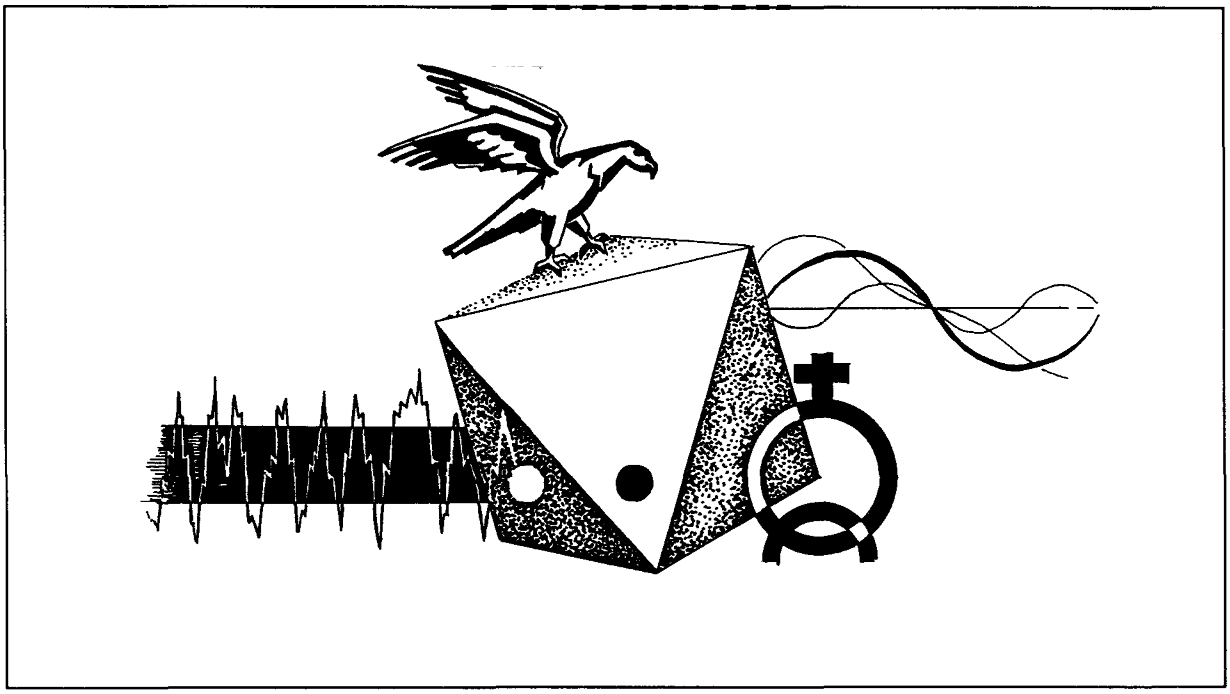
EUROPEAN COMMUNITY ENVIRONMENTAL LEGISLATION 1967 - 1987

Vol. 2

AIR
&
NOISE



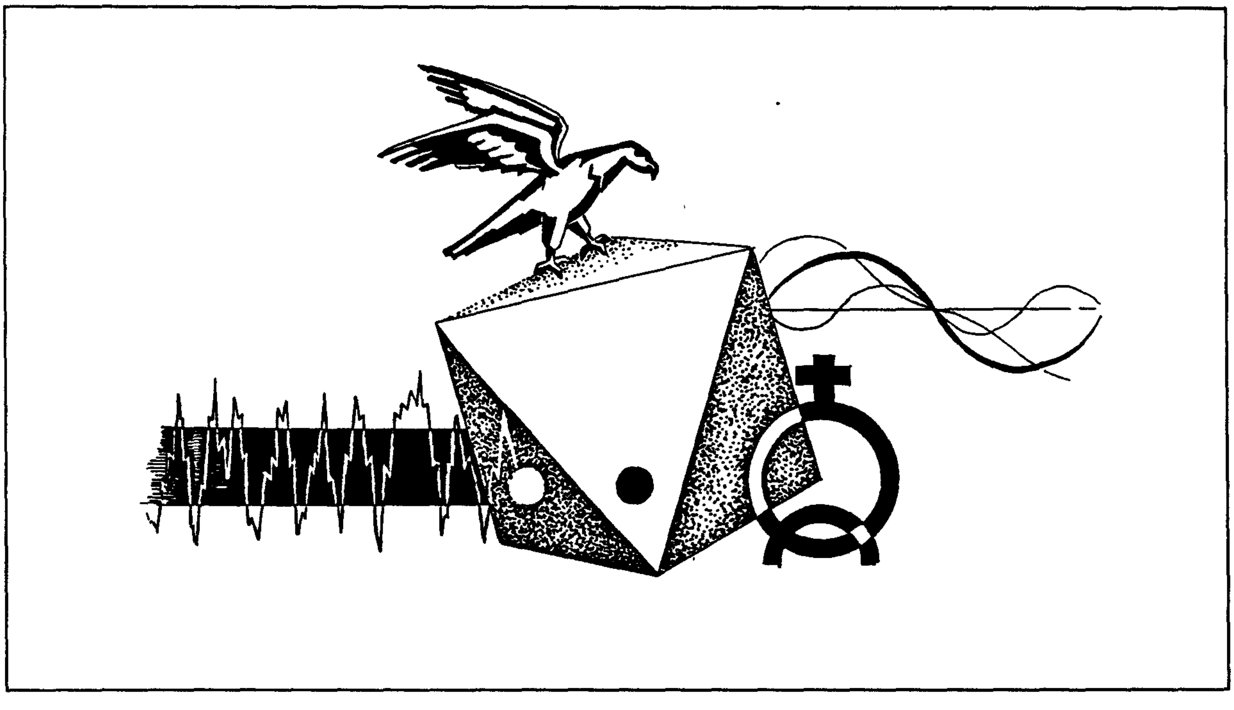
Commission of the European Communities
Directorate-General for Environment,
Consumer Protection and
Nuclear Safety
Brussels

**EUROPEAN YEAR
OF THE ENVIRONMENT**

EUROPEAN COMMUNITY ENVIRONMENTAL LEGISLATION 1967 - 1987

Vol. 2

AIR & NOISE



Commission of the European Communities
Directorate-General for Environment,
Consumer Protection and
Nuclear Safety
Brussels

**EUROPEAN YEAR
OF THE ENVIRONMENT**

European Community Environmental Legislation 1967 - 1987

Volume 2: Air & Noise

Document No. XI/989/87

Commission of the European Communities
Directorate-General for Environment,
Consumer Protection and Nuclear Safety

Brussels

European Community Environmental Legislation
Volume 2: Air & Noise

Series Editor: Cynthia Whitehead

The editor is grateful for the support of Nigel Haigh in the preparation of the introductions to these volumes. His book *EEC Environmental Policy & Britain, 2nd edition* (Longman: London, December 1987) offers fuller summaries and detailed analyses of the EC environment directives presented here.

The cover illustration, by Pierre Nagant, uses components of different symbolic systems to represent the element *Air* :
Platonic – the octahedron; Astrological – Eagle; Planetary – Mercury; Pythagorean – the third row of the Tetractys.

These volumes are also available in Danish, Dutch, French, German, Greek, Italian, Portuguese and Spanish.

Document No. XI/989/87

200, Rue de la Loi
B - 1049 Brussels
Belgium
Tel. (32-2) 235.11.11

Compiled, designed and produced by POPLAR s.c., Brussels

Printed in Belgium

Contents

Air

Noise

Preface

The Fourth Programme of Action for the Environment 1987-1992 sets out as one of its top priorities the correct application of the European directives for the protection of the environment by all member states. This goal is to be pursued with increased vigour by the Commission of the European Communities and it is to this end that this legislation is collected together in four volumes – in the nine languages of the Community.

The responsible authorities in each member state will have in this way a handy reference on the correct version of a particular directive.

The organisations for the protection of the environment and the public in general can find in these volumes what has been achieved until now for the European environment.

The various economic sectors can find here the directives that affect the organisation of their work.

In addition, there are included here multilateral conventions signed by the Community along with its neighbour countries – as well as many countries of the rest of the world – for the preservation of our planet.

These texts are the result of the collaboration of the member states within the Council of Ministers along with the Commission, under the scrutinizing eyes of the European Parliament and the Econmic and Social Committee. All in all they represent an impressive part of the growing domain of European law.

They have been achieved in a rather short time since the beginning of the active pursuit of a European environmental policy in 1973.

Finally these texts owe their existence not in a small measure to the efforts of all those who have been working in the Directorate-General XI for the Environment, Consumer Protection and Nuclear Safety.

They, along with me, proudly dedicate these four volumes to the people of Europe as our contribution to their well-being.

L. J. Brinkhorst

Director General

Introduction

1. The nature of the European Community

The European Community is a unique political entity. It is neither a national government nor just an international organisation. The EC member states are not subnational entities (like the 50 states of the USA or the German Länder) but sovereign states. Still, these states have given the Community law-making and law-enforcing powers that go far beyond those of international organisations such as the United Nations, the Organisation for Economic Co-operation and Development (OECD), or the secretariats set up under numerous international treaties whose primary functions are to gather information and propose actions.

The European Community has institutions which can propose and adopt legislation that is binding on citizens and the member states without further national review or ratification. Further, it can monitor, coordinate and enforce the implementation of its laws.

2. The Institutions of the European Community

The European Community was established by the 1957 Treaty of Rome, the Euratom Treaty, and the Treaty on Coal and Steel; it was strengthened by a series of amendments to the Treaties which are contained in the Single European Act of 1987.

At present, the EC has 12 member states – Belgium, Denmark, the Federal Republic of Germany, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom.

The EC has an elected Parliament, a Council of Ministers with legislative powers, a Commission to propose and administer laws and regulations, and a Court of Justice to interpret and enforce its laws and the founding Treaties. The Economic and Social Committee advises the Council and Commission on current issues of law and policy.

2.1 The Council

The Council is composed of one minister from each of the member states; in practice the Council is composed of the minister responsible for the subject under discussion. Thus, it has become usual to refer to the 'Agriculture Council' or the 'Environment' or 'Consumer Affairs' Council. The 'European Council', composed of the prime ministers or heads of state, meets at least twice a year to discuss broad policy issues, including environment.

The Presidency of the Council passes from one member state to the next every 6 months (in alphabetical order in the language of each country). It decides the agenda for and presides over the Council meetings.

The Council is the main legislative institution of the Community. It can only act upon a proposal from the Commission. It may request the Commission to make a proposal on a particular subject, but this request is not mandatory.

Each member state maintains a Permanent Representation in Brussels to maintain relations with the EC institutions. The Committee of Permanent Representations (COREPER) and its working groups prepare issues for the Council. The working group is chaired by an official of the member state that holds the Presidency of the Council. Hence, the priorities set during each Presidency affect not only the decisions of the Council during that Presidency but also the agendas for the following 12-18 months.

Most environment legislation falls under the competency of the Environment Council, but some issues might fall under the competency of the Council that deals with the Internal Market or Industrial Affairs, Agriculture or others. Occasionally, as in the case of dangerous chemicals, a special, combined Council will be convened to consider proposed legislation or issues that cut across several areas of competence.

2.2 The Commission

The Commission has the sole, formal power to propose legislation. It is composed of 17 Commissioners, proposed by the member states, who serve for a collective 4-year term of office and must take an oath that they are free from influence by their national government.

The Commissioners meet one day each week, normally Wednesdays, and must agree on all legislation proposed to the Council.

The Commission is supported by a number of administrative units: 'Directorates-General' and 'Services'. The Directorate-General XI (DG XI) is responsible for Environment, Consumer Protection and Nuclear Safety. The DG V – Employment, Social Affairs and Education – is responsible for worker safety and the DG III – Internal Markets and Industrial Affairs – is responsible for much product safety legislation, including pharmaceuticals, veterinary medicines, foodstuffs and food additives, and some dangerous chemical products. The DG VI – Agriculture – is responsible for pesticide regulation.

The Commissioners' responsibilities may cut across the competencies of or be divided among 2 or more Directorates-General.

In addition to its power to propose legislation, the Commission may adopt legislation in certain limited areas. This power, for example, is often used to adapt environmental laws to scientific or technical progress by amending requirements set out in annexes to the legislation; in such cases member states participate in the legislative process through a special committee.

The Commission is also responsible for monitoring the implementation of EC legislation by the member states. It is the 'Guardian of the Treaty' and can bring a member state before the Court of Justice for failure to carry out the obligations laid down in the EC Treaties or legislation.

2.3 The European Parliament

If the Council of Ministers may be said to represent the national interests of the member states, and the Commission to represent the 'Community interest', then the Parliament can be said to represent the voice of the people.

As the legislative role is filled by the Commission and the Council, the European Parliament is left with a largely advisory role. Its opinion must be obtained before certain types of legislation can be adopted by the Council and it has used this power quite frequently to delay legislation to achieve concessions from the Commission and the Council. It can raise new issues in parliamentary inquiries, debates and resolutions. The Parliament's consultative role has been strengthened by the Single European Act.

Members of the European Parliament (MEPs) are elected every 4 years and have divided themselves into political groupings cutting across nationalities.

Most of the work is carried out in the committees.

The Parliament meets once a month for about a week in Strasbourg, and the plenary sessions are open to the public. The committees meet once a month, usually in Brussels. The deliberations of the Environment Committee are open to the public, but this is not the case for many of the other committees.

2.4 The Court of Justice

The Court is composed of judges appointed by agreement with the member states. The judges are assisted by advocates general who analyse and propose decisions on the cases brought before it.

Cases may be brought by:

- the EC institutions against one another
- the Commission against member states
- the member states against the Commission
- natural or legal persons against the member states or the Commission.

National courts have retained the power to review actions taken by national institutions for implementation and enforcement of environmental legislation . They may apply to the Court of Justice for a preliminary ruling on an issue of EC law before reaching a decision.

The Court of Justice does not normally have the power to apply sanctions, but under the Treaty member states are required to comply with its rulings and have generally done so. National courts, of course, do have the power to enforce their decisions, including those concerning Community law.

2.5 The Economic and Social Committee (ESC)

The members of this Committee are nominated by the member states to represent employers, employees, and other public interest organisations, including local government, consumer and environmental organisations. Often, it too must deliver its opinion before EC legislation may be adopted.

3. Competence for Environmental Law

3.1 The Treaties of Rome

The Treaty establishing the European Economic Community did not provide for environment protection as such, but for the need to achieve 'the constant improvement of the living and working conditions'. The first environmental laws – those concerning products – were based on Art. 100 of the Treaty, which empowers the Council to issue directives for the aproximation of the laws, regulations or administrative actions in member states that directly affect the establishment or functioning of the common market. Later laws were based on Arts. 100 and 235. The latter empowers the Council to take appropriate measures to attain, in the course of the operation of the common market, one of the objectives of the Community where the Treaty has not provided the necessary powers.

3.2 The Single European Act

A new Title VII 'Environment' (Articles 130 R, S & T) has been added to Part Three of the EEC Treaty covering the 'foundations and the policy of the Community', covering also human health and natural resource management. Environmental protection requirements must become a component of other Community policies. Art. 130 S empowers the Council to decide to take certain decisions by qualified majority. The text discusses the relationship between the Community and the member states at length and explicitly empowers the member states to maintain or adopt more stringent protective measures.

The new Article 100 A on the internal market cuts across environmental protection interests by introducing decision-making by a qualified majority, the Council being required to take a 'high level of protection' as its starting point. This clearly applies to product legislation, but is qualified by an escape clause permitting member states, for reasons of worker or environment protection, to continue to apply existing, more stringent legislation, provided it is not protectionist.

The meaning of this overlap between the protection of the common market and the protection of the environment where decisions are taken by qualified majority will before long probably have to be decided by the Court of Justice.

4. Forms of European Community Legislation

The Council can adopt:

- non-binding **recommendations and resolutions**
- **regulations** that are binding and directly applicable in all member states
- **decisions** that are directly binding on the persons to whom it is addressed, including member states, individuals and legal persons
- **directives** that must be implemented by the laws or regulations of the member states within a designated time limit.

Regulations are usually used for very specific purposes such as trade in products and financial matters; they have not often been used for environmental legislation, except for controls on trade in endangered species.

Decisions have been primarily used in environmental legislation to authorise the Community to become a party to international conventions, but also for other purposes, e.g. to set up a system of information exchange on water quality.

The directive is the main tool of Community environmental policy. It empowers the Community to define objectives, standards and procedures but allows the member states some flexibility in that implementation must take place through national legislation and regulation.

In fact, environmental directives have sometimes been similar to regulations by laying down precise limits, controls, or technical, testing or labelling requirements, particularly regarding industrial products.

Some directives have set environmental quality standards combined with implementation plans or monitoring systems. This system allows the member states greater latitude in setting controls on actual emissions of individual polluters while meeting overall goals set by the Community.

Other directives have set broad environmental policy goals and encouraged cooperation among the member states without going so far as to define actual limits to pollution. This can be a useful tool when agreement on precise controls cannot be achieved in the Council.

The legislative process of the European Comunity is usually very thorough. It involves numerous close consultations with the member states, the European Parliament, the Economic and Social Committee, as well as private organisations, at both national and EC levels. During the process of developing their national positions on proposed EC legislation the member states must often formally consult their national parliaments and carry out informal consultations with national interest groups.

This painstaking process of consultation is a necessary part of the development of laws that must:

- serve the common interests of the European Community
- be integrated into the different legal systems of the member states, and
- be implemented by their different and varied administrations and levels of government.

5. Environmental Action Programmes

Although not legislation, the European Community has adopted three 5-year Action Programmes to guide its activities. The Action Programmes set out the Commission's priorities for the coming period.

The Fourth Environmental Action Programme

On 24 October 1987 the Council formally adopted the Fourth Environmental Action Programme.

The Fourth Programme will mark an important new phase in EC environmental policy. It reflects the fundamental improvement in the status of environmental policy under the Single European Act by calling for protection of the environment to become an integral part of EC and national economic and social policies, in particular the Common Agriculture Policy, and Regional, Social, and Development policies.

Four areas are given top priority:

- **Implementation of EC legislation**: The Commission intends to step up efforts to ensure that member states apply directives fully, controlling both formal legal compliance and practical implementation. It is examining the possibility of appointing Community environment inspectors, and plans to encourage individuals and NGOs to monitor and report implementation problems, and organize workshops where national authorities can discuss their experiences.
- **'Substance'- and 'Source'- oriented pollution control**: The Programme reinforces the Community's commitment to preventive environmental policies by adopting a 'substance-oriented' approach to the regulation of existing problem chemicals such as asbestos, cadmium and lead. This approach is based on the analysis of all emissions of the substance to the environment and its movement and distribution through air, water and soil. It also seeks to revive the 'source-oriented' approach (all emissions from an installation to whatever environmental medium).
- **Information**: In 1987, the Commission has promised to draft a proposal that would expand the rights of citizens to obtain information from government about environmental policies and problems. It will also publish a report on the state of the environment every three years, beginning in 1987.
- **Job creation**: The Commission has proposed a five-year programme of demonstration projects in all member states to examine the job-creation potential of environmental investment.

Cynthia Whitehead

Brussels, 1987

Summaries of the legislation

Council Directive 84/360/EEC – industrial plants

This is a framework directive which requires the member states to ensure that the types of industrial plants listed in Annex I receive authorization before operation or substantial alteration.

An authorization may be issued only when the competent authority is satisfied that all appropriate measures against air pollution have been taken, including the application of the best available technology, so long as the costs are not excessive; the plant will not cause significant air pollution, particularly of the substances listed in Annex II; none of the applicable emission limit values is exceeded; all applicable air quality limit values are taken into account.

So far, asbestos is the only Annex II substance for which specific limit values have been adopted (see Directive 87/217/EEC, Volume 4 of this series).

