small engines are typically of the "swirl chamber" type: this type of engine has usually lower NO_x emissions, but higher particulate emissions than direct injection engines;
- combustion quality depends (for direct injection engines) on the position of the injector: whereas on larger, four-valve per cylinder engines, the injector location can be optimized relative to the combustion bowl, this is not possible on small, two-valve cylinder heads;
- combustion quality (always on direct injection engines) depends on injection pressure; whereas for larger engines available injection systems can deliver very high injection pressures, this is today not possible on small engines.

The industry also provided an analysis of the particulate emissions of a sample of 118 engines complying with the "EURO 1" standards. The 15 "small" engines of the sample had an average particulate emission of 0.45 g/kWh, whereas the average of the 99 bigger engines was 0.20 g/kWh. This data was confirmed by the type-approval data of a Member State.

2.1.3. Technical options for achieving the "EURO 2" particulate standard in 1996.

At the present stage of technological development, it is evident that the typical small high speed diesel engine cannot meet the "EURO 2" particulate standard of 0.15 g/kWh in 1996. The data show, however, that a limit value of 0.25 g/kWh is achievable for new vehicle types from 1 October 1995 for small diesel engines. This represents about a 60% reduction from the limit value prevailing currently ("EURO 1").

Important re-designs to such engines including the development of electronically controlled injection systems, turbocharging and aftercooling which would have a significant effect on reducing emissions, will not be completed by 1996. In the light of this there would appear to be two options open; either to leave the standard as it is and accept the consequences, or, to envisage a modification of the standard for an interim period to allow more time for the industry to make the necessary additional investments needed to meet the standard of 0.15 g/kWh in due course.

2.1.3.1 OPTION 1 - leave the standard as it is.

If the particulate standard is left unchanged, the manufacturers would be obliged to install larger engines of the type currently used on medium trucks. This would have the consequence of increasing vehicle weight, with the result that the total amount of NO_x emissions, of fuel consumed to perform a typical mission (door to door delivery of goods) and, hence CO₂ emissions, will also increase even if the specific performance of the two engine types is equivalent. Transportation costs would also rise significantly.

2.1.3.2 OPTION 2 - provide an additional period for the "EURO 2" standard to be met.

In setting the standard of 0.15 g/kWh in 1991, the Council was aware that it was very ambitious and would be difficult to meet, since it represented a reduction of about 75% compared to the EURO 1 level for engines of 85 kW or less. For this reason it provided for the possibility of an increase in the particulate standard for these vehicles in Article 5(2) of the Directive.

The Commission continues to believe that in the light of the highly noxious character of particulate pollutants, the EURO 2 standard should remain the target to be achieved. In addition, the Commission considers that with the further application of existing technologies, such as the further development of:

- electronically controlled injection systems,
- turbo charging and aftercooling,
- particulate filters, and
- better quality fuels,

this target should be met in the future.

With regard to diesel fuels, the interconnection between diesel fuel quality and engine performance has now been recognized by all concerned parties, in particular in relation to the particulate emissions. The discussion and finalization of a global approach on fuel/technology potentials in the EC, in terms of future emission standards and new fuel specifications, has become a major issue of the "European Programme Emissions, Fuels and Engine Technology (EPEFE) which is currently carried out by the European Automobile and Petroleum industries in conjunction with the Commission.

Definitive results, as far as the definition of future diesel fuels are concerned, are not expected before early 1995 and the petrol industry will undoubtedly request a considerable lead time to adapt their European refineries to the production of such fuels. Improved diesel fuel can therefore realistically be taken into account only for the definition of the emission standards of the year 1999/2000.

2.1.4 Definition of small diesel engines

Under Directive 91/542/EEC, a small diesel engine is defined as one having a power output ≤ 85 kW.

In the view of the Commission this definition is too large and leads to too many vehicles being exempted from the lower particulate standards applied to vehicles above 85 kW. It is proposed therefore that the category of vehicles subject to the exemption be narrowed. This is achieved by defining "small" engines as those with a cylinder swept volume less than or equal to 0.7 dm³ and a rated power speed $> 3.000 \text{ min}^{-1}$. This reduces the engine families subject to the exemption from 5 to 4. The remaining engine family - whose power output is equal or less than 85 kW, but where the swept volume is greater than 0.7 dm³/cyl - will be required to meet the lower 0.15 g/kWh particulate emission standard from 1996/7.