The member states may define particularly polluted areas and impose more stringent emission limit values and special conditions on industrial plants located there.

The Council can fix emission limit values based on the best available technology not entailing excessive costs and taking into account the nature, quantities and harmfulness of the emissions. It may also stipulate measurement and assessment techniques.

The member states must monitor emissions from industrial plants. They must follow developments in best available technology and the state of the environment and, in the light of this knowledge, impose conditions on plants authorized under the Directive, taking into account *inter alia* the economic situation of the plants. They must adopt policies to ensure that existing plants covered by Annex I are gradually adapted to the best available technology, taking into account the plant's characteristics, its remaining life, the nature and volume of pollutants emitted, and costs.

The member states may adopt stricter provisions.

Industrial plants serving national defence purposes are exempted from the Directive.

Applications for authorizations and the decisions of the competent authorities must be made available to the public according to national procedures.

The list of most important polluting substances under Annex II include sulphur and nitrogen compounds, organic chemicals, heavy metals, asbestos, chlorine and fluorine compounds.

Council Directive 70/220/EEC – motor vehicle pollution

This Directive, which has been amended and updated four times, lays down technical standards for emissions of carbon monoxide (CO) and unburnt hydrocarbons from vehicles with petrol engines, except tractors and public works vehicles. Limits for nitrogen oxides (NOx) were added by Directive 77/102/EEC. The limits for all three pollutants were reduced in 1978 by Directive 78/665/EEC, and again substantially by the last amendment, Directive 83/351/EEC.

The Directive embodies the legislative technique of 'optional harmonisation' in that it does not set mandatory standards, but prevents member states from refusing to grant national or EC type approval to vehicles which meet the standards of the Directive.

This Directive, as for the directives on air pollution from diesel engines (72/306/EEC) and on diesel engines for tractors (77/537/EEC), is based on the regulations drafted by the United Nations Economic Commission for Europe (ECE).

Council Directive 83/351/EEC - motor vehicles

The Directive updated Directive 70/220/EEC and set new deadlines for compliance with the standards laid down.

Council Decision 80/372/EEC - Chlorofluorocarbons

The Decision requires the member states to prevent any increase in the production of two chlorofluorocarbons (CFCs) F-11 and F-12. It further requires the member states to reduce the use of CFCs in aerosol cans by 30 % by 31 December 1981, compared with 1976 levels.

It commits the Commission and member states to re-examine these measures in the light of scientific and economic data. Upon a proposal by the Commission the Council was to adopt any further measures necessary before 30 June 1981.

Council Decision 82/795/EEC - Chlorofluorocarbons

In follow-up to the previous Decision, the Council agreed to maintain the production cap on CFCs and adopted a definition of production capacity and a reference figue of 480,000 tonnes per year of F-11 and F-12, based on the capacity of the producers operating in the Community in March 1980.

Member states are required to cooperate with the Commission in gathering and evaluating statistical information. A further re-examination of the problem was set for 1983 and the Council was to take further measures no later than 31 December 1983.

Council Directive 82/884/EEC - Lead in air

The Directive lays down a maximum limit value for lead concentrations in air of 2 microgrammes per cubic metre, expressed as an annual average mean concentration. It does not apply to occupational exposure. Member states may impose stricter limit values.

The member states must ensure that sampling stations are operated at places where individuals may be exposed continually for a long period and where they consider that the limit value is likely not to be observed. They must ensure that the limit value is met by 9 December 1987.

In places where, after 4 years, the limit value is exceeded, the member states must draw up plans for the improvement of the air and send them to the Commission. A final deadline for compliance is 9 December 1989, seven years after notification of the Directive.

Member states must inform the Commission by 1 July, annually, of the places where the limit value is exceeded, by how much, and the measures to bring lead concentrations below the limit value.

Measures taken under the Directive must not bring about a significant deterioration in air quality where the level of pollution by lead is low in relation to the limit value.

Characteristics for choosing a sampling method and a reference method for analyzing the concentration of lead in air are given in an Annex.

Council Directive 85/210/EEC - Lead in petrol

The Directive replaces and goes further than Directive 78/611/EEC which set limits on the lead content of petrol. The earlier Directive had set limits of from 0.4 to 0.15 grammes of lead per litre (g Pb/l) in petrol. This Directive requires the member states to reduce the permitted lead content to 0.15 g Pb/l as soon as they consider it appropriate, and also to ensure the availability and balanced distribution of unleaded petrol (having a content below 0.013 g Pb/l) from 1 October 1989, at the latest.

Member states may prohibit the marketing of leaded petrol having a motor octane number lower than 85 at the pump and a research octane number lower than 95 at the pump for reasons of health and environment protection and to promote the availability and balanced distribution of unleaded petrol within their territory, and must inform the Commission and the public 6 months in advance.

Derogations from the limits for up to 4 months are possible in the event of suddent changes in supply.

The benzene content of both leaded and unleaded petrol may not exceed 5.0 % as of 1 October 1989.

Council Directive 85/203/EEC - Nitrogen dioxide in air

The Directive lays down limit values to protect human health (Annex I) and guide values to improve protection of human health and to protect the environment (Annex II) for nitrogen dioxide in air. It does not apply to occupational exposure or inside buildings.

The limit value is 200 microgrammes per cubic metre from 1 July 1987. The member states must inform the Commission of areas where this value is exceeded and draw up plans to meet the limit value 'as rapidly as possible', by 1 January 1994 at the latest.

They may set lower limit values in zones where there is a foreseeable increase in NOx from urban or industrial development. Lower guide values may be set in areas that are considered to need special environmental protection.

They must establish measuring stations in accordance with Annex III, and report annually to the Commission supplying detailed information about NOx concentrations and abatement measures. Some specified information must be made available to the public, as well. A reference method is described in Annex IV.

Measures taken under the Directive may not lead to a significant deterioration in air quality in zones where NOx pollution levels are low in relation to the limit value.

Consultation between member states and the Commission is required when a member state chooses to fix lower levels of NOx concentrations in a border region.

Council Directive 75/716/EEC – Sulphur content of gas oil

The Directive limits the concentration of sulphur in light oil used for household heating and cooking, and for diesel-engine motor vehicles for the purpose of protecting the environment and ensuring the availability of the common market to these products.

The Directive originally allowed two grades of gas oil to be sold in the EC. Type A, with a lower sulphur content, could be used without restriction. Type B could only be used in zones designated by the member states. It provided for the sulphur content to be reduced in two stages in 1976 and in 1980.

It was replaced in 1987 by the new text set out in Directive 87/219/EEC.

Under the new text, the distinction between Type A and Type B is dropped. A single maximum sulphur content of 0.3 % is set. Member states may set a limit of 0.2 % within special zones (see Directive 80/779/EEC, following) or where damage to the environment from sulphur dioxide emissions requires it. The marketing of any gas oil with a sulphur content of less than 0.2 % may not be prohibited.

The Commission is to submit a proposal for a single value before April 1990.

Council Directive 80/779/EEC – Sulphur dioxide and suspended particulates

The Directive fixes limit values (Annex I) and guide values (Annex II) for sulphur dioxide and suspended particulates in the atmosphere and conditions for their application (Annexes III, IV and V).

The limit values were to have been met by 1 April 1983, but where that seemed unlikely in certain zones the Commission was to have been informed and plans for the progressive improvement of those zones were to have been submitted to the Commission by 1 October 1982.

The member states must endeavour to move towards the application of the stricter guide values set out in Annex II. These guide values govern measures taken in two types of zone which may be designated to prevent a foreseeable increase in pollution in the wake of urban or industrial development, or special environmental protection zones.

The air quality may not deteriorate substantially in areas which are already below the limit values set by the Directive.

Member states must establish monitoring stations and supply data regularly to the Commission. Once a year member states must inform the Commission of instances where limit values have been exceeded, the reasons and the measures that have been taken to avoid recurrences. A member state must consult its neighbor and the Commission before setting a limit value in a border region. The Commission must publish an annual report based on the data submitted by the member states.

Council Decision 81/462/EEC – Convention on long-range transboundary air pollution

The Decision adopts the Convention on long-range transboundary air pollution, which had been drawn up under the auspices of the United Nations Economic Commission for Europe (ECE). The Convention's purpose is to protect human health and the environment against air pollution by monitoring, limiting and gradually reducing such air pollution, in particular transboundary air pollution by sulphur dioxide.

It provides for the exchange of information, research and monitoring, and the development of policies to combat the discharge of air pollutants. It was signed in 1979, and came into force in 1983.

Council Decision 86/277/EEC - EMEP

The Decision approves the Protocol to the Convention which arranges the long-term financing of the 'cooperative programme for the monitoring and evaluation of the long-range transmission of air pollutants in Europe' (EMEP).

Council Decision 82/459/EEC - Information exchange

The Decision sets up an information exchange procedure on a number of air polluting substances. It repeals an earlier Decision 75/441/EEC (OJ L 194, 25.7.75) on the exchange of information about sulphur dioxide and suspended particulates (smoke).

The Decision added heavy metals, nitrogen oxides, carbon monoxide and ozone to the information exchange system. The data are to be sent annualy in a specified form to the European Commission. Member states are required to maintain the monitoring stations that had been designated according to the criteria of Decision 75/441/EEC and to select additional stations to be representative of the conditions for the pollutant concerned. The Decision is valid for 7 years from 1 October 1982 to 24 June 1989.

Air

COUNCIL DIRECTIVE

of 28 June 1984

on the combating of air pollution from industrial plants

(84/360/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Articles 100 and 235 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 1973 (4), 1977 (5) and 1983 (6) action programmes of the European Communities on the environment stress the importance of the prevention and reduction of air pollution;

Whereas the 1973 and 1977 action programmes in particular provide not only for the objective evaluation of the risks to human health and to the environment from air pollution but also for the formulation of quality objectives and the setting of quality standards, especially for a number of air pollutants regarded as the most hazardous;

Whereas the Council has already adopted several Directives under these programmes;

Whereas, moreover, under Decision 81/462/EEC (7) the Community is a party to the Convention on long-range transboundary air pollution;

Whereas the 1983 action programme, the general guidelines of which have been approved by the Council of the European Communities and by the representatives of the Member States meeting within the Council, envisages that the Commission will

---

(1) OJ No C 139, 27. 5. 1983, p. 5.
(2) OJ No C 342, 19. 12. 1983, p. 160.
(3) OJ No C 23, 30. 1. 1984, p. 27.
(4) OJ No C 112, 20. 12. 1973, p. 1.
(5) OJ No C 139, 13. 6. 1977, p. 1.
(6) OJ No C 46, 17. 2. 1983, p. 1.
(7) OJ No L 171, 27. 6. 1981, p. 11.

continue its efforts to establish air quality standards and that where appropriate emission standards for certain types of source should be laid down;

Whereas all the Member States have laws, regulations and administrative provisions concerning the combating of air pollution from stationary industrial plants; whereas several Member States are in the process of amending the existing provisions;

Whereas the disparities between the provisions concerning the combating of air pollution from industrial installations currently in force, or in the process of amendment, in the different Member States are liable to create unequal conditions of competition and thus have a direct effect on the functioning of the common market; whereas, therefore, approximation of the law in this field is required, as provided for by Article 100 of the Treaty;

Whereas one of the essential tasks of the Community is to promote throughout the Community a harmonious development of economic activities and a continuous and balanced expansion, tasks which are inconceivable in the absence of a campaign to combat pollution and nuisances or of an improvement in the quality of life and in the protection of the environment;

Whereas the Community should and must help increase the effectiveness of action undertaken by the Member States to combat air pollution from stationary industrial plants;

Whereas in order to achieve this end certain principles aiming at the implementation of a series of measures and procedures designed to prevent and reduce air pollution from industrial plants within the Community should be introduced;

Whereas the Community's endeavours to introduce these principles can be only gradual, bearing in mind the complexity of the situations and the fundamental principles on which the various national policies are based;

Whereas initially a general framework should be introduced to permit the Member States to adapt, where necessary, their existing rules to the principles adopted at Community level; whereas the Member States should therefore introduce a system of prior authorization for the operation and substantial alteration of stationary industrial plants which can cause air pollution;

Whereas, moreover, the competent national authorities cannot grant such authorization unless a number of conditions have been fulfilled, including the requirements that all appropriate preventive measures are taken, and that the operation of the plant does not result in a significant level of air pollution;

Whereas it should be possible to apply special provisions in particularly polluted areas and in areas in need of special protection;

Whereas the rules applicable to the authorization procedures and to the determination of emissions must satisfy certain requirements;

Whereas in certain situations the competent authorities must explore the need to impose further requirements, which, however, must not result in excessive costs for the undertaking concerned;

Whereas the provisions taken pursuant to this Directive are to be applied gradually to existing plants, taking due account of technical factors and the economic effects;

Whereas provision must be made for cooperation between the Member States themselves and with the Commission to facilitate implementation of the measures designed to prevent and to reduce air pollution and to develop preventive technology,

HAS ADOPTED THIS DIRECTIVE:

Article 1

The purpose of this Directive is to provide for further measures and procedures designed to prevent or reduce air pollution from industrial plants within the Community, particularly those belonging to the categories set out in Annex I.

Article 2

For the purposes of this Directive:

1. 'Air pollution' means the introduction by man, directly or indirectly, of substances or energy into the air resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems and material property and impair or interfere with amenities and other legitimate uses of the environment.

2. 'Plant' means any establishment or other stationary plant used for industrial or public utility purposes which is likely to cause air pollution.

3. 'Existing plant' means a plant in operation before 1 July 1987 or built or authorized before that date.

4. 'Air quality limit values' means the concentration of polluting substances in the air during a specified period which is not to be exceeded.

5. 'Emission limit values' means the concentration and/or mass of polluting substances in emissions from plants during a specified period which is not to be exceeded.

Article 3

1. Member States shall take the necessary measures to ensure that the operation of plants belonging to the categories listed in Annex I requires prior authorization by the competent authorities. The necessity to meet the requirements prescribed for such authorization must be taken into account at the plant's design stage.

2. Authorization is also required in the case of substantial alteration of all plants which belong to the categories listed in Annex I or which, as a result of the alteration, will fall within those categories.

3. Member States may require other categories of plants to be subject to authorization or, where national legislation so provides, prior notification.

Article 4

Without prejudice to the requirements laid down by national and Community provisions with a purpose other than that of this Directive, an authorization may be issued only when the competent authority is satisfied that:

1. all appropriate preventive measures against air pollution have been taken, including the application of the best available technology, provided that the application of such measures does not entail excessive costs;
2. the use of plant will not cause significant air pollution particularly from the emission of substances referred to in Annex II;
3. none of the emission limit values applicable will be exceeded;
4. all the air quality limit values applicable will be taken into account.

Article 5

Member States may:

- define particularly polluted areas for which emission limit values more stringent than those referred to in Article 4 may be fixed,
- define areas to be specially protected for which air quality limit values and emission limit values more stringent than those referred to in Article 4 may be fixed,
- decide that, within the abovementioned areas, specified categories of plants set out in Annex I may not be built or operated unless special conditions are complied with.

Article 6

Applications for authorization shall include a description of the plant containing the necessary information for the purposes of the decision whether to grant authorization in accordance with Articles 3 and 4.

Article 7

Subject to the provisions regarding commercial secrecy, Member States shall exchange information among themselves and with the Commission regarding their experience and knowledge of measures for prevention and reduction of air pollution, as well as technical processes and equipment and air quality and emission limit values.

Article 8

1. The Council, acting unanimously on a proposal from the Commission, shall if necessary fix emission limit values based on the best available technology not entailing excessive costs, and taking into account the nature, quantities and harmfulness of the emissions concerned.

2. The Council, acting unanimously on a proposal from the Commission, shall stipulate suitable measurement and assessment techniques and methods.

Article 9

1. Member States shall take the necessary measures to ensure that applications for authorization and the decisions of the competent authorities are made available to the public concerned in accordance with procedures provided for in the national law.

2. Paragraph 1 shall apply without prejudice to specific national or Community provisions concerning the assessment of the environmental effects of public and private projects and subject to observance of the provisions regarding commercial secrecy.

Article 10

The Member States shall make available to the other Member States concerned, as a basis for all necessary consultation within the framework of their bilateral relations, the same information as is furnished to their own nationals

Article 11

Member States shall take the necessary measures to ensure that emissions from plants are determined for the purpose of monitoring compliance with the obligations referred to in Article 4. The determination methods must be approved by the competent authorities.

Article 12

The Member States shall follow developments as regards the best available technology and the environmental situation.

In the light of this examination they shall, if necessary, impose appropriate conditions on plants authorized in accordance with this Directive, on the basis both of those developments and of the desirability of avoiding excessive costs for the plants in question, having regard in particular to the economic situation of the plants belonging to the category concerned.

Article 13

In the light of an examination of developments as regards the best available technology and the environmental situation, the Member States shall implement policies and strategies, including appropriate measures, for the gradual adaptation of existing plants belonging to the categories given in Annex I to the best available technology, taking into account in particular:

- the plant's technical characteristics,
- its rate of utilization and length of its remaining life,
- the nature and volume of polluting emissions from it,
- the desirability of not entailing excessive costs for the plant concerned, having regard in particular to the economic situation of undertakings belonging to the category in question.

Article 14

Member States may, in order to protect public health and the environment, adopt provisions stricter than those provided for in this Directive.

Article 15

The Directive does not apply to industrial plants serving national defence purposes.

Article 16

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 30 June 1987.

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

Article 17

This Directive is addressed to the Member States.

Done at Luxembourg, 28 June 1984.

For the Council
The President
H. BOUCHARDEAU

ANNEX I

CATEGORIES OF PLANTS (¹)
(covered by Article 3)

1. **Energy industry**

1.1. Coke ovens

1.2. Oil refineries (excluding undertakings manufacturing only lubricants from crude oil)

1.3. Coal gasification and liquefaction plants

1.4. Thermal power stations (excluding nuclear power stations) and other combustion installations with a nominal heat output of more than 50 MW.

2. **Production and processing of metals**

2.1. Roasting and sintering plants with a capacity of more than 1 000 tonnes of metal ore per year

2.2. Integrated plants for the production of pig iron and crude steel

2.3. Ferrous metal foundries having melting installations with a total capacity of over 5 tonnes

2.4. Plants for the production and melting of non-ferrous metals having installations with a total capacity of over 1 tonne for heavy metals or 0,5 tonne for light metals.

3. **Manufacture of non-metallic mineral products**

3.1. Plants for the production of cement and rotary kiln lime production

3.2. Plants for the production and processing of asbestos and manufacture of asbestos-based products

3.3. Plants for the manufacture of glass fibre or mineral fibre

3.4. Plants for the production of glass (ordinary and special) with a capacity of more than 5 000 tonnes per year

3.5. Plants for the manufacture of coarse ceramics notably refractory bricks, stoneware pipes, facing and floor bricks and roof tiles.

4. **Chemical industry**

4.1. Chemical plants for the production of olefins, derivatives of olefins, monomers and polymers

4.2. Chemical plants for the manufacture of other organic intermediate products

4.3. Plants for the manufacture of basic inorganic chemicals.

5. **Waste disposal**

5.1. Plants for the disposal of toxic and dangerous waste by incineration

5.2. Plants for the treatment by incineration of other solid and liquid waste.

6. **Other industries**

Plants for the manufacture of paper pulp by chemical methods with a production capacity of 25 000 tonnes or more per year.

(¹) The thresholds given in this Annex refer to production capacities.

ANNEX II

LIST OF MOST IMPORTANT POLLUTING SUBSTANCES
(within the meaning of Article 4 (2))

1. Sulphur dioxide and other sulphur compounds
2. Oxides of nitrogen and other nitrogen compounds
3. Carbon monoxide
4. Organic compounds, in particular hydrocarbons (except methane)
5. Heavy metals and their compounds
6. Dust; asbestos (suspended particulates and fibres), glass and mineral fibres
7. Chlorine and its compounds
8. Fluorine and its compounds

COUNCIL DIRECTIVE

of 20 March 1970

on the approximation of the laws of the Member States relating to measures to be taken against air pollution by gases from engines of motor vehicles

(70/220/EEC)

(as amended by Council Directive 74/290/EEC of 28 May 1974 (OJ L 159, 15.6.74, p. 61); extended by Commission Directive 77/102/EEC of 20 March 1976 adapting to technical progress 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 gases from positive-ignition engines of motor vehicles (OJ L 32, 3.2.77, p. 32); amended by Council Directive 78/665/EEC of 14 July 1978 (OJ L 223, 14.8.78, p. 48); and Council Directive 83/351/EEC of 16 June 1983 (OJ L 197, 20.7.83, p. 1))

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;

Having regard to the Opinion of the European Parliament[1];

Having regard to the Opinion of the Economic and Social Committee[2];

Whereas a regulation of 14 October 1968 amending the *Straßenverkehrs-Zulassungs-Ordnung* was published in Germany in the *Bundesgesetzblatt* Part I of 18 October 1968; whereas that regulation contains provisions on measures to be taken against air pollution by positive-ignition engines of motor vehicles; whereas those provisions will enter into force on 1 October 1970;

Whereas a regulation of 31 March 1969 on the 'Composition of exhaust gases emitted from petrol engines of motor vehicles' was published in France in the *Journal officiel* of 17 May 1969; whereas that regulation is applicable:

— from 1 September 1971, to type-approved vehicles with a new type of engine, that is to say, a type of engine which has never before been installed in a type-approved vehicle;

— from 1 September 1972, to vehicles put into service for the first time;

Whereas those provisions are liable to hinder the establishment and proper functioning of the common market; whereas it is therefore necessary that all Member States adopt 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 the Council Directive[3] 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 to be applied in respect of each type of vehicle;

Whereas, however, the present Directive will be applied before the date laid down for the application of the Directive of 6 February 1970; whereas at that time therefore the procedures of this last Directive will not yet be applicable; whereas therefore an *ad hoc* procedure must be laid down in the form of a communication certifying that a vehicle type has been tested and that it satisfies the requirements of this Directive;

Whereas, on the basis of that communication, each Member State requested to grant national type approval of a type of vehicle must be able to ascertain whether that type has been submitted to the tests laid down in this Directive; whereas, to this end, each Member State should inform the other Member States of its findings by sending them a copy of the communication completed for each type of motor vehicle which has been tested;

Whereas a longer period of adaptation should be laid down for industry in respect of the requirements relating to the testing of the average emission of gaseous pollutants in a congested urban area after a cold start than in respect of the other technical requirements of this Directive;

Whereas it is desirable to use the technical requirements adopted by the UN Economic Commission for

---

[1] OJ No C 160, 18.12.1969, p. 7.

[2] OJ No C 48, 16.4.1969, p. 16.

[3] OJ No L 42, 23.2.1970, p. 1.

Europe in its Regulation No 15[1] (Uniform provisions concerning the approval of vehicles equipped with a positive-ignition engine with regard to the emission of gaseous pollutants by the engine), annexed to the Agreement of 20 March 1958 concerning the adoption of uniform conditions of approval and reciprocal recognition of approval for motor vehicle equipment and parts;

Whereas, furthermore, the technical requirements must be rapidly adapted to take account of technical progress; whereas, to this end, provision should be made for application of the procedure laid down in Article 13 of the Council Directive of 6 February 1970 on the type approval of motor vehicles and their trailers;

HAS ADOPTED THIS DIRECTIVE:

Article 1

For the purposes of this Directive, "vehicle" means any vehicle with a positive-ignition engine or with a compression-ignition engine, intended for use on the road, with or without bodywork, having at least four wheels, a permissible maximum mass of at least 400 kg and a maximum design speed equal to or exceeding 50 km/h, with the exception of agricultural tractors and machinery and public works vehicles.

Article 2

No Member State may refuse to grant EEC type approval or national type approval of a vehicle on grounds relating to air pollution by gases from positive-ignition engines of motor vehicles:

- from 1 October 1970, where that vehicle satisfies both the requirements contained in Annex I, with the exception of those in items 3.2.1.1 and 3.2.2.1, and the requirements contained in Annexes II, IV, V and VI;
- from 1 October 1971, where that vehicle satisfies, in addition, the requirements contained in items 3.2.1.1 and 3.2.2.1 of Annex I and in Annex III.

Article 3

1. On application being made by a manufacturer or his authorised representative, the competent authorities of the Member State concerned shall complete the sections of the communication provided for in Annex VII. A copy of that communication shall be sent to the other Member States and to the applicant. Other Member States which are requested to grant national type approval for the same type of vehicle shall accept that document as proof that the tests provided for have been carried out.

2. The provisions of paragraph 1 shall be revoked as soon as the Council Directive of 6 February 1970 on the type approval of motor vehicles and their trailers enters into force.

Article 4

The Member State which has granted type approval shall take the necessary measures to ensure that it is informed of any modification of a part or characteristic referred to in item 1.1 of Annex I. The competent authorities of that Member State shall determine whether fresh tests should be carried out on the modified prototype and whether a fresh report should be drawn up. Where such tests reveal failure to comply with the requirements of this Directive, the modification shall not be approved.

Article 5

The amendments necessary for adjusting the requirements of Annexes I to VII so as to take account of technical progress shall be adopted in accordance with the procedure laid down in Article 13 of the Council Directive of 6 February 1970 on the type approval of motor vehicles and their trailers.

Article 6

1. Member States shall adopt provisions containing the requirements needed in order to comply with this Directive before 30 June 1970 and shall forthwith inform the Commission thereof.

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

Article 7

This Directive is addressed to the Member States.

Done at Brussels, 20 March 1970.

For the Council
The President
P. HARMEL

---

[1] ECE (Geneva) Document W/TRANS/WP 29/293/Rev. 1, 11.4.1969.

ANNEX I

SCOPE, DEFINITIONS, APPLICATION FOR EEC TYPE-APPROVAL, EEC TYPE-APPROVAL, SPECIFICATIONS AND TESTS, EXTENSION OF EEC TYPE-APPROVAL, CONFORMITY OF PRODUCTION, TRANSITIONAL PROVISIONS

1. SCOPE

This Directive applies to the emission of gaseous pollutants from all motor vehicles equipped with positive-ignition engines and from vehicles of categories M_1 and N_1 (¹) equipped with compression-ignition engines, covered by Article 1.

2. DEFINITIONS

For the purposes of this Directive:

2.1. 'Vehicle type', with regard to the emission of gaseous pollutants from the engine, means a category of power-driven vehicles which do not differ in such essential respects as:

2.1.1. the equivalent inertia determined in relation to the reference mass as prescribed in 5.1 of Annex III; and

2.1.2. the engine and vehicle characteristics as defined in 1 to 6 and 8 of Annex II and Annex VII.

2.2. 'Reference mass' means the 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.

2.2.1. 'Mass of the vehicle in running order' means the mass defined under 2.6 of Annex I to Directive 70/156/EEC.

2.3. 'Maximum mass' means the mass defined under 2.7 of Annex I to Directive 70/156/EEC.

2.4. 'Gaseous pollutants' means carbon monoxide, hydrocarbons (assuming a ratio of $CH_{1,85}$), and oxides of nitrogen, the latter being expressed in nitrogen dioxide (NO_2) equivalent.

2.5. 'Engine crankcase' means the spaces in or external to an engine which are connected to the oil sump by internal or external ducts through which gases and vapours can escape.

2.6. 'Cold start device' means a device which enriches the air/fuel mixture of the engines temporarily, thus assisting the engine to start.

2.7. 'Starting aid' means a device which assists the engine to start without enrichment of the air/fuel mixture of the engine, e.g. glow plugs, modifications to the injection timing.

3. APPLICATION FOR EEC TYPE-APPROVAL

3.1. The application for approval of a vehicle type with regard to the emission of gaseous pollutants from its engine is submitted by the vehicle manufacturer or by his authorized representative.

3.2. It is accompanied by the following documents in triplicate and by the following particulars:

(¹) As defined in 0.4 of Annex I to Directive 70/156/EEC (OJ No L 42, 23. 2. 1970, p. 1).

3.2.1. a description of the engine type comprising all the particulars referred to in Annex II;

3.2.2. drawings of the combustion chamber and of the piston, including the piston rings;

3.2.3. maximum lift of valves and angles of opening and closing in relation to dead centres.

3.3. A vehicle representative of the vehicle type to be approved is submitted for the tests described in 5 of this Annex to the technical service responsible for the type-approval tests.

4. EEC TYPE-APPROVAL

4.1. A form conforming to the model set out in Annex VII must be attached to the EEC type-approval certificate.

5. REQUIREMENTS AND TESTS

5.1. General

The components liable to affect the emission of gaseous pollutants must be so designed, constructed and assembled as to enable the vehicle, in normal use, to comply with the requirements of this Directive, despite the vibration to which they may be subjected.

5.2. Description of tests

5.2.1. The vehicle must, according to its category, be subjected to tests of different types, as specified below. The tests are:

- type I, II and III if powered by a positive-ignition engine, and
- type I if powered by a compression-ignition engine.

5.2.1.1. *Type I test* (verifying the average emission of gaseous pollutants after a cold start)

5.2.1.1.1. This test must be carried out on all vehicles referred to in 1, of a maximum mass not exceeding 3,5 tonnes.

5.2.1.1.2. The vehicle is placed on a dynamometer bench equipped with a means of load and inertia simulation. A test lasting a total of 13 minutes and comprising four cycles is performed without interruption. Each cycle comprises 15 phases (idling, acceleration, steady speed, deceleration, etc.). During the test the exhaust gases are diluted and a proportional sample collected in one or more bags. The exhaust gases of the vehicle tested are diluted, sampled and analyzed following the procedure described below; the total volume of the diluted exhaust is measured.

5.2.1.1.3. The test is carried out by the procedure described in Annex III. The methods used to collect and analyze the gases must be those prescribed. Other analysis methods may be approved if it is found that they yield equivalent results.

5.2.1.1.4. Subject to the requirements of 5.2.1.1.4.2 and 5.2.1.1.5, the test is repeated three times. For a vehicle of a given reference mass, the mass of the carbon monoxide and the combined mass of the hydrocarbons and of the nitrogen oxides obtained in the test must be less than the amounts shown in the table below:

Reference mass RW (kg)	Carbon monoxide L_1 (g/test)	Combined emission of hydrocarbons and oxides of nitrogen L_2 (g/test)
RW ≤ 1 020	58	19,0
1 020 < RW ≤ 1 250	67	20,5
1 250 < RW ≤ 1 470	76	22,0
1 470 < RW ≤ 1 700	84	23,5
1 700 < RW ≤ 1 930	93	25,0
1 930 < RW ≤ 2 150	101	26,5
2 150 < RW	110	28,0

5.2.1.1.4.1. Nevertheless, for each of the pollutants referred to in 5.2.1.1.4, one of the three results obtained may exceed by not more than 10 % the limit prescribed in that section for the vehicle concerned, provided the arithmetical mean of the three results is below the prescribed limit. Where the prescribed limits are exceeded for more than one pollutant (i.e. carbon monoxide and the combined mass of hydrocarbons and nitrogen oxides) it is immaterial whether this occurs in the same test or in different tests (1).

5.2.1.1.4.2. The number of tests prescribed in 5.2.1.1.4 may, on the request of the manufacturer, be increased to 10 tests provided that the arithemtic mean ($\bar{x}_1$) of the three results performed for carbon monoxide and/or for the combined emissions of hydrocarbons and of oxides of nitrogen falls between 100 and 110 % of the limit. In this case, the decision, after testing, depends exclusively on the average results obtained from all 10 tests ($\bar{x} < L$).

5.2.1.1.5. The number of tests prescribed in 5.2.1.1.4 is reduced in the conditions hereinafter defined, where V_1 is the result of the first test and V_2 the result of the second test for each of the pollutants referred to in 5.2.1.1.4.

5.2.1.1.5.1. Only one test is performed if V_1 readings of carbon monoxide as well as the combined hydrocarbon and oxides of nitrogen reading are less than or equal to 0,70 L.

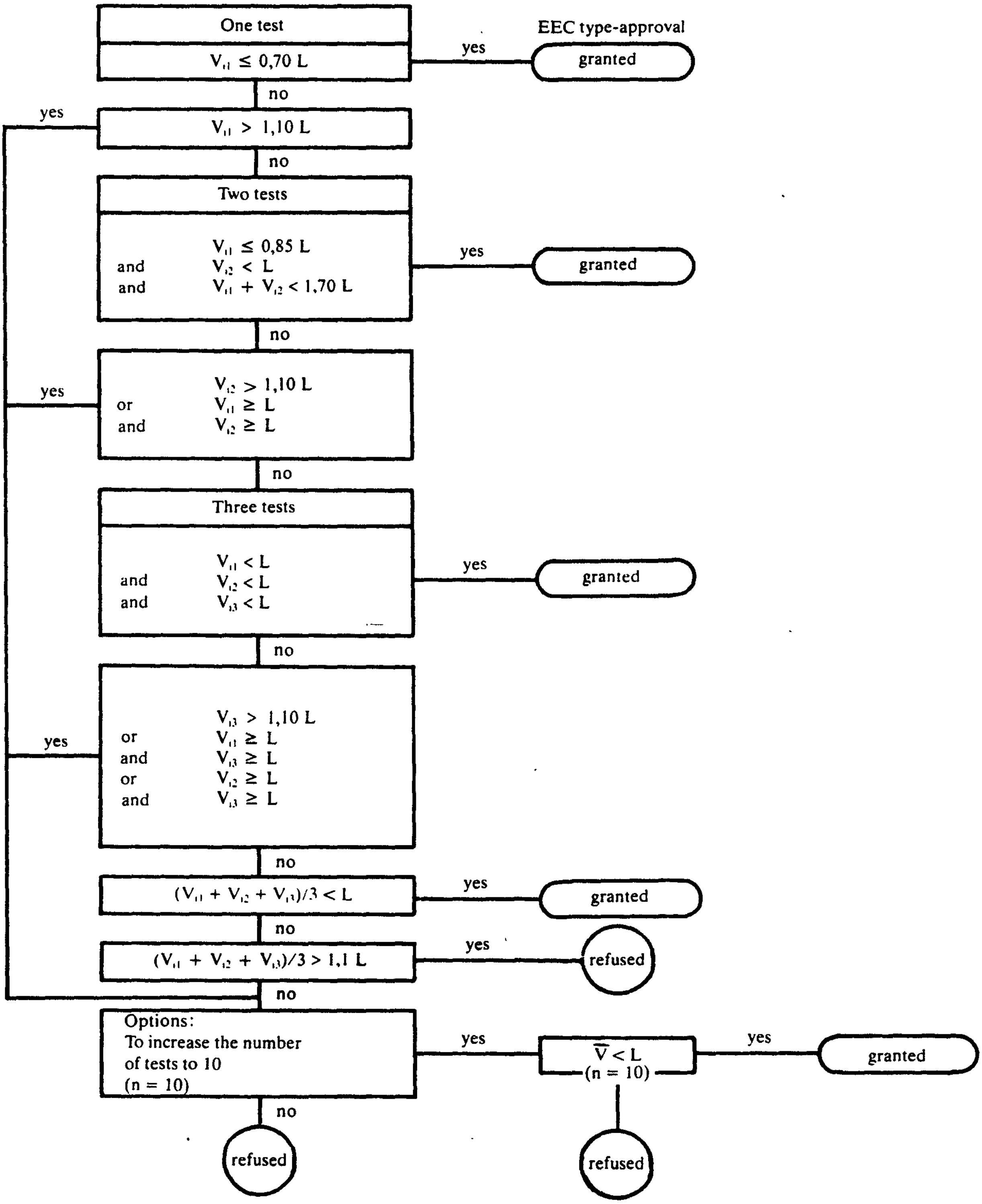
5.2.1.1.5.2. Only two tests are performed if the results of both the carbon monoxide and the combined value of hydrocarbons and oxides of nitrogen are $V_1 \leq 0{,}85$ L, and if, at the same time, one of these values is $V_1 > 0{,}70$ L. In addition, the V_2 readings of both the carbon monoxide emissions and the combined emissions of hydrocarbon and oxides of nitrogen must satisfy the requirement that $V_1 + V_2 \leq 1{,}70$ L, and $V_2 \leq$ L.

---

(1) If one of the three results obtained of each of the pollutants exceeds by more than 10 % the limit prescribed in 5.2.1.1.4 for the vehicle concerned, the test may be continued as specified in 5.2.1.1.4.2.

Figure 1

Flow sheet for the type-approval of the European test procedure (see 5.2)



5.2.1.2. *Type II test* (carbon monoxide emission test at idling speed)

5.2.1.2.1. With the exception of vehicles powered by a compression-ignition engine, this test must be carried out on all vehicles referred to in 1.

5.2.1.2.2. The carbon monoxide content by volume of the exhaust gases emitted with the engine idling must not exceed 3,5 %. When a check is made in accordance with the requirements of Annex IV under operating conditions not in conformity with the standards recommended by the manufacturer (configuration of the adjustment components), the maximum content measured by volume must not exceed 4,5 %.

5.2.1.2.3. Conformity with the latter requirement is checked by means of a test carried out using the procedure described in Annex IV.

5.2.1.3. *Type III test* (verifying emissions of crankcase gases)

5.2.1.3.1. This test must be carried out on all vehicles referred to in 1 except those having compression-ignition engines.

5.2.1.3.2. The engine's crankcase ventilation system must not permit the emission of any of the crankcase gases into the atmosphere.

5.2.1.3.3. Conformity with the latter requirement is checked by means of a test carried out using the procedure described in Annex V.

6. EXTENSION OF EEC TYPE-APPROVAL

6.1. Vehicle types of different reference masses

6.1.1. Approval of a vehicle type may under the following conditions be extended to vehicle types which differ from the type approved only in respect of their reference mass.

6.1.1.1. Approval may be extended to vehicle types of a reference mass requiring merely the use of the next higher or next lower equivalent inertia.

6.1.1.2. If the reference mass of the vehicle type for which extension of the approval is requested requires the use of a flywheel of equivalent inertia higher than that used for the vehicle type already approved, extension of the approval is granted.

6.1.1.3. If the reference mass of the vehicle type for which extension of the approval is requested requires the use of a flywheel of equivalent inertia lower than that used for the vehicle type already approved, extension of the approval is granted if the masses of the pollutants obtained from the vehicle already approved are within the limits prescribed for the vehicle for which extension of the approval is requested.

6.2. Vehicle types with different overall gear ratios

6.2.1. Approval granted to a vehicle type may under the following conditions be extended to vehicle types differing from the type-approval only in respect of their overall transmission ratios:

6.2.1.1. For each of the transmission ratios used in the type I test, it is necessary to determine the proportion $E = \frac{V_2 - V_1}{V_1}$ where V_1 and V_2 are respectively the speed at 1 000 r/min of the engine of the vehicle type approved and the speed of the vehicle type for which extension of the approval is requested.

6.2.2. If for each gear ratio $E \leq 8$ %, the extension is granted without repeating the type I tests;

6.2.3. If for at least one gear ratio $E > 8$ % and if for each gear ratio $E \leq 13$ %, the type I tests are repeated, but may be performed in a laboratory chosen by the manufacturer subject to the approval of the authority granting type-approval. The report of the tests must be sent to the technical service responsible for the type-approval tests.

6.3. Vehicle types of different reference masses and different overall transmission rating

Approval granted to a vehicle type may be extended to vehicle types differing from the approved type only in respect of their reference mass and their overall transmission ratios, provided that all the conditions prescribed in 6.1 and 6.2 are fulfilled.