Overall it is estimated that approximately 7% of the engines on all commercial vehicles will be exempted from the lower particulate standards originally foreseen in Directive 91/542/EEC.

2.1.5 Conclusions relating to the particulate standard.

For the reasons outlined above, it is proposed therefore to extend the present exceptional regime for small diesel engines beyond 1995, until 30 September 1999. After this date, the next stage of limit values for the vehicles covered by the scope of this Directive will have to be implemented in accordance with Article 5(2) of Directive 91/542/EEC. This next stage will be based, if necessary, on a revised test procedure; should this procedure be introduced, the degree of stringency of the particulate emission standard for small diesel engines will not be altered.

In the interim period between 1 October 1995 and 30 September 1999, the type-approval limit value for the particulate emissions of small engines shall be reduced from the current maximum of 0.61 g/kWh to 0.25 g/kWh.

As far as the definition of small engines for the purpose of this Directive is concerned, it is proposed to replace the present criteria of 85kW by the criteria:

- cylinder swept volume lower than 0.7 dm³, and
- rated power speed higher than 3,000 min⁻¹.

2.1.6 Tax incentives

In order to encourage the early introduction of the lower particulate limit values for these vehicles, it is proposed that Member States be allowed to grant tax incentives in accordance with the framework agreed in Article 3 of Directive 94/12/EC on car emissions.

2.2. New Statistical Method for the Control of Conformity of Production (COP)

2.2.1. Availability of a new method

Consultations with technical experts has shown that the new statistical method development for the COP control of passenger cars which was adopted by Council and Parliament in Directive 94/12/EC of 23 March 1994 can be used for commercial vehicles and their engines with some adaptations. The amendments proposed in the directive therefore take account of the specific conditions of the production of diesel engines for commercial vehicles e.g. the generally lower production runs.

The method is based on modern principles of quality assurances measures used in the automotive industry. It replaces the statistical method used until now in the EC emission directives which was developed in the 1960's.

2.2.2. Operational conclusions

The revision of the statistical method for controlling COP could, in principle, be adopted by the Commission by means of the adaptation procedures referred to in Article 4 of Directive 88/77/EEC. However, in order to avoid duplication of procedures relating to the same directive it is appropriate to deal with this aspect together with the exception for the particulate emissions for small diesel engines in this proposal which is duly submitted to Council and Parliament.

2.3. With Directive 70/156/EEC as last amended by directive 93/81/EEC, the Community considered that the completion of the Internal Market in the field of the motor vehicles required the implementation in each Member State of a type-approval procedure which would gradually be replaced by a single Community type-approval procedure; this would not allow Member States to apply different rules for the type-approval and the registration of new vehicles as is the case with the harmonised procedures. It is within the exclusive competence of the Community to adapt these rules to technological progress, by means of directives according to general prescriptions and the regulatory approach established in Directive 70/156/EEC, as well as the additional methods which appear in the separate directives.

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THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

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

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

Having regard to the Opinion of the Economic and Social Committee⁽²⁾,

Acting in accordance with the procedure laid down in Article 189b of the Treaty,

Whereas measures should be adopted within the framework of the internal market; whereas the internal market comprises an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured;

Whereas the first programme of action of the European Community on protection of the environment⁽³⁾, approved by the Council on 22 November 1973, called for account to be taken of the latest scientific advances in combating atmospheric pollution caused by gases emitted from motor vehicles and for Directives adopted previously to be amended accordingly; whereas the fifth programme of action, which in its general approach was approved by the Council in its Resolution of 1 February 1993⁽⁴⁾, provides for additional efforts to be made to effect a considerable reduction in the present level of pollutants emitted from motor vehicles;

Whereas the objective of reducing the level of pollutant emissions from motor vehicles and the establishment and operation of the internal market for vehicles cannot be adequately achieved by individual Member States and can therefore be better achieved by the approximation of the laws of the Member States relating to measures to be taken against air pollution by motor vehicles;

Whereas it is recognized that the development of transport in the Community has entailed significant constraints for the environment; whereas a certain number of official estimates of the increase in traffic density have proved to be lower than the actual figures; whereas for that reason stringent emission standards should be laid down for all motor vehicles;

(1) OJ No C 56, 26.2.1993, p. 34.