6.4. Note

When a vehicle type has been approved in accordance with 6.1 to 6.3, such approval may not be extended to other vehicle types.

7. CONFORMITY OF PRODUCTION

7.1. As a general rule, conformity of production models, with regard to limitation of the emission of gaseous pollutants from the engine, is checked on the basis of the description in the Annex to the type-approval certificate set out in Annex VII and, where necessary, of all or some of the tests of types I, II and III described in 5.2.

7.1.1. Conformity of the vehicle in a type I test is checked as follows:

7.1.1.1. A vehicle is taken from the series and subjected to the test described in 5.2.1.1. However, the limits shown in 5.2.1.1.4 are replaced by the following:

Reference mass RW (kg)	Carbon monoxide L_1 (g/test)	Combined standard for hydrocarbons and oxides of nitrogen L_2 (g/test)
RW ≤ 1 020	70	23,8
1 020 < RW ≤ 1 250	80	25,6
1 250 < RW ≤ 1 470	91	27,5
1 470 < RW ≤ 1 700	101	29,4
1 700 < RW ≤ 1 930	112	31,3
1 930 < RW ≤ 2 150	121	33,1
2 150 < RW	132	35,0

7.1.1.2. If the vehicle taken from the series does not satisfy the requirements of 7.1.1.1, the manufacturer may ask for measurements to be performed on a sample of vehicles taken from the series and including the vehicle originally taken. The manufacturer determines the size n of the sample. Vehicles other than the vehicle originally taken are subjected to a single type I test.

The result to be taken into consideration for the vehicle taken originally is the arithmetical mean of the three type I tests carried out on the vehicle. The arithmetic mean ($\overline{x}$) of the results obtained with the sample and the standard deviation S (1) must be determined for both the carbon monoxide emission and for the combined emissions of hydrocarbons and oxides of nitrogen. The production of the series is then deemed to conform if the following condition is met:

$$\bar{x} + k \cdot S \leq L$$

where

L is the limit value laid down in 7.1.1.1 for the emissions of carbon monoxide and the combined emissions of hydrocarbons and oxides of nitrogen;

k is a statistical factor depending on n and given in the following table:

n	2	3	4	5	6	7	8	9	10
k	0,973	0,613	0,489	0,421	0,376	0,342	0,317	0,296	0,279
n	11	12	13	14	15	16	17	18	19
k	0,265	0,253	0,242	0,233	0,224	0,216	0,210	0,203	0,195

$$\text{If } n \geq 20, \quad k = \frac{0{,}860}{\sqrt{n}}$$

7.1.2. In a type II or type III test carried out on a vehicle taken from the series, the conditions laid down in 5.2.1.2.2 and 5.2.1.3.2 must be complied with.

7.1.3. Notwithstanding the requirements of 3.1.1 of Annex III, the technical service responsible for verifying the conformity of production may, with the consent of the manufacturer, carry out tests of types I, II and III on vehicles which have been driven less than 3 000 km.

8. TRANSITIONAL PROVISIONS

8.1. For the type-approval and checking of production conformity of vehicles other than those of category M_1 as well as of vehicles of category M_1 designed to carry more than six occupants including the driver, the limits for the combined emissions of hydrocarbons and oxides of nitrogen are those resulting from the multiplication of the values L_2 given in the tables in 5.2.1.1.4 and 7.1.1.1 by a factor of 1,25.

8.2. For the checking of production conformity of vehicles which were type-approved before 1 October 1984 as far as their emissions of pollutants are concerned, in accordance with the provisions of Directive 70/220/EEC, as amended by Directive 78/665/EEC, the provisions of the abovementioned Directive remain applicable until the Member States make use of Article 2 (3) of this Directive.

---

(1) $S^2 = \sum \frac{(x - \bar{x})^2}{n - 1}$, where x is any one of the individual results obtained with the sample n.

ANNEX II

ESSENTIAL CHARACTERISTICS OF THE ENGINE AND INFORMATION CONCERNING THE CONDUCT OF TEST (1)

1. **Description of engine**

1.1. Make: ....

1.2. Type: ....

1.3. Working principle: positive ignition/compression ignition, four stroke/two stroke (2):

1.4. Bore: .... mm

1.5. Stroke: .... mm

1.6. Number and layout of cylinders and firing order: ....

1.7. Cylinder capacity: .... cm³

1.8. Compression ratio (3): ....

1.9. Drawings of combustion chamber and piston crown: ....

1.10. Cooling system: liquid/air cooling (2): ....

1.11. Supercharger: yes/no (2) Description of the system: ....

1.12. *Intake system*

Intake manifold: .... Description: ....

Air filter: .... Make: .... Type: ....

Intake silencer: .... Make: .... Type: ....

1.13. Device for recycling crankcase gases (description and diagrams):

2. **Additional anti-pollution devices** (if any, and if not covered by another heading)

Description and diagrams: ....

3. **Air intake and fuel feed**

3.1. Description and diagrams of inlet pipes and their accessories (dash-pot, heating device, additional air intakes, etc.): ....

3.2. Fuel feed

3.2.1. By carburettor(s) (2): .... Number: ....

3.2.1.1. Make: ....

---

(1) In the case of non-conventional engines and systems, particulars equivalent to those referred to here shall be supplied by the manufacturer.

(2) Delete as inapplicable.

(3) Specify the tolerance.

3.2.1.2. Type: ....

3.2.1.3. Adjustments (¹) ....

3.2.1.3.1. Jets: ....

3.2.1.3.2. Venturis: ....

3.2.1.3.3. Float-chamber level: ....

3.2.1.3.4. Mass of float: ....

3.2.1.3.5. Float needle: ....

or Curve of fuel delivery plotted against air flow, and settings required to keep to the curve (¹)(²)

3.2.1.4. Manual/automatic choke (²):
Closure setting (¹): ....

3.2.1.5. Feed pump
Pressure (¹): .... or characteristic diagram (¹): ....

3.2.2. By fuel injection (²) system description
Working principle: Intake manifold/direct injection
injection prechamber/swirl chamber (²): ....

3.2.2.1. Fuel pump: ....

3.2.2.1.1. Make: ....

3.2.2.1.2. Type: ....

3.2.2.1.3. Delivery: .... mm³ per stroke at a pump speed of .... r/min (¹)(²)
or, alternatively, a characteristic diagram (¹)(²): ....
Calibration procedure: test bench/engine (²)

3.2.2.1.4. Injection timing: ....

3.2.2.1.5. Injection curve: ....

3.2.2.2. Injector nozzle: ....

3.2.2.3. Governor: ....

3.2.2.3.1. Make: ....

3.2.2.3.2. Type: ....

3.2.2.3.3. Cut-off point under load min⁻¹: ....

3.2.2.3.4. Maximum speed without load min⁻¹: ....

3.2.2.3.5. Idle speed: ....

3.2.2.4. Cold start device: ....

3.2.2.4.1. Make: ....

3.2.2.4.2. Type: ....

(¹) Specify the tolerance.
(²) Delete as inapplicable.

3.2.2.4.3. System description: ....

3.2.2.5. Starting aid: ....

3.2.2.5.1. Make: ....

3.2.2.5.2. Type: ....

3.2.2.5.3. System description: ....

4. Valve timing or equivalent data

4.1. Maximum lift of valves, angles of opening and closing, or timing details of alternative distribution systems, in relation to top dead centre: ....

....

4.2. Reference and/or setting ranges (1): ....

5. Ignition

5.1. Ignition system type: ....

5.1.1. Make: ....

5.1.2. Type: ....

5.1.3. Ignition advance curve (2): ....

5.1.4. Ignition timing (2): ....

5.1.5. Contact-point gap (2) and dwell-angle (1)(2): ....

6. Exhaust system

6.1. Description and diagrams: ....

7. Additional information on test conditions

7.1. *Sparking plugs*

7.1.1. Make: ....

7.1.2. Type: ....

7.1.3. Spark-gap setting: ....

7.2. *Ignition coil*

7.2.1. Make: ....

7.2.2. Type: ....

---

(1) Delete as inapplicable.
(2) Specify the tolerance.

7.3. *Ignition condenser*

7.3.1. Make: ....

7.3.2. Type: ....

8. **Engine performance** (declared by manufacturer)

8.1. Idle r/min [1]: ....

8.2. Carbon monoxide content by volume in the exhaust gas with the engine idling — % (manufacturer's standard): ....

8.3. R/min at maximum power [1]: ....

8.4. Maximum power: .... kW (according to the method described in Annex I to Directive 80/1269/EEC)

9. **Lubricant used**

9.1. Make: ....

9.2. Type: ....

---

[1] Specify the tolerance.

ANNEX III

TYPE I TEST

(Verifying the average emission of pollutants in a congested urban area after a cold start)

1. INTRODUCTION

This Annex describes the procedure for the type I test defined in 5.2.1.1 of Annex I.

2. OPERATING CYCLE ON THE CHASSIS DYNAMOMETER

2.1. Description of the cycle

The operating cycle on the chassis dynamometer is that indicated in the following table and depicted in the graph in Appendix 1. The breakdown by operations is also given in the table in the said Appendix.

2.2. General conditions under which the cycle is carried out

Preliminary testing cycles must be carried out if necessary to determine how best to actuate the accelerator and brake controls so as to achieve a cycle approximating to the theoretical cycle within the prescribed limits.

2.3. Use of the gearbox

2.3.1. If the maximum speed which can be attained in first gear is below 15 km/h, the second, third and fourth gears are used. The second, third and fourth gears may also be used when the driving instructions recommend starting in second gear on level ground, or when first gear is therein defined as a gear reserved for cross-country driving, crawling or towing.

2.3.2. Vehicles equipped with semi-automatic-shift gearboxes are tested by using the gears normally employed for driving, and the gear shift is used in accordance with the manufacturer's instructions.

2.3.3. Vehicles equipped with automatic-shift gearboxes are tested with the highest gear ('Drive') engaged. The accelerator must be used in such a way as to obtain the steadiest acceleration possible, enabling the various gears to be engaged in the normal order. Furthermore, the gear-change points shown in Appendix 1 to this Annex do not apply; acceleration must continue throughout the period represented by the straight line connecting the end of each period of idling with the beginning of the next following period of steady speed. The tolerances given in 2.4 apply.

2.3.4. Vehicles equipped with an overdrive which the driver can actuate are tested with the overdrive out of action.

2.4. Tolerances

2.4.1. A tolerance of ± 1 km/h is allowed between the indicated speed and the theoretical speed during acceleration, during steady speed, and during deceleration when the vehicle's brakes are used. If the vehicle decelerates more rapidly without the use of the brakes, only the requirements of 6.5.3 apply. Speed tolerances greater than those prescribed are accepted during phase changes provided that the tolerances are never exceeded for more than 0,5 s on any one occasion.

2.4.2. The time tolerances are ± 0,5 s. The above tolerances apply equally at the beginning and at the end of each gear-changing period (1).

---

(1) It should be noted that the time of two seconds allowed includes the time for changing gear and, if necessary, a certain amount of latitude to catch up with the cycle.

Operating cycle on the chassis dynamometer

No of operation	Operation	Phase	Acceleration (m/s²)	Speed (km/h)	Duration of each		Cumulative time (s)	Gear to be used in the case of a manual gearbox
					Operation (s)	Phase (s)		
1	Idling	1			11	11	11	6 s PM + 5 s K_1 (*)
2	Acceleration	2	1,04	0−15	4	4	15	1
3	Steady speed	3		15	8	8	23	1
4	Deceleration	4	−0,69	15−10	2	2	25	1
5	Deceleration, clutch disengaged		−0,92	10−0	3	3	28	K_1 (*)
6	Idling	5			21	21	49	16 s PM + 5 s K_1 (*)
7	Acceleration	6	0,83	0−15	5	12	54	1
8	Gear change				2		56	
9	Acceleration		0,94	15−32	5		61	2
10	Steady speed	7		32	24	24	85	2
11	Deceleration	8	−0,75	32−10	8	11	93	2
12	Deceleration, clutch disengaged		−0,92	10−0	3		96	K_2 (*)
13	Idling	9			21	21	117	16 s PM + 5 s K_1 (*)
14	Acceleration	10	0,83	0−15	5	26	122	1
15	Gear change				2		124	
16	Acceleration		0,62	15−35	9		133	2
17	Gear change				2		135	
18	Acceleration		0,52	35−50	8		143	3
19	Steady speed	11		50	12	12	155	3
20	Deceleration	12	−0,52	50−35	8	8	163	3
21	Steady speed	13		35	13	13	176	3
22	Gear change	14			2	12	178	
23	Deceleration		−0,86	32−10	7		185	2
24	Deceleration, clutch disengaged		−0,92	10−0	3		188	K_2 (*)
25	Idling	15			7	7	195	7 s PM (*)

(*) PM = gearbox in neutral, clutch engaged.
K_1, K_2 = first or second gear engaged, clutch disengaged.

2.4.3. The speed and time tolerances are combined as indicated in Appendix 1 to this Annex.

3. VEHICLE AND FUEL

3.1. Test vehicle

3.1.1. The vehicle must be presented in good mechanical condition. It must have been run-in and driven at least 3 000 km before the test.

3.1.2. The exhaust device must not exhibit any leak likely to reduce the quantity of gas collected, which quantity must be that emerging from the engine.

3.1.3. The tightness of the intake system may be checked to ensure that carburation is not affected by an accidental intake of air.

3.1.4. The settings of the engine and of the vehicle's controls must be those prescribed by the manufacturer. This requirement also applies, in particular, to the settings for idling (rotation speed and carbon monoxide content of the exhaust gases), for the cold start device and for the exhaust gas pollutant emission control system.

3.1.5. The vehicle to be tested, or an equivalent vehicle, must be fitted, if necessary, with a device to permit the measurement of the characteristic parameters necessary for chassis dynamometer setting, in conformity with 4.1.1.

3.1.6. The technical service may verify that the vehicle's performance conforms to that stated by the manufacturer, that it can be used for normal driving and, more particularly, that it is capable of starting when cold and when hot.

3.1.7. A vehicle equipped with a catalytic converter must be tested with the catalyst fitted, if the vehicle manufacturer states that the vehicle so equipped and supplied with fuel having a lead content of up to 0,4 grams per litre is capable of complying with the requirements of this Directive for the catalyst life as defined by the vehicle manufacturer.

3.2. **Fuel**

The appropriate reference fuel as defined in Annex VI must be used for testing.

4. TEST EQUIPMENT

4.1. **Chassis dynamometer**

4.1.1. The dynamometer must be capable of simulating road load within one of the following classifications:

- dynamometer with fixed load curve, i.e. a dynamometer whose physical characteristics provide a fixed load curve shape,
- dynamometer with adjustable load curve, i.e. a dynamometer with at least two road load parameters that can be adjusted to shape the load curve.

4.1.2. The setting of the dynamometer must not be affected by the lapse of time. It must not produce any vibrations perceptible to the vehicle and likely to impair the vehicle's normal operations.

4.1.3. It must be equipped with means to simulate inertia and load. These simulators are connected to the front roller in the case of a two-roller dynamometer.

4.1.4. *Accuracy*

4.1.4.1. It must be possible to measure and read the indicated load to an accuracy of ± 5 %.

4.1.4.2. In the case of a dynamometer with a fixed load curve the accuracy of the load setting at 50 km/h must be ± 5 %. In the case of a dynamometer with adjustable load curve, the accuracy of matching dynamometer load to road load must be 5 % at 30, 40, and 50 km/h and 10 % at 20 km/h. Below this, dynamometer absorption must be positive.

4.1.4.3. The total inertia of the rotating parts (including the simulated inertia where applicable) must be known and must be within ± 20 kg of the inertia class for the test.

4.1.4.4. The speed of the vehicle must be measured by the speed of rotation of the roller (the front roller in the case of a two roller dynamometer). It must be measured with an accuracy of ± 1 km/h at speeds above 10 km/h.

4.1.5. *Load and inertia setting*

4.1.5.1. Dynamometer with fixed load curve: the load simulator must be adjusted to absorb the power exerted on the driving wheels at a steady speed of 50 km/h. The means by which this load is determined and set are described in Appendix 3.

4.1.5.2. Dynamometer with adjustable load curve: the load simulator must be adjusted in order to absorb the power exerted on the driving wheels at steady speeds of 20, 30, 40 and 50 km/h. The means by which these loads are determined and set are described in Appendix 3.

4.1.5.3. Inertia

Dynamometers with electrical inertia simulation must be demonstrated to be equivalent to mechanical inertia systems. The means by which equivalence is established is described in Appendix 4.

4.2. **Exhaust gas-sampling system**

4.2.1. The exhaust gas-sampling system is designed to enable the measurements of the true mass emission of pollutants by the vehicle exhaust. The system to be used is the constant volume sampler (CVS) system. This requires that the vehicle exhaust be continuously diluted with ambient air under controlled conditions. In the constant volume sampler concept of measuring mass emissions, two conditions must be satisfied, the total volume of the mixture of exhaust and dilution air must be measured and a continuously proportional sample of the volume must be collected for analysis. Mass emissions are determined from the sample concentrations corrected for the pollutant content of the ambient air, and totalized flow over the test period.

4.2.2. The flow through the system must be sufficient to eliminate water condensation at all conditions which may occur during a test, as defined in Appendix 5.

4.2.3. Figure 1 gives a schematic diagram of the general concept. Appendix 5 gives examples of three types of constant volume sampler system which satisfy the requirements set out in this Annex.

4.2.4. The gas and air mixture must be homogeneous at point S2 of the sampling probe.

4.2.5. The probe must extract a true sample of the diluted exhaust gases.

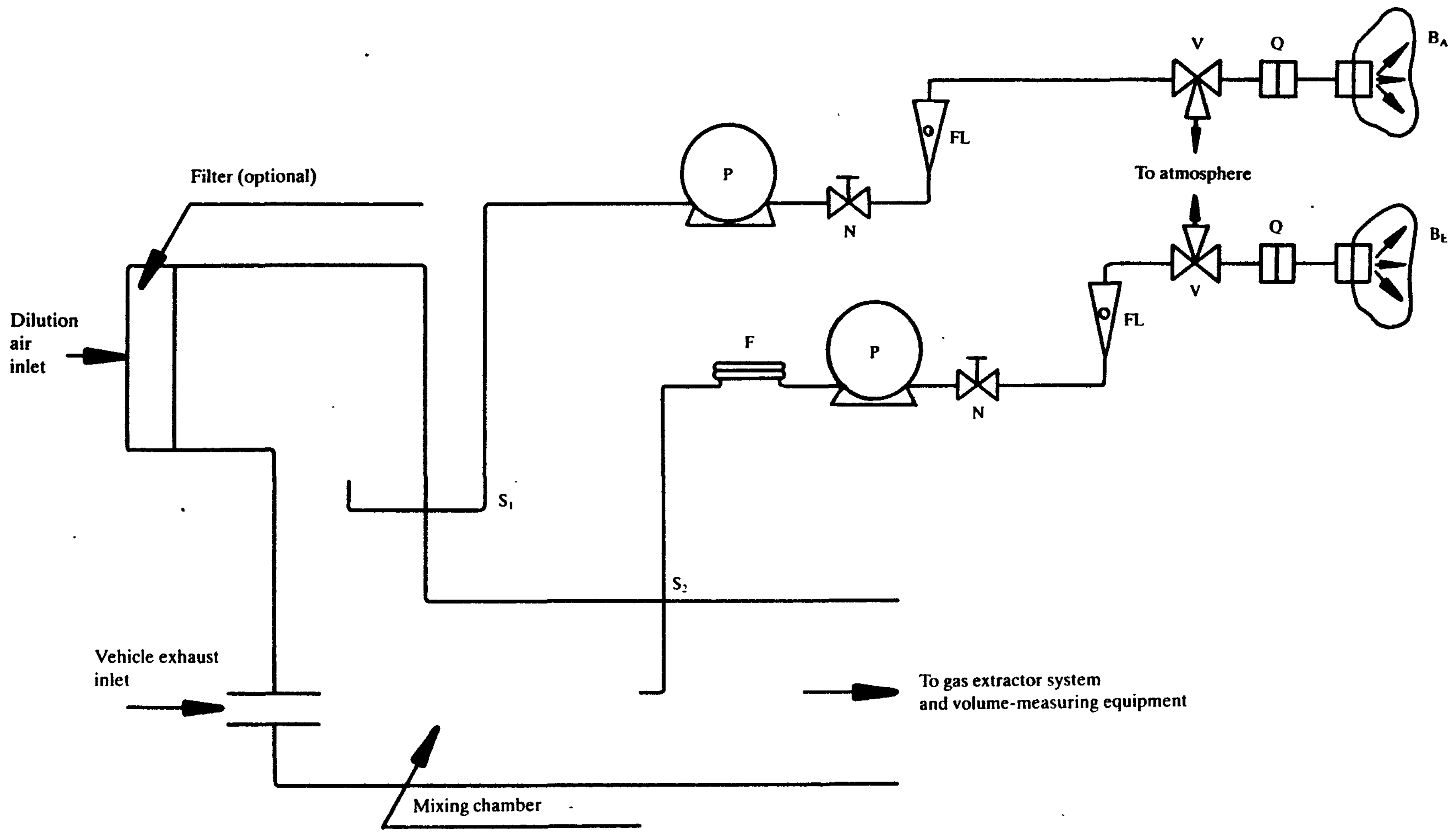
4.2.6. The system must be free of gas leaks. The design and materials must be such that the system does not influence the pollutant concentration in the diluted exhaust gas. Should any component (heat exchanger, blower, etc.) change the concentration of any pollutant gas in the diluted gas, the sampling for that pollutant must be carried out before that component if the problem cannot be corrected.