(2) OJ No C 201, 26.7.1993, p. 9.

(3) OJ No C 112, 20.12.1973, p. 1.

(4) OJ No C 138, 17.5.1993, p. 1.

Whereas Directive 88/77/EEC⁽⁵⁾, as last amended by Directive 91/542/EEC⁽⁶⁾, laid down the limit values for the emissions of carbon monoxide, unburnt hydrocarbons and nitrogen oxides from diesel engines for use in motor vehicles on the basis of a test procedure representative for European driving conditions for the vehicles concerned; whereas Directive 91/542/EEC provides for two stages, the first stage (1992/3) coinciding with the implementation dates of the new European emission standards for passenger cars; whereas the second stage (1995/6) established a longer-term guideline for the European motor industry by fixing limit values based on the expected performance of technologies still under development, whilst granting to industry a lead time for perfecting such technologies;

Whereas Article 5(2) of Directive 91/542/EEC instructed the Commission to report to the Council before the end of 1993 on progress made regarding the availability of technologies for controlling air-polluting emissions from diesel engines, particularly those of less than 85 kW; whereas this report should cover also new statistical methods to monitor the conformity of production-arrangements for these vehicles; whereas in the light of this report, the Commission was instructed, if necessary, to submit a proposal to the Council for revising upwards the limit values for particulate emissions;

Whereas consultation with experts has demonstrated the feasibility of introducing new provisions on the conformity of products;

Whereas, on the other hand, the ambitious limit value for particulate emissions set in Directive 91/542/EEC for stage 2 cannot, at the present state of technology, be met by most small diesel engines of less than 85 kW by 1995; whereas a significant reduction in particulate emissions can nonetheless be achieved from October 1995 for those vehicles; whereas, for small diesel engines with a cylinder swept volume lower than 0.7 dm³ and a rated power speed higher than 3,000 min⁻¹, the limit value for particulate emissions set in Directive 91/542/EEC should be introduced from 1999 instead; whereas this additional time period will allow the industry to make the necessary changes to ensure compliance with the deferred limit value;

Whereas, in order to encourage the early introduction of the lower particulate emission standards for diesel engines of less than 85 kW, Member States should be allowed to encourage, by means of tax incentives, the introduction of such vehicles which satisfy the requirements adopted at Community level; whereas such tax incentives must comply with the provisions of the Treaty and satisfy certain conditions intended to avoid distortions of the internal market; whereas the provisions of this Directive do not affect the Member States' right to include emissions of pollutants and other substances in the basis on which road traffic taxes on motor vehicles are calculated;

Whereas the prior notification requirement of this Directive is without prejudice to notification requirements under other provisions of Community law, and in particular Article 93(3) of the Treaty,

⁽⁵⁾ OJ No L 36, 9.2.1988, p. 33.

⁽⁶⁾ OJ No L 295, 25.10.1991, p. 1.

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Annex I to Directive 88/77/EEC is amended in accordance with the Annex to this Directive.

Article 2

Without prejudice to Article 3 of Directive 88/77/EEC, Member States may make provision for tax incentives in respect of the particulate emissions of small diesel engines for use in vehicles, as defined in the Annex to this Directive. Such incentives shall comply with the provisions of the Treaty and satisfy the following conditions:

- they shall apply to all new engines for use in vehicles offered for sale on the market of a Member State which comply in advance with the limit value of 0.15 g/kWh;
- they shall be terminated with effect from 30 September 2000, being the date of the mandatory application of the particulate limit values laid down in the Annex to this Directive for those engines;
- for each type of engine, they shall be for a lesser amount than the additional cost of the technical devices used to ensure compliance with the values set and of their installation in the vehicle.

The Commission shall be informed in sufficient time of plans to institute or change the tax incentives referred to in the first paragraph, so that it can submit its observations.

Article 3

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 1 October 1995. They shall immediately inform the Commission thereof.

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

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Article 4

This Directive shall enter into force on the twentieth day following that of its publication in the Official Journal of the European Communities.

Article 5

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament
The President

For the Council
The President

Amendments to the Annexes to Directive 88/77/EEC
as amended by Directive 91/542/EEC

ANNEX I

- 1) Item 6.2.1. : the following footnote (**) is added to the figure "0.15" of the last line of the table (B (1.10.1995)), last column (Mass of particulates (PT) g/kWh):

"(**) : until 30 September 1999 the value applied to the particulate emissions of engines having a cylinder swept volume of less than 0.7 dm³ and a rated power speed of more than 3,000 min⁻¹, is 0.25 g/kWh."

- 2) Item 8.3.1.1. : the following footnote (**) is added to the figure "0.15" of the last line of the table (B (1.10.1995)), last column (Mass of particulates (PT) g/kWh):

"(**) : until 30 September 2000 the value applied to the particulate emissions of engines having a cylinder swept volume of less than 0.7 dm³ and a rated power speed of more than 3,000 min⁻¹, is 0.25 g/kWh."

- 3) Section 8 reads as follows :

8. CONFORMITY OF PRODUCTION

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

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

8.1.1. 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.

8.1.1.1. Conformity of the engine for emissions of pollutants test.

After presentation to the authority, the manufacturer shall not undertake any adjustment to the engines selected.

8.1.1.1.1. If the production is not defined as a small series (*), three engines are randomly taken in the series and are subjected to the test referred to in section 6.2. The limit values are given in paragraph 6.2.1. of this Annex.

8.1.1.1.2. If the authority is satisfied with the production standard deviation given by the manufacturer, according to Annex X of Directive 70/156/EEC modified by Directive 92/53/EEC, in so far as it applies to motor vehicles and their trailers, the tests are carried out according to appendix 1 of this Annex.

If the authority is not satisfied with the production standard deviation given by the manufacturer according to Annex X of Directive 70/156/EEC modified by Directive 92/53/EEC, in so far as it applies to motor vehicles and their trailers, the tests are carried out according to appendix 2 of this Annex.

At the manufacturer's request, the test can be carried out according to appendix 3 of this Annex.