4.2.7. If the vehicle being tested is equipped with an exhaust pipe comprising several branches, the connecting tubes must be connected as near as possible to the vehicle.

4.2.8. Static pressure variations at the tailpipe(s) of the vehicle must remain within ± 1,25 kPa of the static pressure variations measured during the dynamometer driving cycle with no connection to the tailpipe(s). Sampling systems capable of maintaining the static pressure to within ± 0,25 kPa are used if a written request from a manufacturer to the competent authority issuing the approval substantiates the need for the narrower tolerance. The back-pressure must be measured in the exhaust pipe, as near as possible to its end or in an extension having the same diameter.

Figure 1

Diagram of exhaust-gas sampling system



4.2.9. The various valves used to direct the exhaust gases must be of a quick-adjustment, quick-acting type.

4.2.10. The gas samples are collected in sample bags of adequate capacity. These bags must be made of such materials as will not change the pollutant gas by more than ± 2 % after 20 minutes of storage.

4.3. **Analytical equipment**

4.3.1. *Requirements*

4.3.1.1. Pollutant gases must be analyzed with the following instruments:

Carbon monoxide (CO) and carbon dioxide (CO_2) analysis:

The carbon monoxide and carbon dioxide analyzers must be of the non-dispersive infra-red (NDIR) absorption type.

Hydrocarbons (HC) analysis — spark-ignition engines:

The hydrocarbons analyzer must be of the flame ionization (FID) type calibrated with propane gas expressed equivalent to carbon atoms (C_1).

Hydrocarbons (HC) analysis — compression-ignition engines:

The hydrocarbons analyzer must be of the flame ionization type with detector, valves, pipework, etc. heated to 190 ± 10 °C (HFID). It must be calibrated with propane gas expressed equivalent to carbon atoms (C_1).

Nitrogen oxide (NO_x) analysis:

The nitrogen oxide analyzer must be either of the chemiluminescent (CLA) or of the non-dispensive ultra-violet resonance absorption (NDUVR) type, both with an NO_x — NO converter.

4.3.1.2. Accuracy

The analyzers must have a measuring range compatible with the accuracy required to measure the concentrations of the exhaust gas sample pollutants.

Measurement error must not exceed ± 3 %, disregarding the true value of the calibration gases.

For concentrations of less than 100 ppm the measurement error must not exceed ± 3 ppm. The ambient air sample must be measured on the same analyzer and range as the corresponding diluted exhaust sample.

4.3.1.3. Ice-trap

No gas drying device must be used before the analyzers unless shown to have no effect on the pollutant content of the gas stream.

4.3.2. *Particular requirements for compression-ignition engines*

A heated sample line for a continuous HC-analysis with the flame ionization detector (HFID), including recorder (R) must be used. The average concentration of the measured hydrocarbons must be determined by integration. Throughout the test, the temperature of the heated sample line must be controlled at 190 ± 10 °C. The heated sampling line must be fitted with a heated filter (F_H) 99 % efficient with particle $\geq$ 0,3 µm to extract any solid particles from the continuous flow of gas required for analysis. The sampling system response time (from the probe to the analyzer inlet) must be no more than four seconds.

The HFID must be used with a constant flow (heat exchanger) system to ensure a representative sample, unless compensation for varying CFV or CFO flows is made.

4.3.3. *Calibration*

Each analyzer must be calibrated as often as necessary and in any case in the month before type-approval testing and at least once every six months for verifying conformity of production. The calibration method to be used is described in Appendix 6 for the analyzers referred to in 4.3.1.

4.4. Volume measurement

4.4.1. The method of measuring total dilute exhaust volume incorporated in the constant volume sampler must be such that measurement is accurate to ± 2 %.

4.4.2. *Constant volume sampler calibration*

The constant volume sampler system volume measurement device must be calibrated by a method sufficient to ensure the prescribed accuracy and at a frequency sufficient to maintain such accuracy.

An example of a calibration procedure which will give the required accuracy is given in Appendix 6. The method utilizes a flow metering device which is dynamic and suitable for the high flow-rate encountered in constant volume sampler testing. The device must be of certified accuracy in conformity with an approved national or international standard.

4.5. Gases

4.5.1. *Pure gases*

The following pure gases must be available, if necessary, for calibration and operation:

- purified nitrogen (purity ≤ 1 ppm C, ≤ 1 ppm CO, ≤ 400 ppm CO_2, ≤ 0,1 ppm NO),
- purified synthetic air (purity ≤ 1 ppm C, ≤ 1 ppm CO, ≤ 400 ppm CO_2, ≤ 0,1 ppm NO); oxygen content between 18 and 21 % vol,
- purified oxygen (purity ≤ 99,5 % vol O_2),
- purified hydrogen (and mixture containing hydrogen) (purity ≤ 1 ppm C, ≤ 400 ppm CO_2).

4.5.2. *Calibration and span gases*

Gases having the following chemical compositions must be available: mixtures of:

- C_3H_8 and purified synthetic air (4.5.1),
- CO and purified nitrogen,
- CO_2 and purified nitrogen,
- NO and purified nitrogen.

(The amount of NO_2 contained in this calibration gas must not exceed 5 % of the NO content.)

The true concentration of a calibration gas must be within ± 2 % of the stated figure.

The concentrations specified in Appendix 6 may also be obtained by means of a gas divider, diluting with purified N_2 or with purified synthetic air. The accuracy of the mixing device must be such that the concentrations of the diluted calibration gases may be determined to within ± 2 %.

4.6. Additional equipment

4.6.1. *Temperatures*

The temperatures indicated in Appendix 8 are measured with an accuracy of ± 1,5 °C.

4.6.2. *Pressure*

The atmospheric pressure must be measurable to within ± 0,1 kPa.

4.6.3. *Absolute humidity*

The absolute humidity (H) must be measurable to within ± 5 %.

4.7. The exhaust gas-sampling system must be verified by the method described in 3 of Appendix 7. The maximum permissible deviation between the quantity of gas introduced and the quantity of gas measured is 5 %.

5. PREPARING THE TEST

5.1. Adjustment of inertia simulators to the vehicle's translatory inertias

An inertia simulator is used enabling a total inertia of the rotating masses to be obtained proportional to the reference mass within the following limits:

Reference mass of vehicle RW (kg)	Equivalent inertias I (kg)
RW ≤ 750	680
750 < RW ≤ 850	800
850 < RW ≤ 1 020	910
1 020 < RW ≤ 1 250	1 130
1 250 < RW ≤ 1 470	1 360
1 470 < RW ≤ 1 700	1 590
1 700 < RW ≤ 1 930	1 810
1 930 < RW ≤ 2 150	2 040
2 150 < RW ≤ 2 380	2 270
2 380 < RW ≤ 2 610	2 270
2 610 < RW	2 270

5.2. Setting of dynamometer

The load is adjusted according to methods described in 4.1.4.

The method used and the values obtained (equivalent inertia — characteristic adjustment parameter) must be recorded in the test report.

5.3. Conditioning of vehicle

5.3.1. Before the test, the vehicle must be kept in a room in which the temperature remains relatively constant between 20 and 30 °C. This conditioning must be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within ± 2 °C of the temperature of the room.

If the manufacturer so requests, the test must be carried out not later than 30 hours after the vehicle has been run at its normal temperature.

5.3.2. The tyre pressures must be the same as that specified by the manufacturer and used for the preliminary road test for brake adjustment. The tyre pressures may be increased by up to 50 % from the manufacturer's recommended setting in the case of a two-roller dynamometer. The actual pressure used must be recorded in the test report.

6. PROCEDURE FOR BENCH TESTS

6.1. Special conditions for carrying out the cycle

6.1.1. During the test, the test cell temperature must be between 20 and 30 °C. The absolute humidity (H) of either the air in the test cell or the intake air of the engine must be such that:

$$5{,}5 \leq H \leq 12{,}2 \text{ g } H_2O/\text{kg dry air}$$

6.1.2. The vehicle must be approximately horizontal during the test so as to avoid any abnormal distribution of the fuel.

6.1.3. The test must be carried out with the bonnet raised unless this is technically impossible. An auxiliary ventilating device acting on the radiator (water-cooling) or on the air intake (air-cooling) may be used if necessary to keep the engine temperature normal.

6.1.4. During the test the speed is recorded against time so that the correctness of the cycles performed can be assessed.

6.2. Starting-up the engine

6.2.1. The engine must be started up by means of the devices provided for this purpose according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles.

6.2.2. The engine must be kept idling for a period of 40 seconds. The first cycle must begin at the end of the aforesaid period of 40 seconds at idle.

6.3. Idling

6.3.1. *Manual-shift or semi-automatic gearbox*

6.3.1.1. During periods of idling the clutch must be engaged and the gears in neutral.

6.3.1.2. To enable the accelerations to be performed according to the normal cycle the vehicle must be placed in first gear, with the clutch disengaged, five seconds before the acceleration following the idling period considered.

6.3.1.3. The first idling period at the beginning of the cycle consists of six seconds of idling in neutral with the clutch engaged and five seconds in first gear with the clutch disengaged.

6.3.1.4. For the idling periods during each cycle the corresponding times are 16 seconds in neutral and five seconds in first gear with the clutch disengaged.

6.3.1.5. The idling period between two successive cycles comprises 13 seconds in neutral with the clutch engaged.

6.3.2. *Automatic-shift gearbox*

After initial engagement the selector must not be operated at any time during the test except as in the case specified in 6.4.3.

6.4. Accelerations

6.4.1. Accelerations must be so performed that the rate of acceleration is as constant as possible throughout the phase.

6.4.2. If an acceleration cannot be carried out in the prescribed time, the extra time required is, if possible, deducted from the time allowed for changing gear, but otherwise from the subsequent steady-speed period.

6.4.3. *Automatic-shift gearboxes*

If an acceleration cannot be carried out in the prescribed time, the gear selector is operated in accordance with requirements for manual-shift gearboxes.

6.5. Deceleration

6.5.1. All decelerations are effected by removing the foot completely from the accelerator, the clutch remaining engaged. The clutch is disengaged, without use of the gear lever, at a speed of 10 km/h.

6.5.2. If the period of deceleration is longer than that prescribed for the corresponding phase, the vehicle's brakes are used to enable the timing of the cycle to be complied with.

6.5.3. If the period of deceleration is shorter than that prescribed for the corresponding phase, the timing of the theoretical cycle is restored by constant speed or idling period merging into the following operation.

6.5.4. At the end of the deceleration period (halt of the vehicle on the rollers) the gears are placed in neutral and the clutch engaged.

6.6. Steady speeds

6.6.1. 'Pumping' or the closing of the throttle must be avoided when passing from acceleration to the following steady speed.

6.6.2. Periods of constant speed are achieved by keeping the accelerator position fixed.

7. PROCEDURE FOR SAMPLING AND ANALYSIS

7.1. Sampling

Sampling begins at the beginning of the test cycle as defined in 6.2.2 and ends at the end of the idling period after the fourth cycle.

7.2. Analysis

7.2.1. The exhaust gases contained in the bag must be analyzed as soon as possible and in any event not later than 20 minutes after the end of the test cycle.

7.2.2. Prior to each sample analysis the analyzer range to be used for each pollutant must be set to zero with the appropriate zero gas.

7.2.3. The analyzers are then set to the calibration curves by means of span gases of nominal concentrations of 70 to 100 % of the range.

7.2.4. The analyzers' zeros are then rechecked. If the reading differs by more than 2 % of range from that set in 7.2.2, the procedure is repeated.

7.2.5. The samples are then analyzed.

7.2.6. After the analysis, zero and span points are rechecked using the same gases. If these rechecks are within 2 % of those in 7.2.3, the analysis is considered acceptable.

7.2.7. At all points in this section the flow-rates and pressures of the various gases must be the same as those used during calibration of the analyzers.

7.2.8. The figure adopted for the content of the gases in each of the pollutants measured is that read off after stabilization on the measuring device. Hydrocarbon mass emissions of compression-ignition engines are calculated from the integrated HFID reading, corrected for varying flow if necessary as shown in Appendix 5.

DETERMINATION OF THE QUANTITY OF GASEOUS POLLUTANTS EMITTED

8.1. The volume considered

The volume to be considered must be corrected to conform to the conditions of 101,33 kPa and 273,2 K.

8.2. Total mass of gaseous pollutants emitted

The mass M of each pollutant emitted by the vehicle during the test is determined by obtaining the product of the voluminal concentration and the volume of the gas in question, with due regard for the following densities at the abovementioned reference condition:

- in the case of carbon monoxide (CO) d = 1,25 grams per litre,
- in the case of hydrocarbons ($CH_{1,85}$) d = 0,619 grams per litre,
- in the case of nitrogen oxides (NO_2) d = 2,05 grams per litre.

Appendix 8 gives calculations relative to the various methods, followed by examples, to determine the quantity of gaseous pollutants emitted.

APPENDIX I

BREAKDOWN OF THE OPERATING CYCLE USED FOR THE TYPE I TEST

1. **Breakdown by phases**

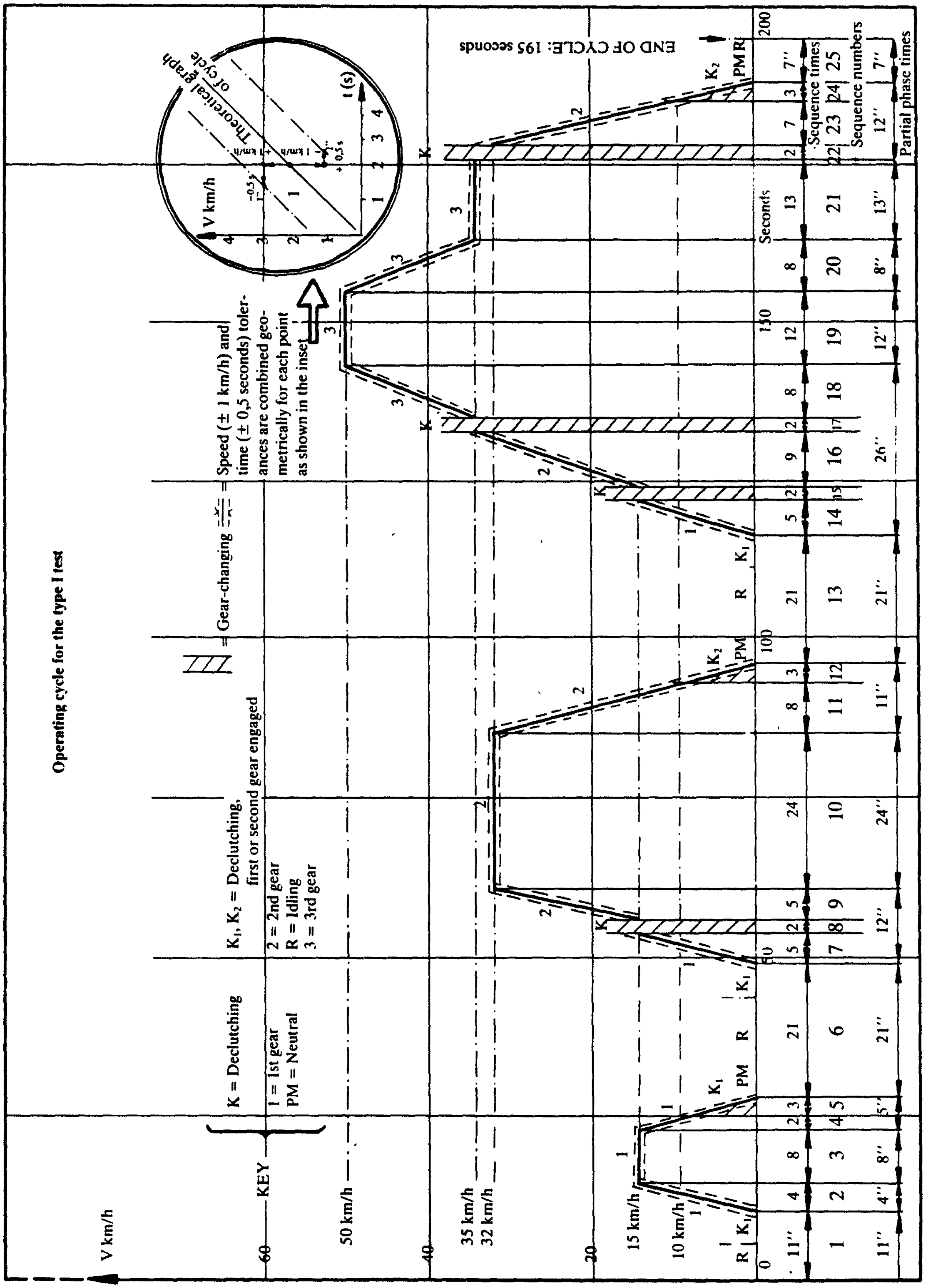
	Time	%	
Idling:	60 s	30,8	35,4
Idling, vehicle moving, clutch engaged on one combination:	9 s	4,6	
Gear-shift:	8 s		4,1
Accelerations:	36 s		18,5
Steady-speed periods:	57 s		29,2
Decelerations:	25 s		12,8
	195 s		100

2. **Breakdown by use of gears**

Idling:	60 s	30,8	35,4
Idling, vehicle moving, clutch engaged on one combination:	9 s	4,6	
Gear-shift:	8 s		4,1
First gear:	24 s		12,3
Second gear	53 s		27,2
Third gear:	41 s		21
	195 s		100

Average speed during test: 19 km/h.
Effective running time: 195 s.
Theoretical distance covered per cycle: 1,013 km.
Equivalent distance for the test (4 cycles): 4,052 km

Operating cycle for the type I test



Speed (± 1 km/h) and time (± 0,5 seconds) tolerances are combined geometrically for each point as shown in the inset

APPENDIX 2

CHASSIS DYNAMOMETER

1. DEFINITION OF A CHASSIS DYNAMOMETER WITH FIXED LOAD CURVE

1.1. Introduction

In the event that the total resistance to progress on the road cannot be reproduced on the chassis dynamometer between speeds of 10 and 50 km/h, it is recommended to use a chassis dynamometer having the characteristics defined below.