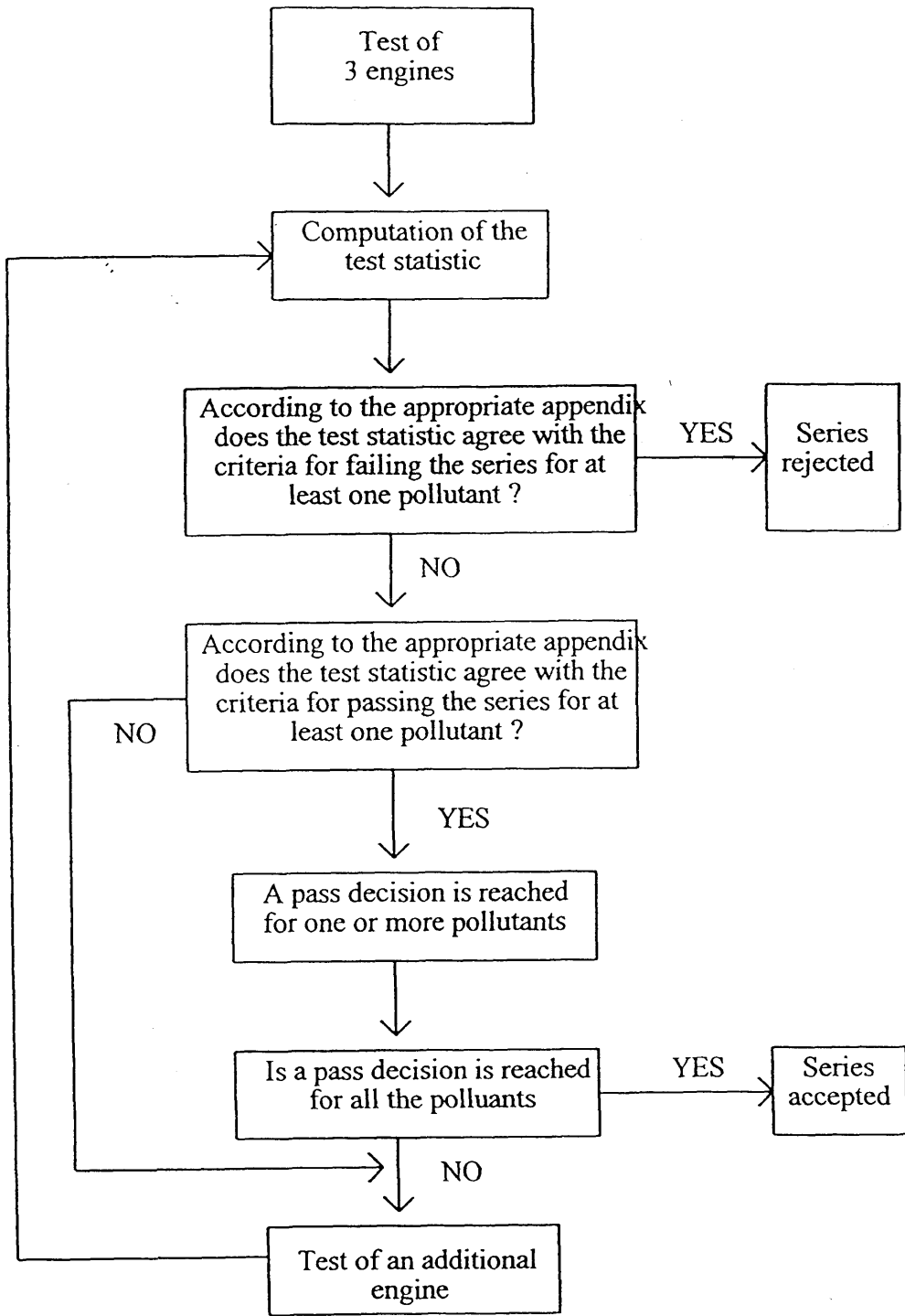
8.1.1.1.3. The production of a series is regarded as conforming or non conforming, on the basis of a test of the engines by sampling, once a pass decision is reached for all the pollutants or a fail decision is reached for one pollutant, according to the test criteria applied in the appropriate appendix.

When a pass decision has been reached for one pollutant, this decision will not be changed by any additional tests made 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 1/7).

At anytime, the manufacturer may chose stop testing if no decision is reached : a fail decision is then recorded.

**FIGURE
1/7**



8.1.1.2. The tests will be carried out on newly manufactured engines.

8.1.1.2.1. However, at the request of the manufacturer, the tests will be carried out on engines which have been run-in 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.

8.1.1.2.2. When the manufacturer asks to conduct a running-in procedure : x hours where $x \leq (100)$ hours, 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 tested engine,
- the evolution coefficient of the emissions between zero and "x" hours will be calculated for each pollutant :

$$\frac{\text{Emissions "x" hours}}{\text{Emissions zero hour}}$$

It may be less than 1.

- 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.

8.1.1.2.3. 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.

APPENDIX I

- 1 - This appendix describes the procedure to be used to verify the conformity of production requirements for the emissions of pollutants test when the manufacturer's production standard deviation is satisfactory.
- 2 - With a minimum sample size of 3 the sampling procedure is set so that the probability of a lot passing a test with 30 % of the production defective is 0.90 (producer's risk = 10 %) while the probability of a lot being accepted with 65 % of the production defective is 0.1 (consumer's risk = 10 %).
- 3 - For each of the pollutants given in paragraph 6.2.1. of Annex I, the following procedure is used (see Figure I/7).

Let L be the natural logarithm of the limit value for the pollutant,

x_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 is the current sample number.