1.2. Definition

1.2.1. The chassis dynamometer may have one or two rollers.

The front roller drives, directly or indirectly, the inertia masses and the power absorption device.

1.2.2. Having set the load at 50 km/h by one of the methods described in 3, K can be determined from $P = KV^3$.

The power absorbed (P_a) by the brake and the chassis internal frictional effects from the reference setting to a vehicle speed of 50 km/h, are as follows:

If V > 12 km/h:

$$P_a = KV^3 \pm 5\,\%\,KV^3 \pm 5\,\%\,PV_{50}$$

(without being negative).

If V ≤ 12 km/h:

P_a will be between 0 and $P_a = KV_{12}^3 + 5\,\%\,KV_{12}^3 + 5\,\%\,PV_{50}$ where K is a characteristic of the chassis dynamometer and PV_{50} is the power absorbed at 50 km/h.

2. METHOD OF CALIBRATING THE DYNAMOMETER

2.1. Introduction

This Appendix describes the method to be used to determine the power absorbed by a dynamometric brake.

The power absorbed comprises the power absorbed by frictional effects and the power absorbed by the power-absorption device. The dynamometer is brought into operation beyond the range of test speeds. The device used for starting up the dynamometer is then disconnected: the rotational speed of the driven roller decreases.

The kinetic energy of rollers is dissipated by the power-absorption unit and by the frictional effects. This method disregards variations in the roller's internal frictional effects caused by rollers with or without the vehicle. The frictional effects of the rear roller shall be disregarded when this is free.

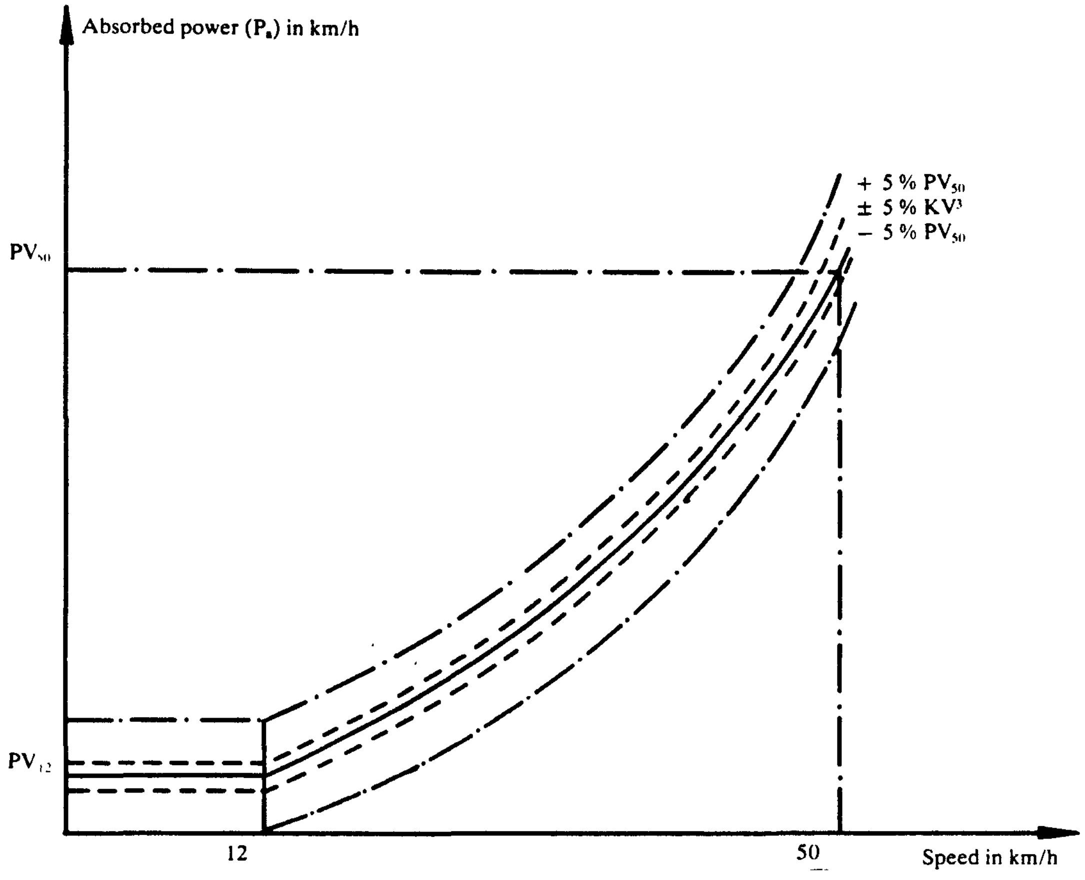
2.2. Calibrating the power indicator to 50 km/h as a function of the power absorbed

The following procedure is used.

2.2.1. Measure the rotational speed of the roller if this has not already been done. A fifth wheel, a revolution counter or some other method may be used.

2.2.2. Place the vehicle on the dynamometer or devise some other method of starting up the dynamometer.

2.2.3. Use the fly-wheel or any other system of inertia simulation for the particular inertia class to be used.



2.2.4. Bring the dynamometer to a speed of 50 km/h.

2.2.5. Note the power indicated (Pi).

2.2.6. Bring the dynamometer to a speed of 60 km/h.

2.2.7. Disconnect the device used to start up the dynamometer.

2.2.8. Note the time taken by the dynamometer to pass from a speed of 55 km/h to a speed of 45 km/h.

2.2.9. Set the power-absorption device at a different level.

2.2.10. The requirements of 2.2.4 to 2.2.9 must be repeated sufficiently often to cover the range of road powers used.

2.2.11. Calculate the power absorbed, using the formula:

$$P_a = \frac{M_1 (V_1^2 - V_2^2)}{2\,000\ t}$$

where

P_a = power absorbed in kW,

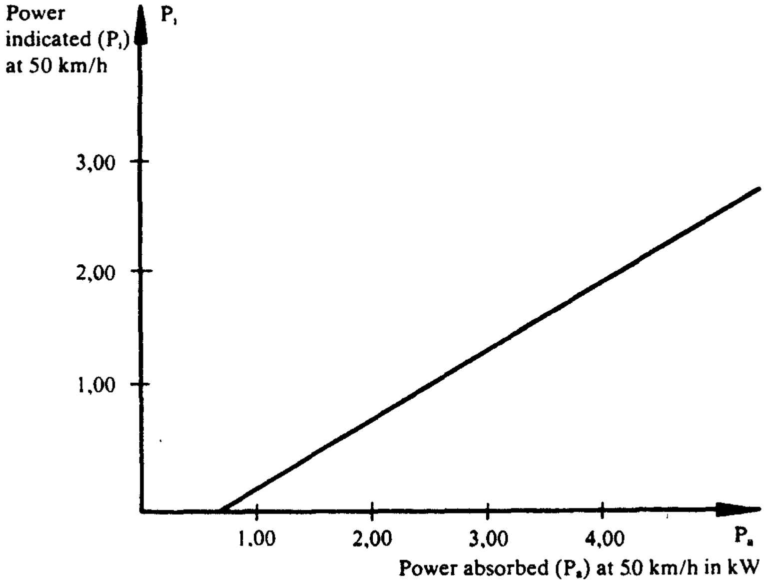
M_J = equivalent inertia in kg (exluding the inertial effects of the free rear roller),

V_1 = initial speed in m/s (55 km/h = 15,28 m/s),

V_2 = final speed in m/s (45 km/h = 12,50 m/s),

t = time taken by the roller to pass from 55 to 45 km/h.

2.2.12. Diagram showing power indicated at 50 km/h in terms of power absorbed at 50 km/h.



2.2.13. The operations described in 2.2.3 to 2.2.12 must be repeated for all inertia classes to be used.

2.3. Calibration of the power indicator as a function of the absorbed power for other speeds

The procedures described in 2.2 must be repeated as often as necessary for the chosen speeds.

2.4. Verification of the power-absorption curve of the dynamometer from a reference setting at a speed of 50 km/h

2.4.1. Place the vehicle on the dynamometer or devise some other method of starting up the dynamometer.

2.4.2. Adjust the dynamometer to the absorbed power (P_a) at 50 km/h.

2.4.3. Note the power absorbed at 40 — 30 — 20 km/h.

2.4.4. Draw the curve $P_a(V)$ and verify that it corresponds to the requirements of 1.2.2.

2.4.5. Repeat the procedure set out in 2.4.1 to 2.4.4 for other values of power P_a at 50 km/h and for other values of inertias.

2.5. The same procedure must be used for force or torque calibration.

3. SETTING OF THE DYNAMOMETER

3.1. Vacuum method

3.1.1. *Introduction*

This method is not a preferred method and must be used only with fixed load curve shape dynamometers for determination of load setting at 50 km/h and cannot be used for vehicles with compression-ignition engines.

3.1.2. *Test instrumentation*

The vacuum (or absolute pressure) in the intake manifold vehicle is measured to an accuracy of ± 0,25 kPa. It must be possible to record this reading continuously or at intervals of no more than one second. The speed must be recorded continuously with a precision of ± 0,4 km/h.

3.1.3. *Road test*

3.1.3.1. Ensure that the requirements of 4 of Appendix 3 are met.

3.1.3.2. Drive the vehicle at a steady speed of 50 km/h recording speed and vacuum (or absolute pressure) in accordance with the requirements of 3.1.2.

3.1.3.3. Repeat procedure set out in 3.1.3.2 three times in each direction. All six runs must be completed within four hours.

3.1.4. *Data reduction and acceptance criteria*

3.1.4.1. Review results obtained in accordance with 3.1.3.2 and 3.1.3.3 (speed must not be lower than 49,5 km/h or greater than 50,5 km/h for more than one second). For each run, read vacuum level at one-second intervals, calculate mean vacuum $(\bar{v})$ and standard deviation (s). This calculation must consist of no less than 10 readings of vacuum.

3.1.4.2. The standard deviation must not exceed 10 % of mean $(\bar{v})$ for each run.

3.1.4.3. Calculate the mean value $(\bar{v})$ for the six runs (three runs in each direction).

3.1.5. *Dynamometer setting*

3.1.5.1. Preparation

Perform the operations specified in 5.1.2.2.1 to 5.1.2.2.4 of Appendix 3.

3.1.5.2. Setting

After warm-up, drive the vehicle at a steady speed of 50 km/h and adjust dynamometer load to reproduce the vacuum reading $(\bar{v})$ obtained in accordance with 3.1.4.3. Deviation from this reading must be no greater than 0,25 kPa. The same instruments are used for this exercise as were used during the road test.

3.2. **Other setting methods**

The dynamometer setting may be carried out at a constant speed of 50 km/h in accordance with the requirements of Appendix 3.

3.3. **Alternative method**

With the manufacturer's agreement the following method may be used:

3.3.1. The brake is adjusted so as to absorb the power exerted at the driving wheels at a constant speed of 50 km/h in accordance with the following table:

Reference mass of vehicle: RW (kg)	Power absorbed by the dynamometer: P_a (kW)
RW ≤ 750	1,3
750 < RW ≤ 850	1,4
850 < RW ≤ 1 020	1,5
1 020 < RW ≤ 1 250	1,7
1 250 < RW ≤ 1 470	1,8
1 470 < RW ≤ 1 700	2,0
1 700 < RW ≤ 1 930	2,1
1 930 < RW ≤ 2 150	2,3
2 150 < RW ≤ 2 380	2,4
2 380 < RW ≤ 2 610	2,6
2 610 < RW	2,7

3.3.2. In the case of vehicles, other than passenger cars, with a reference mass of more than 1 700 kg, or vehicles whose wheels are all driven, the power values given in the table set out in 3.3.1 are multiplied by the factor 1,3.

APPENDIX 3

RESISTANCE TO PROGRESS OF A VEHICLE — MEASUREMENT METHOD ON THE ROAD — SIMULATION ON A CHASSIS DYNAMOMETER

1. OBJECT OF THE METHODS

The object of the methods defined below is to measure the resistance to progress of a vehicle at stabilized speeds on the road and to simulate this resistance on a dynamometer, in accordance with 4.1.4.1 of Annex III.

2. DEFINITION OF THE ROAD

The road must be level and sufficiently long to enable the measurements specified below to be made. The slope must be constant to within ± 0,1 % and must not exceed 1,5 %.

3. ATMOSPHERIC CONDITIONS

3.1. **Wind**

Testing must be limited to wind speeds averaging less than 3 m/s with peak speeds less than 5 m/s. In addition, the vector component of the wind speed across the test road must be less than 2 m/s. Wind velocity must be measured 0,7 m above the road surface.

3.2. **Humidity**

The road must be dry.

3.3. **Pressure — Temperature**

Air density at the time of the test must not deviate by more than ± 7,5 % from the reference conditions, p = 100 kPa and T = 293,2 K.

4. VEHICLE PREPARATION

4.1. **Running in**

The vehicle must be in normal running order and adjustment after having been run-in for at least 3 000 km. The tyres must be run in at the same time as the vehicle or have a tread depth within 90 and 50 % of the initial tread depth.

4.2. **Verifications**

The following checks must be made in accordance with the manufacturer's specifications for the use considered:

- wheels, wheel trims, tyres (make, type, pressure),
- front axle geometry,
- brake adjustment (elimination of parasitic drag),
- lubrication of front and rear axles,
- adjustment of the suspension and vehicle level, etc.

4.3. **Preparation for the test**

4.3.1. The vehicle is loaded to its reference mass. The level of the vehicle must be that obtained when the centre of gravity of the load is situated midway between the 'R' points of the front outer seats and on a straight line passing through those points.

4.3.2. In the case of road tests, the windows of the vehicle must be closed. Any covers of air climatization systems, headlamps, etc., must be in the non-operating position.

4.3.3. The vehicle must be clean.

4.3.4. Immediately prior to the test the vehicle is brought to normal running temperature in an appropriate manner.

5. METHODS

5.1. **Method of energy variation during coast-down**

5.1.1. *On the road*

5.1.1.1. Test equipment and error

- Time must be measured to an error lower than 0,1 s.
- Speed must be measured to an error lower than 2 %.

5.1.1.2. Test procedure

5.1.1.2.1. Accelerate the vehicle to a speed 10 km/h greater than the chosen test speed V.

5.1.1.2.2. Place the gearbox in 'neutral' position

5.1.1.2.3. Measure the time taken for the vehicle to decelerate from

$$V_2 = V + \Delta V \text{ km/h to } V_1 = V - \Delta V \text{ km/h} : t_1 \cdot \Delta V \leq 5 \text{ km/h}$$

5.1.1.2.4. Perform the same test in the opposite direction: t_2.

5.1.1.2.5. Take the average T_1 of the two times t_1 and t_2.

5.1.1.2.6. Repeat these tests several times such that the statistical accuracy (p) of the average

$$T = \frac{1}{n} \cdot \sum_{i=1}^{n} Ti \text{ is no more than } 2\,\% \; (p \leq 2\,\%)$$

The statistical accuracy (p) is defined by:

$$p = \frac{ts}{\sqrt{n}} \cdot \frac{100}{T}$$

where:

t = coefficient given by the table below,

s = standard deviation,

n = number of tests. $s = \sqrt{\sum_{i=1}^{n} \frac{(Ti - T)^2}{n - 1}}$

n	4	5	6	7	8	9	10	11	12	13	14	15
t	3,2	2,8	2,6	2,5	2,4	2,3	2,3	2,2	2,2	2,2	2,2	2,2
$\frac{t}{\sqrt{n}}$	1,6	1,25	1,06	0,94	0,85	0,77	0,73	0,66	0,64	0,61	0,59	0,57

5.1.1.2.7. Calculate the power by the formula:

$$P = \frac{M \cdot V \cdot \Delta V}{500\, T}$$

where:

P is expressed in kW,

V = speed of the test in m/s,

Δ V = speed deviation from speed V, in m/s,

M = reference mass in kg,

T = time in seconds.

5.1.2. *On the dynamometer*

5.1.2.1. Measurement equipment and accuracy

The equipment must be identical to that used on the road.

5.1.2.2. Test procedure

5.1.2.2.1. Install the vehicle on the test dynamometer.

5.1.2.2.2. Adjust the tyre pressure (cold) of the driving wheels as required by the dynamometer.

5.1.2.2.3. Adjust the equivalent inertia of the dynamometer.

5.1.2.2.4. Bring the vehicle and dynamometer to operating temperature in a suitable manner.

5.1.2.2.5. Carry out the operations specified in 5.1.1.2 with the exception of 5.1.1.2.4 and 5.1.1.2.5 and with replacing M by I in the formula set out in 5.1.1.2.7.

5.1.2.2.6. Adjust the brake to meet the requirements of 4.1.4.1. of Annex III.

5.2. **Torque measurement method at constant speed**

5.2.1. *On the road*

5.2.1.1. Measurement equipment and error

Torque measurement must be carried out with an appropriate measuring device accurate to within 2 %.

Speed measurement must be accurate to within 2 %.

5.2.1.2. Test procedure

5.2.1.2.1. Bring the vehicle to the chosen stabilized speed V.

5.2.1.2.2. Record the torque C(t) and speed over a period of a least 10 s by means of class 1 000 instrumentation meeting ISO standard No 970.

5.2.1.2.3. Differences in torque C(t) and speed relative to time must not exceed 5 % for each second of the measurement period.

5.2.1.2.4. The torque C_{t_1} is the average torque derived from the following formula:

$$C_{t_1} = \frac{1}{\Delta t} \int_{t}^{t+\Delta t} C(t)dt$$

5.2.1.2.5. Carry out the test in the opposite direction, i.e. C_{t_2}.

5.2.1.2.6. Determine the average of these two torques C_{t_1} and C_{t_2} i.e. C_t.

5.2.2. *On the dynamometer*

5.2.2.1. Measurement equipment and error

The equipment must be identical to that used on the road.

5.2.2.2. Test procedure

5.2.2.2.1. Perform the operations specified in 5.1.2.2.1 to 5.1.2.2.4.

5.2.2.2.2. Perform the operations specified in 5.2.1.2.1 to 5.2.1.2.4.

5.2.2.2.3. Adjust the brake setting to meet the requirements of 4.1.4.1 of Annex III.

5.3. **Integrated torque over variable driving pattern**

5.3.1. This method is a non-obligatory complement to the constant speed method described in 5.2.

5.3.2. In this dynamic procedure the mean torque value $\overline{M}$ is determined. This is accomplished by integrating the actual torque values with respect to time during operation of the test vehicle with a defined driving cycle. The integrated torque is then divided by the time difference.

The result is:

$$\overline{M} = \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} M(t) \cdot dt \text{ (with } M(t) > 0)$$

$\overline{M}$ is calculated from six sets of results.

It is recommended that the sampling rate of $\overline{M}$ be not less than two samples per second.

5.3.3. *Dynamometer setting*

The dynamometer load is set by the method described in 5.2. If $\overline{M}$ dynamometer does not then match $\overline{M}$ road, the brake setting is adjusted until the values are equal within ± 5 %.

Note:

This method can be used only for dynamometers with electrical inertia simulation or fine adjustment.

5.3.4. *Acceptance criteria*

Standard deviation of six measurements must be no more than 2 % of the mean value.

5.4. Method of deceleration measurement by gyroscopic platform

5.4.1. *On the road*

5.4.1.1. Measurement equipment and error

- Speed must be measured with an error lower than 2 %.
- Deceleration must be measured with an error lower than 1 %.
- The slope of the road must be measured with an error lower than 1 %.
- Time must be measured with an error lower than 0,1 s.