- 4 - Compute for the sample, the test statistic quantifying the sum of the standardised deviations to the limit and defined as :

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

- 5 - Then :

- * if the test statistic is greater than the pass decision number for the sample size given in Table (I/1/5), a pass decision is reached for the pollutant,
- * if the test statistic is less than the fail decision number for the sample size given in Table (I/1/5), a fail decision is reached for the pollutant,
- * otherwise, an additional engine is tested according to paragraph 8.1.1.1. of Annex I and the procedure is applied to the sample with one unit more.

TABLE I/1/5

Cumulative number of tested engines (current sample size)	Pass decision number	Fail decision number
3	2.624	-2.207
4	2.693	-2.137
5	2.763	-2.068
6	2.833	-1.998
7	2.902	-1.928
8	2.972	-1.859
9	3.041	-1.789
10	3.111	-1.720
11	3.180	-1.650
12	0.834	0.834

APPENDIX 2

- 1 - This appendix describes the procedure to be used to verify the conformity of production requirements for the emissions of pollutants test when the manufacturer's evidence of production standard deviation is either unsatisfactory or unavailable.
- 2 - With a minimum sample size of 3 the sampling procedure is set so that the probability of a lot passing a test with 30 % of the production defective is 0.90 (producer's risk = 10 %) while the probability of a lot being accepted with 65 % of the production defective is 0.1 (consumer's risk = 10 %).
- 3 - The measurements of the pollutants given in paragraph 6.2.1. of Annex 1 are considered to be log normally distributed and should first be transformed by taking their 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.
- 4 - If the natural logarithm of the measurements in the series are x_1, x_2, \dots, x_j and L is the natural logarithm of the limit value for the pollutant, then, define :

$$d_j = x_j - L$$

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

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

- 5 - Table I/2/5 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 $A_n < \bar{d}_n / V_n < B_n$

6 -

Remarks.

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

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

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

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

TABLE I/2/5

sample size	Pass decision	Fail decision
n	number	number
n	An	Bn
3	-0.69148	6.09356
4	-0.65832	3.42688
5	-0.6308	2.32183
6	-0.60608	1.72892
7	-0.58291	1.36012
8	-0.56069	1.10798
9	-0.53906	0.924
10	-0.5178	0.78328
11	-0.49679	0.67175
12	-0.47592	0.58086
13	-0.45512	0.50515
14	-0.43435	0.44093
15	-0.41354	0.38563
16	-0.39268	0.33743
17	-0.37172	0.29495
18	-0.35065	0.25717
19	-0.32944	0.22331
20	-0.30807	0.19273
21	-0.28652	0.16496
22	-0.26476	0.13959
23	-0.24279	0.1163
24	-0.22057	0.09483
25	-0.1981	0.07496
26	-0.17536	0.05649
27	-0.15232	0.03928
28	-0.12897	0.02318
29	-0.10529	0.00809
30	-0.08126	-0.00609
31	-0.05687	-0.01946
32	-0.03208	-0.03208

APPENDIX 3

- 1 - This appendix describes the procedure to be used to verify, at the manufacturer's request the conformity of production requirements for the emissions of pollutants test.
- 2 - With a minimum sample size of 3 the sampling procedure is set so that the probability of a lot passing a test with 30 % of the production defective is 0.90 (producer's risk = 10 %) while the probability of a lot being accepted with 65 % of the production defective is 0.1 (consumer's risk = 10 %).
- 3 - For each of the pollutants given in paragraph 6.2.1. of Annex I, the following procedure is used (see Figure I/7).
Let L the limit value for the pollutant,
 x_i the value of the measurement for the i -th engine of the sample,
 n is the current sample number.
- 4 - Compute for the sample, the test statistic quantifying the number of non conforming engines, ie : $x_i > L$.
- 5 - Then :
 - * if the test statistic is less or equal to the pass decision number for the sample size given in Table (I/3/5), a pass decision is reached for the pollutant,
 - * if the test statistic is greater or equal to the fail decision number for the sample size given in Table (I/3/5), a fail decision is reached for the pollutant,
 - * otherwise, an additional engine is tested according to paragraph 8.1.1.1. of Annex I and the procedure is applied to the sample with one unit more.

In table (I/3/5) the pass and fail decision numbers are computed with the International Standard ISO 8422:1991.

TABLE I/3/5

Cumulative number of engine tested	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

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