The level of the vehicle is measured on a reference horizontal ground; as an alternative, it is possible to correct for the slope of the road (α_1).

5.4.1.2. Test procedure

5.4.1.2.1. Accelerate the vehicle to a speed 5 km/h greater than the chosen test speed: V.

5.4.1.2.2. Record the deceleration between V + 0,5 km/h and V − 0,5 km/h.

5.4.1.2.3. Calculate the average deceleration attributed to the speed V by the formula:

$$\bar{\gamma}_1 = \frac{1}{t} \int_0^t \gamma_1 (t)\, dt - g \cdot \sin \alpha_1$$

where:

$\bar{\gamma}_1$ = average deceleration value at the speed V in one direction of the road,

t = time between V + 0,5 km/h and V − 0,5 km/h,

$\gamma_1 (t)$ = deceleration recorded with the time,

g = 9,81 m s^{-2}.

5.4.1.2.4. Perform the same test in the other direction: $\bar{\gamma}_2$.

5.4.1.2.5. Calculate the average of $\Gamma_i = \frac{\bar{\gamma}_1 + \bar{\gamma}_2}{2}$ for test i.

5.4.1.2.6. Perform a sufficient number of tests as specified in 5.1.1.2.6 replacing T by Γ where:

$$\Gamma = \frac{1}{n} \sum_{1 = i}^{n} \Gamma_i$$

5.4.1.2.7. Calculate the average force absorbed F = M · Γ

where:

M = vehicle reference mass in kg,

Γ = average deceleration calculated beforehand.

5.4.2. *Dynamometer method*

5.4.2.1. Measurement equipment and error

The measurement instrumentation of the dynamometer itself must be used as defined in 2 of Appendix 2 to this Annex.

5.4.2.2. Test procedure

5.4.2.2.1. Adjustment of the force on the rim under steady speed

On chassis dynamometer, the total resistance is of the type:

$(F_{total}) = (F_{indicated}) + (F_{driving\ axle\ rolling})$, with

$(F_{total}) = (F_{road})$,

$(F_{indicated}) = (F_{road}) - (F_{driving\ axle\ rolling})$,

where:

$(F_{indicated})$ is the force indicated on the force indicating device of the chassis dynamometer,

(F_{road}) is known,

$(F_{driving\ axle\ rolling})$ can be:

— measured on chassis dynamometer able to work as a motor.

The test vehicle, gearbox in neutral position, is driven by the chassis dynamometer at the test speed; the rolling resistance of the driving axle is then measured on the force indicating device of the chassis dynamometer;

— determined on chassis dynamometer unable to work as a motor.

For the two-roller chassis dynamometer, the R_R value is the one which is determined before on the road.

For the single-roller chassis dynamometer, the R_R value is the one which is determined on the road multiplied by a coefficient (R) which is equal to the ratio between the driving axle mass and the vehicle total mass.

Note

R_R is obtained from the curve: $F = f(V)$.

APPENDIX 4

VERIFICATION OF INERTIAS OTHER THAN MECHANICAL

1. OBJECT

The method described in this Appendix makes it possible to check that the simulated total inertia of the dynamometer is carried out satisfactorily in the running phases of the operating cycle.

2. PRINCIPLE

2.1. Drawing up working equations

Since the dynamometer is subjected to variations in the rotating speed of the roller(s), the force at the surface of the roller(s) can be expressed by the formula:

$$F = I \cdot \gamma = I_M \cdot \gamma + F_I$$

where:

F = force at the surface of the roller(s),

I = total inertia of the dynamometer (equivalent inertia of the vehicle: cf. table in 5.1),

I_M = inertia of the mechanical masses of the dynamometer,

γ = tangential acceleration at roller surface,

F_I = inertia force.

Note:

An explanation of this formula with reference to dynamometers with mechanically simulated inertias is appended.

Thus, the total inertia is expressed as follows:

$$I = I_M + \frac{F_I}{\gamma}$$

where:

I_M can be calculated or measured by traditional methods,

F_I can be measured on the dynamometer,

γ can be calculated from the peripheral speed of the rollers.

The total inertia (I) is determined during an acceleration or deceleration test with values higher than or equal to those obtained on an operating cycle.

2.2. Specification for the calculation of total inertia

The test and calculation methods must make it possible to determine the total inertia I with a relative error ($\Delta I/I$) of less than 2 %.

3. SPECIFICATION

3.1. The mass of the simulated total inertia I must remain the same as the theoretical value of the equivalent inertia (see 5.1 of Annex III) within the following limits:

3.1.1. ± 5 % of the theoretical value for each instantaneous value;

3.1.2. ±2 % of the theoretical value for the average value calculated for each sequence of the cycle.

3.2. The limit given in 3.1.1 is brought to ±50 % for one second when starting and, for vehicles with manual transmission, for two seconds during gear changes.

4. VERIFICATION PROCEDURE

4.1. Verification is carried out during each test throughout the cycle defined in 2.1 of Annex III.

4.2. However, if the requirements of 3 are met, with instantaneous accelerations which are at least three times greater or smaller than the values obtained in the sequences of the theoretical cycle, the verification described above is not necessary.

5. TECHNICAL NOTE

Explanation of drawing-up working equations.

5.1. Equilibrium of the forces on the road:

$$CR = k_1 \, Jr_1 \frac{d\Theta 1}{dt} + k_2 \, Jr_2 \frac{d\Theta 2}{dt} + k_3 \, M \, \gamma r_1 + k_3 \, F_s \, r_1$$

5.2. Equilibrium of the forces on dynamometer with mechanically simulated inertias:

$$\begin{aligned} Cm &= k_1 \, Jr_1 \frac{d\Theta 1}{dt} + k_3 \frac{JRm \dfrac{dWm}{dt}}{Rm} r_1 + k_3 F_s r_1 \\ &= k_1 \, Jr_1 \frac{d\Theta 1}{dt} + k_3 \, I \, \gamma r_1 + k_3 \, F_s \, r_1 \end{aligned}$$

5.3. Equilibrium of the forces of dynamometer with non-mechanically simulated inertias:

$$\begin{aligned} Ce &= k_1 \, Jr_1 \frac{d\Theta 1}{dt} + k_3 \left(\frac{JRe \dfrac{dWe}{dt}}{Re} r_1 + \frac{C_1}{Re} r_1 \right) + k_3 F_s r_1 \\ &= k_1 \, Jr_1 \frac{d\Theta 1}{dt} + k_3 \, (I_M \gamma + F_1) \, r_1 + k_3 \, F_s \, r_1 \end{aligned}$$

In these formulae:

CR = engine torque on the road,

Cm = engine torque on the dynamometer with mechanically simulated inertias,

Ce = engine torque on the dynamometer with electrically simulated inertias,

Jr_1 = moment of inertia of the vehicle transmission brought back to the driving wheels,

Jr_2 = moment of inertia of the non-driving wheels,

JRm = moment of inertia of the dynamometer with mechanically simulated inertias,

JRe = moment of mechanical inertia of the dynamometer with electrically simulated inertias,

M = mass of the vehicle on the road,

I = equivalent inertia of the dynamometer with mechanically simulated inertias,

I_M = mechanical inertia of the dynamometer with electrically simulated inertias,

F_v = resultant force at stabilized speed,

C_I = resultant torque from electrically simulated inertias,

F_I = resultant force from electrically simulated inertias,

$\frac{d\Theta 1}{dt}$ = angular acceleration of the driving wheels,

$\frac{d\Theta 2}{dt}$ = angular acceleration of the non-driving wheels,

$\frac{dWm}{dt}$ = angular acceleration of the mechanical dynamometer,

$\frac{dWe}{dt}$ = angular acceleration of the electrical dynamometer,

γ = linear acceleration,

r_1 = radius under load of the driving wheels,

r_2 = radius under load of the non-driving wheels,

Rm = radius of the rollers of the mechanical dynamometer,

Re = radius of the rollers of the electrical dynamometer,

k_1 = coefficient dependent on the gear reduction ratio and the various inertias of transmission and 'efficiency',

k_2 = ratio transmission X $\frac{r_1}{r_2}$ X 'efficiency',

k_3 = ratio transmission X 'efficiency'.

Supposing the two types of dynamometer (5.2 and 5.3) are made equal and simplified, one obtains:

$$k_3 (I_M \cdot \gamma + F_I) r_1 = k_3 I \cdot \gamma \cdot r_1$$

hence,

$$I = I_M + \frac{F_I}{\gamma}$$

APPENDIX 5

DEFINITION OF GAS-SAMPLING SYSTEMS

1. INTRODUCTION

1.1. There are several types of sampling devices capable of meeting the requirements set out in 4.2 of Annex III.

The devices described in 3.1, 3.2 and 3.3 will be deemed acceptable if they satisfy the main criteria relating to the variable dilution principle.

1.2. In its communications, the laboratory must mention the system of sampling used when performing the test.

2. CRITERIA RELATING TO THE VARIABLE-DILUTION SYSTEM FOR MEASURING EXHAUST-GAS EMISSIONS

2.1. Scope

This section specifies the operating characteristics of an exhaust-gas sampling system intended to be used for measuring the true mass emissions of a vehicle exhaust in accordance with the provisions of this Directive. The principle of variable-dilution sampling for measuring mass emissions requires three conditions to be satisfied:

2.1.1. the vehicle exhaust gases must be continuously diluted with ambient air under specified conditions;

2.1.2. the total volume of the mixture of exhaust gases and dilution air must be measured accurately;

2.1.3. a continuously proportional sample of the diluted exhaust gases and the dilution air must be collected for analysis.

Mass emissions are determined from the proportional sample concentrations and the total volume measured during the test. The sample concentrations are corrected to take account of the pollutant content of the ambient air.

2.2. **Technical summary**

Figure 1 gives a schematic diagram of the sampling system.

2.2.1. The vehicle exhaust gases must be diluted with a sufficient amount of ambient air to prevent any water condensation in the sampling and measuring system.

2.2.2. The exhaust-gas sampling system must make it possible to measure the average volume concentrations of the CO_2, CO, HC and NO_x contained in the exhaust gases emitted during the vehicle testing cycle.

2.2.3. The mixture of air and exhaust gases must be homogeneous at the point where the sampling probe is located (see 2.3.1.2).

2.2.4. The probe must extract a representative sample of the diluted exhaust gases.

2.2.5. The system must make it possible to measure the total volume of the diluted exhaust gases from the vehicle being tested.

2.2.6. The sampling system must be gas-tight. The design of the variable-dilution sampling system and the materials that go to make it up must be such that they do not affect the pollutant concentration in the diluted exhaust gases. Should any component in the system (heat exchanger, cyclone separator, blower, etc.) change the concentration of any of the pollutants in the diluted exhaust gases and the fault cannot be corrected, then sampling for that pollutant must be carried out before that component.

2.2.7. If the vehicle tested is equipped with an exhaust system comprising more than one tailpipe, the connecting tubes must be connected together by a manifold installed as near as possible to the vehicle.

2.2.8. The gas samples must be collected in sampling bags of adequate capacity so as not to hinder the gas flow during the sampling period. These bags must be made of such materials as will not affect the concentrations of pollutant gases (see 2.3.4.4).

2.2.9. The variable-dilution system must be so designed as to enable the exhaust gases to be sampled without appreciably changing the back-pressure at the exhaust pipe outlet (see 2.3.1.1).

2.3. Specific requirements

2.3.1. *Exhaust-gas collection and dilution device*

2.3.1.1. The connection tube between the vehicle exhaust tailpipe(s) and the mixing chamber must be as short as possible; it must in no case:

- cause the static pressure at the exhaust tailpipe(s) on the vehicle being tested to differ by more than ±0,75 kPa at 50 km/h or more than ± 1,25 kPa for the whole duration of the test from the static pressures recorded when nothing is connected to the vehicle tailpipes. The pressure must be measured in the exhaust tailpipe or in an extension having the same diameter, as near as possible to the end of the pipe,
- change the nature of the exhaust gas.

2.3.1.2. There must be a mixing chamber in which the vehicle exhaust gases and the dilution air are mixed so as to produce a homogeneous mixture at the chamber outlet.

The homogeneity of the mixture in any cross-section at the location of the sampling probe must not vary by more than ± 2 % from the average of the values obtained at at least five points located at equal intervals on the diameter of the gas stream. In order to minimize the effects on the conditions at the exhaust tailpipe and to limit the drop in pressure inside the dilution-air conditioning device, if any, the pressure inside the mixing chamber must not differ by more than ± 0,25 kPa from atmospheric pressure.

2.3.2. *Suction device/volume measuring device*

This device may have a range of fixed speeds as to ensure sufficient flow to prevent any water condensation. This result is generally obtained by keeping the concentration of CO_2 in the dilute exhaust-gas sampling bag lower than 3 % by volume.

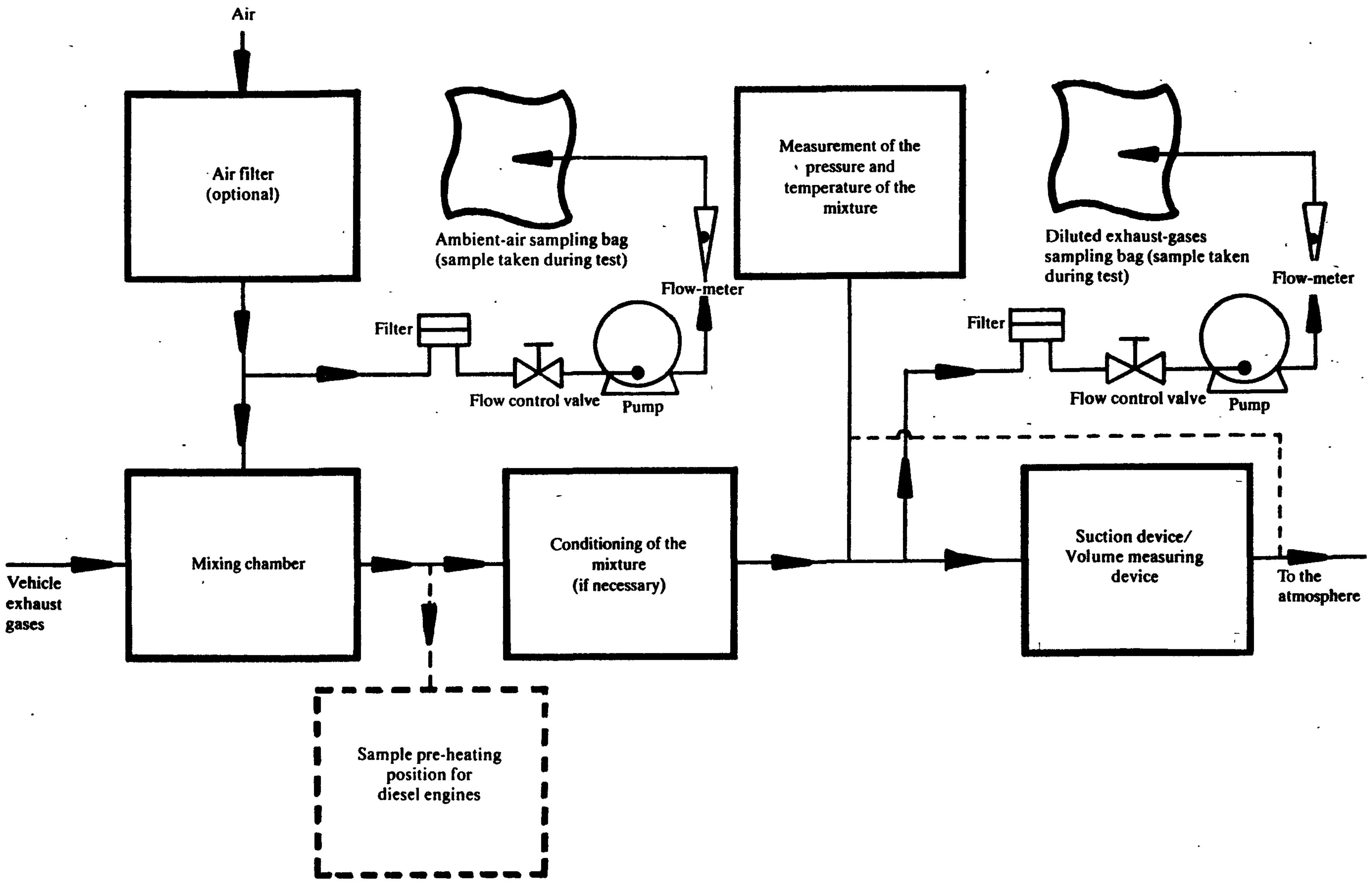
2.3.3. *Volume measurement*

2.3.3.1. The volume measuring device must retain its calibration accuracy to within ±2 % under all operating conditions. If the device cannot compensate for variations in the temperature of the mixture of exhaust gases and dilution air at the measuring point, a heat exchanger must be used to maintain the temperature to within ± 6 °C of the specified operating temperature.

If necessary, a cyclone separator can be used to protect the volume measuring device.

Figure 1

Diagram of a variable-dilution system for measuring exhaust-gas emissions



2.3.3.2. A temperature sensor must be installed immediately before the volume measuring device. This temperature sensor must have an accuracy and a precision of ± 1 °C and a response time of 0,1 s at 62 % of a given temperature variation (value measured in silicone oil).

2.3.3.3. The pressure measurements must have a precision and an accuracy of ± 0,4 kPa during the test.

2.3.3.4. The measurement of the pressure difference from atmospheric pressure is taken before and, if necessary, after the volume measuring device.

2.3.4. *Gas sampling*

2.3.4.1. Dilute exhaust gases

2.3.4.1.1. The sample of dilute exhaust gases is taken before the suction device but after the conditioning devices (if any).

2.3.4.1.2. The flow-rate must not deviate by more than ± 2 % from the average.

2.3.4.1.3. The sampling rate must not fall below 5 litres per minute and must not exceed 0,2 % of the flow-rate of the dilute exhaust gases.

2.3.4.1.4. An equivalent limit applies to constant-mass sampling systems.

2.3.4.2. Dilution air

2.3.4.2.1. A sample of the dilution air is taken at a constant flow-rate near the ambient air inlet (after the filter if one is fitted).

2.3.4.2.2. The air must not be contaminated by exhaust gases from the mixing area.

2.3.4.2.3. The sampling rate for the dilution air must be comparable to that used in the case of the dilute exhaust gases.

2.3.4.3. Sampling operations

2.3.4.3.1. The materials used for the sampling operations must be such that they do not change the pollutant concentration.

2.3.4.3.2. Filters may be used in order to extract the solid particles from the sample.

2.3.4.3.3. Pumps are required in order to convey the sample to the sampling bag(s).

2.3.4.3.4. Flow control valves and flow-meters are needed in order to obtain the flow-rates required for sampling.

2.3.4.3.5. Quick-fastening gas-tight connections may be used between the three-way valves and the sampling bags, the connections sealing themselves automatically on the bag side. Other systems may be used for conveying the samples to the analyzer (three-way stop valves, for example).

2.3.4.3.6. The various valves used for directing the sampling gases must be of the quick-adjusting and quick-acting type.

2.3.4.4. Storage of the sample

The gas samples are collected in sampling bags of adequate capacity so as not to reduce the sampling rate. The bags must be made of such a material as will not change the concentration of synthetic pollutant gases by more than ± 2 % after 20 minutes.

2.4. **Additional sampling apparatus for testing diesel-engined vehicles**

2.4.1. A sampling point after and close to the mixing chamber

2.4.2. Heated piping and sampling probe

2.4.3. Heated filter and/or pump (the latter may be located in the vicinity of the sample source)

2.4.4. A quick-acting connection for analyzing the sample of ambient air collected in the bag

2.4.5. All heated components must be kept at a temperature of 190 ± 10 °C by the heated system.

2.4.6. If it is not possible to compensate for variations in the flow-rate, there must be a heat exchanger and a temperature control device having the characteristics specified in 2.3.3.1 so as to ensure that the flow-rate in the system is constant and the sampling rate is accordingly proportional.

3. DESCRIPTION OF THE DEVICES

3.1. **Variable dilution device with positive displacement pump (PDP-CVS)** (Figure 1)

3.1.1. The positive displacement pump — constant volume sampler (PDP-CVS) satisfies the requirements of this Annex by metering at a constant temperature and pressure through the pump. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional sample is achieved by sampling with pump, flow-meter and flow control valve at a constant flow-rate.

3.1.2. Figure 1 is a schematic drawing of such a sampling system. Since various configurations can produce accurate results exact conformity with the drawing is not essential. Additional components such as instruments, valves, solenoids and switches may be used to provide additional information and coordinate the functions of the component system.

3.1.3. The collecting equipment consists of:

3.1.3.1. A filter (D) for the dilution air, which can be preheated if necessary. This filter must consist of activated charcoal sandwiched between two layers of paper, and shall be used to reduce and stabilize the hydrocarbon concentrations of ambient emissions in the dilution air.

3.1.3.2. A mixing chamber (M) in which exhaust gas and air are mixed homogeneously.

3.1.3.3. A heat exchanger (H) of a capacity sufficient to ensure that throughout the test the temperature of the air/exhaust-gas mixture measured at a point immediately upstream of the positive displacement pump is within ± 6 °C of the designed operating temperature. This device must not affect the pollutant concentrations of diluted gases taken off after for analysis.

3.1.3.4. A temperature control system (TC), used to preheat the heat exchanger before the test and to control its temperature during the test, so that deviations from the designed operating temperature are limited to ± 6 °C.

3.1.3.5. The positive displacement pump (PDP), used to transport a constant-volume flow of the air/exhaust-gas mixture; the flow capacity of the pump must be large enough to eliminate water condensation in the system under all operating conditions which may occur during a test; this can be generally ensured by using a positive displacement pump with a flow capacity:

3.1.3.5.1. — twice as high as the maximum flow of exhaust gas produced by accelerations of the driving cycle, or

3.1.3.5.2. — sufficient to ensure that the CO_2 concentration in the dilute-exhaust sample bag is less than 3 % by volume.

3.1.3.6. A temperature sensor (T_1) (accuracy and precision ± 1 °C), fitted at a point immediately upstream of the positive displacement pump; it must be designed to monitor continuously the temperature of diluted exhaust-gas mixture during the test.

3.1.3.7. A pressure gauge (G_1) (accuracy and precision ± 0,4 kPa) fitted immediately upstream of the volume meter and used to register the pressure gradient between the gas mixture and the ambient air.

3.1.3.8. Another pressure gauge (G_2) (accuracy and precision ± 0,4 kPa) fitted so that the differential pressure between pump inlet and pump outlet can be registered.

3.1.3.9. Two sampling outlets (S_1 and S_2) for taking constant samples of the dilution air and of the diluted exhaust-gas/air mixture.

3.1.3.10. A filter (F), to extract solid particles from the flows of gas collected for analysis.

3.1.3.11. Pumps (P), to collect a constant flow of the dilution air as well as of the diluted exhaust-gas/air mixture during the test.

3.1.3.12. Flow controllers (N), to ensure a constant uniform flow of the gas samples taken during the course of the test from sampling probes S_1 and S_2; and flow of the gas samples must be such that, at the end of each test, the quantity of the samples is sufficient for analysis (~ 10 litres per minute).

3.1.3.13. Flow meters (FL), for adjusting and monitoring the constant flow of gas samples during the test.

3.1.3.14. Quick-acting valves (V), to divert a constant flow of gas samples into the sampling bags or to the outside vent.

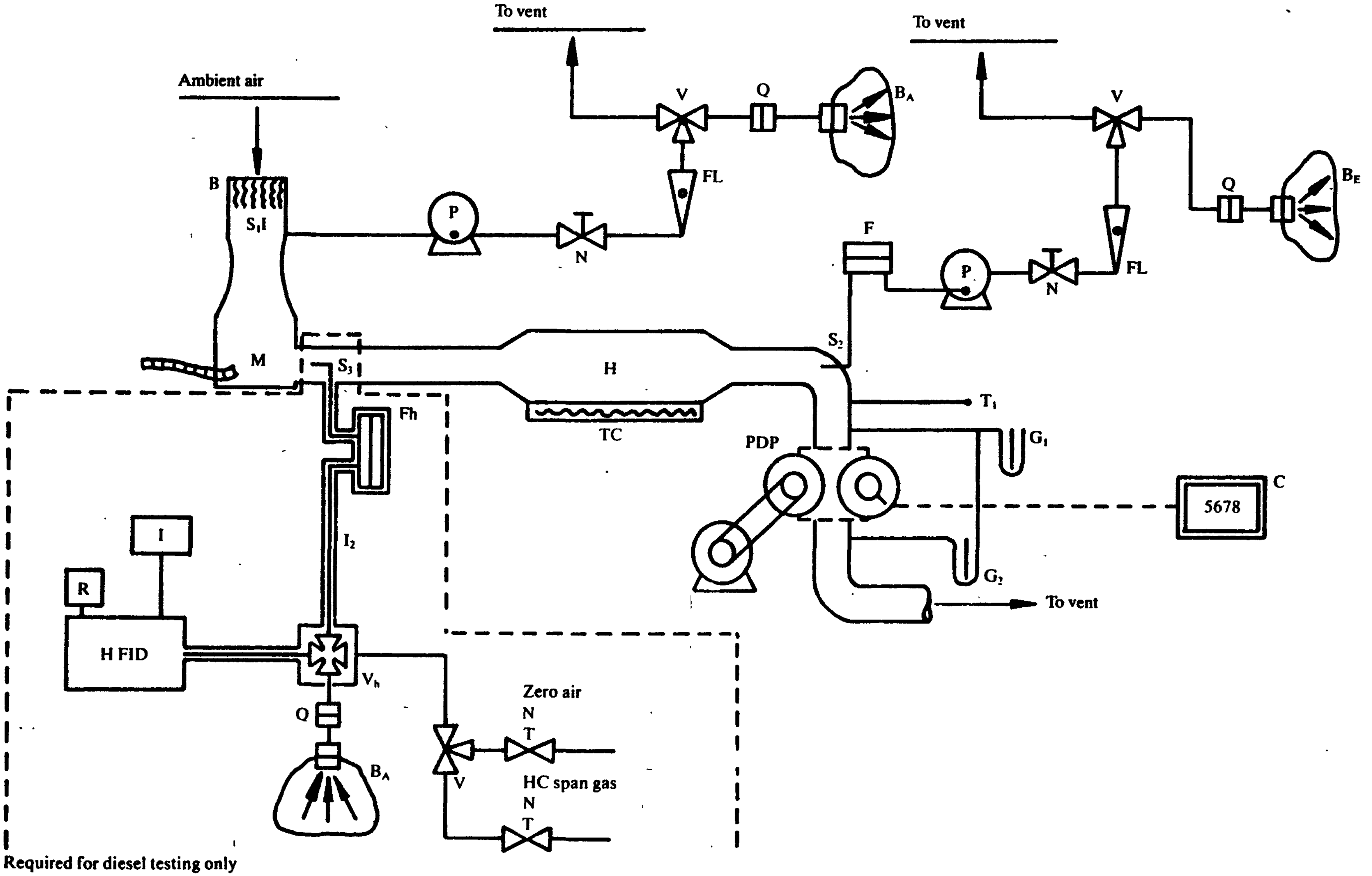
3.1.3.15. Gas-tight, quick-lock coupling elements (Q) between the quick-acting valves and the sampling bags; the coupling must close automatically on the sampling-bag side; as an alternative, other ways of transporting the samples to the analyzer may be used (three-way stopcocks, for instance).

3.1.3.16. Bags (B), for collecting samples of the diluted exhaust gas and of the dilution air during the test; they must be of sufficient capacity not to impede the sample flow; the bag material must be such as to affect neither the measurements themselves nor the chemical composition of the gas samples (for instance: laminated polyethylene/polyamide films, or fluorinated polyhydrocarbons).

3.1.3.17. A digital counter (C), to register the number of revolutions performed by the positive displacement pump during the test.

Figure 1

Constant volume sampler with positive displacement pump (PDP-CVS)



3.1.4. *Additional equipment required when testing diesel-engined vehicles*

To comply with the requirements of 4.3.1.1 and 4.3.2 of Annex III, the additional components within the dotted lines in Figure 1 must be used when testing diesel-engined vehicles:

Fh	is a heated filter,
S_3	is a sample point close to the mixing chamber,
V_h	is a heated multiway valve,
Q	is a quick connector to allow the ambient air sample BA to be analyzed on the HFID,
HFID	is a heated flame ionization analyzer,
R and I	are a means of integrating and recording the instantaneous hydrocarbon concentrations,
Lh	is a heated sample line.

All heated components must be maintained at 190 ± 10 °C.

3.2. **Critical-flow venturi dilution device (CFV-CVS)** (Figure 2)

3.2.1. Using a critical-flow venturi in connection with the CVS sampling procedure is based on the principles of flow mechanics for critical flow. The variable mixture flow rate of dilution and exhaust gas is maintained at sonic velocity which is directly proportional to the square root of the gas temperature. Flow is continually monitored, computed and integrated over the test.

If an additional critical-flow sampling venturi is used, the proportionality of the gas samples taken is ensured. As both pressure and temperature are equal at the two venturi inlets the volume of the gas flow diverted for sampling is proportional to the total volume of diluted exhaust-gas mixture produced, and thus the requirements of this Annex are met.

3.2.2. Figure 2 is a schematic drawing of such a sampling system. Since various configurations can produce accurate results, exact conformity with the drawing is not essential. Additional components such as instruments, valve, solenoids, and switches may be used to provide additional information and coordinate the functions of the component system.

3.2.3. The collecting equipment consists of:

3.2.3.1. A filter (D) for the dilution air, which can be preheated if necessary: the filter must consist of activated charcoal sandwiched between layers of paper, and must be used to reduce and stabilize the hydrocarbon background emission of the dilution air.

3.2.3.2. A mixing chamber (M), in which exhaust gas and air are mixed homogeneously.

3.2.3.3. A cyclone separater (CS), to extract particles.

3.2.3.4. Two sampling probes (S_1 and S_2), for taking samples of the dilution air as well as of the diluted exhaust gas.

3.2.3.5. A sampling critical flow venturi (SV), to take proportional samples of the diluted exhaust gas at sampling probe S_2.

3.2.3.6. A filter (F), to extract solid particles from the gas flows diverted for analysis.

3.2.3.7. Pumps (P), to collect part of the flow of air and diluted exhaust gas in bags during the test.

3.2.3.8. A flow controller (N), to ensure a constant flow of the gas samples taken in the course of the test from sampling probe S_1; the flow of the gas samples must be such that, at the end of the test, the quantity of the samples is sufficient for analysis (~ 10 litres per minute).

3.2.3.9. A snubber (PS), in the sampling line.

3.2.3.10. Flow meters (FL), for adjusting and monitoring the flow of gas samples during tests.

3.2.3.11. Quick-acting solenoid valves (V), to divert a constant flow of gas samples into the sampling bags or the vent.

3.2.3.12. Gas-tight, quick-lock coupling elements (Q), between the quick-acting valves and the sampling bags; the couplings must close automatically on the sampling-bag side; as an alternative, other ways of transporting the samples to the analyzer may be used (three-way stopcocks, for instance).

3.2.3.13. Bags (B), for collecting samples of the diluted exhaust gas and the dilution air during the tests; they must be of sufficient capacity not to impede the sample flow; the bag material must be such as to affect neither the measurements themselves nor the chemical composition of the gas samples (for instance: laminated polyethylene/polyamide films, or fluorinated polyhydrocarbons).

3.2.3.14. A pressure gauge (G), which is precise and accurate to within ±0,4 kPa.

3.2.3.15. A temperature sensor (T), which is precise and accurate to within ± 1 °C and have a response time of 0,1 seconds to 62 % of a temperature change (as measured in silicon oil).

3.2.3.16. A measuring critical flow venturi tube (MV), to measure the flow volume of the diluted exhaust gas.

3.2.3.17. A blower (BL), of sufficient capacity to handle the total volume of diluted exhaust gas.

3.2.3.18. The capacity of the CFV-CVS system must be such that under all operating conditions which may possibly occur during a test there will be no condensation of water. This is generally ensured by using a blower whose capacity is:

3.2.3.18.1. twice as high as the maximum flow of exhaust gas produced by accelerations of the driving cycle;

3.2.3.18.2. sufficient to ensure that the CO_2 concentration in the dilute exhaust sample bag is less than 3 % by volume.

3.2.4. *Additional equipment required when testing diesel-engined vehicles*

To comply with the requirements of 4.3.1.1 and 4.3.2 of Annex III, the additional components shown within the dotted lines of Figure 2 must be used when testing diesel-engined vehicles:

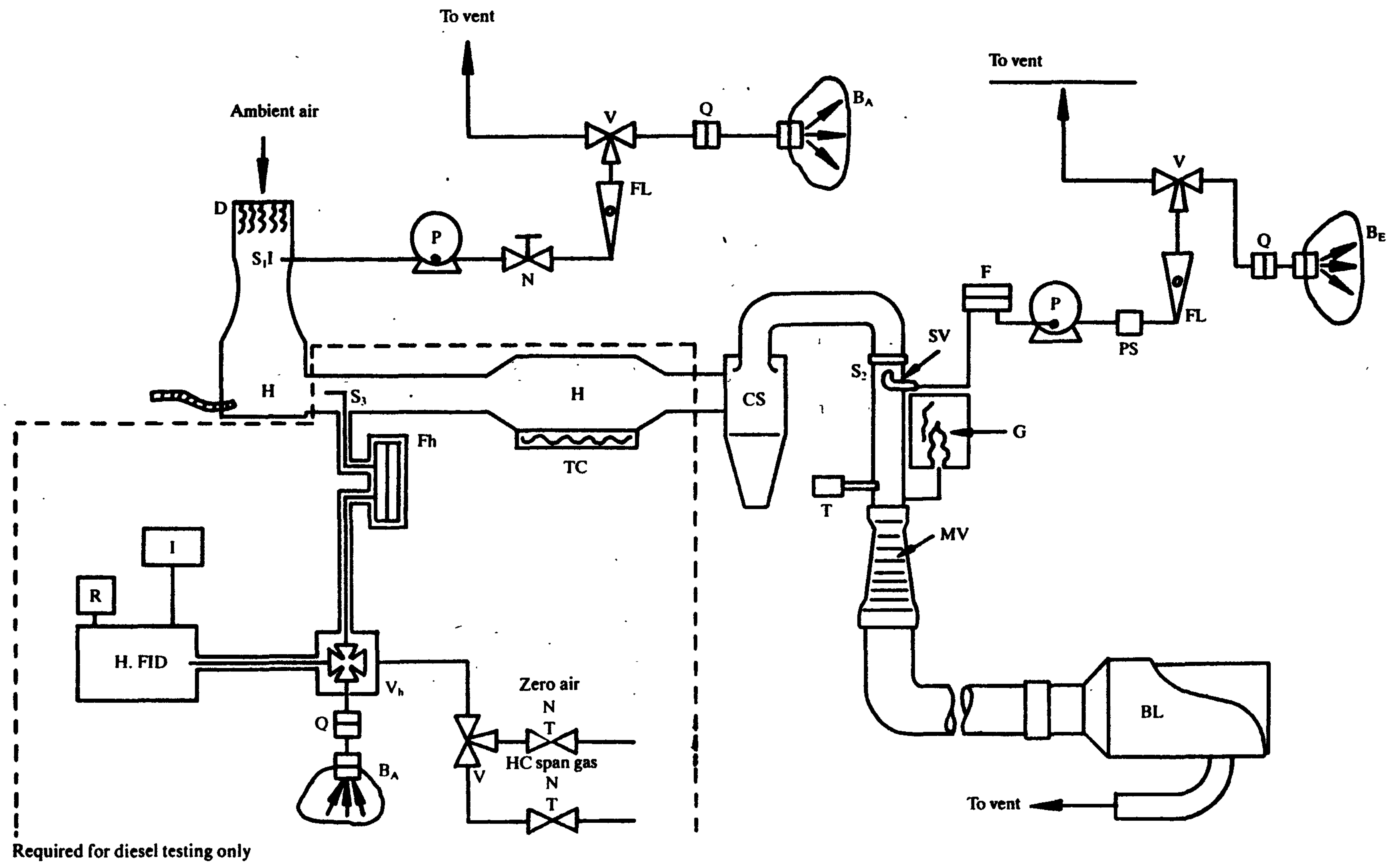
Fh	is a heated filter,
S_3	is a sample point close to the mixing chamber,
Vh	is a heated multiway valve,
Q	is a quick connector to allow the ambient air sample BA to be analyzed on the HFID,
HFID	is a heated flame ionization analyzer,
R and I	are a means of integrating and recording the instantaneous hydrocarbon concentrations,
Lh	is a heated sample line.

All heated components must be maintained at 190 ± 10 °C.

If compensation for varying flow is not possible, then a heat exchanger (H) and temperature control system (TC) as described in 2.2.3 will be required to ensure constant flow through the venturi (MV) and thus proportional flow through S_3.

Figure 2

Constant volume sampler with critical-flow venturi (CFV-CVS)



3.3. **Variable dilution device with constant flow control by orifice (CFO-CVS)** (Figure 3)

3.3.1. The collection equipment consists of:

3.3.1.1. A sampling tube connecting the vehicle's exhaust pipe to the device itself.

3.3.1.2. A sampling device consisting of a pump device for drawing in a diluted mixture of exhaust gas and air.

3.3.1.3. A mixing chamber (M) in which exhaust gas and air are mixed homogeneously.

3.3.1.4. A heat exchanger (H) of a capacity sufficient to ensure that throughout the test the temperature of the air/exhaust-gas mixture measured at a point immediately before the positive displacement of the flow-rate measuring device is within ±6 °C of the designed operating temperature. This device must not alter the pollutant concentration of diluted gases taken off for analysis.

Should this condition not be satisfied for certain pollutants, sampling will be effected before the cyclone for one or several considered pollutants.

If necessary, a device for temperature control (TC) is used to preheat the heat exchanger before testing and to keep up its temperature during the test at ±6 °C.

3.3.1.5. Two probes (S_1 and S_2) for sampling by means of pumps (P) flow-meters (FL) and, if necessary, filters (F) allowing for the collection of solid particles from gases used for the analysis.

3.3.1.6. One pump for dilution air and another one for diluted mixture.

3.3.1.7. A volume-meter with an orifice.

3.3.1.8. A temperature censor (T_1) (accuracy and precision ±1 °C), fitted at a point immediately before the volume measurement device; it must be designed to monitor continuously the temperature of the diluted exhaust-gas mixture during the test.

3.3.1.9. A pressure gauge (G_1) (accuracy and precision ±0,4 kPa) fitted immediately before the volume meter and used to register the pressure gradient between the gas mixture and the ambient air.

3.3.1.10. Another pressure gauge (G_2) (accuracy and precision ±0,4 kPa) fitted so that the differential pressure between pump inlet and pump outlet can be registered.

3.3.1.11. Flow controllers (N) to ensure a constant uniform flow of gas samples taken during the course of the test from sampling outlets S_1 and S_2. The flow of the gas samples must be such that, at the end of each test, the quantity of the samples is sufficient for analysis (~ 10 litres per minute).

3.3.1.12. Flow-meters (FL) for adjusting and monitoring the constant flow of gas samples during the test.

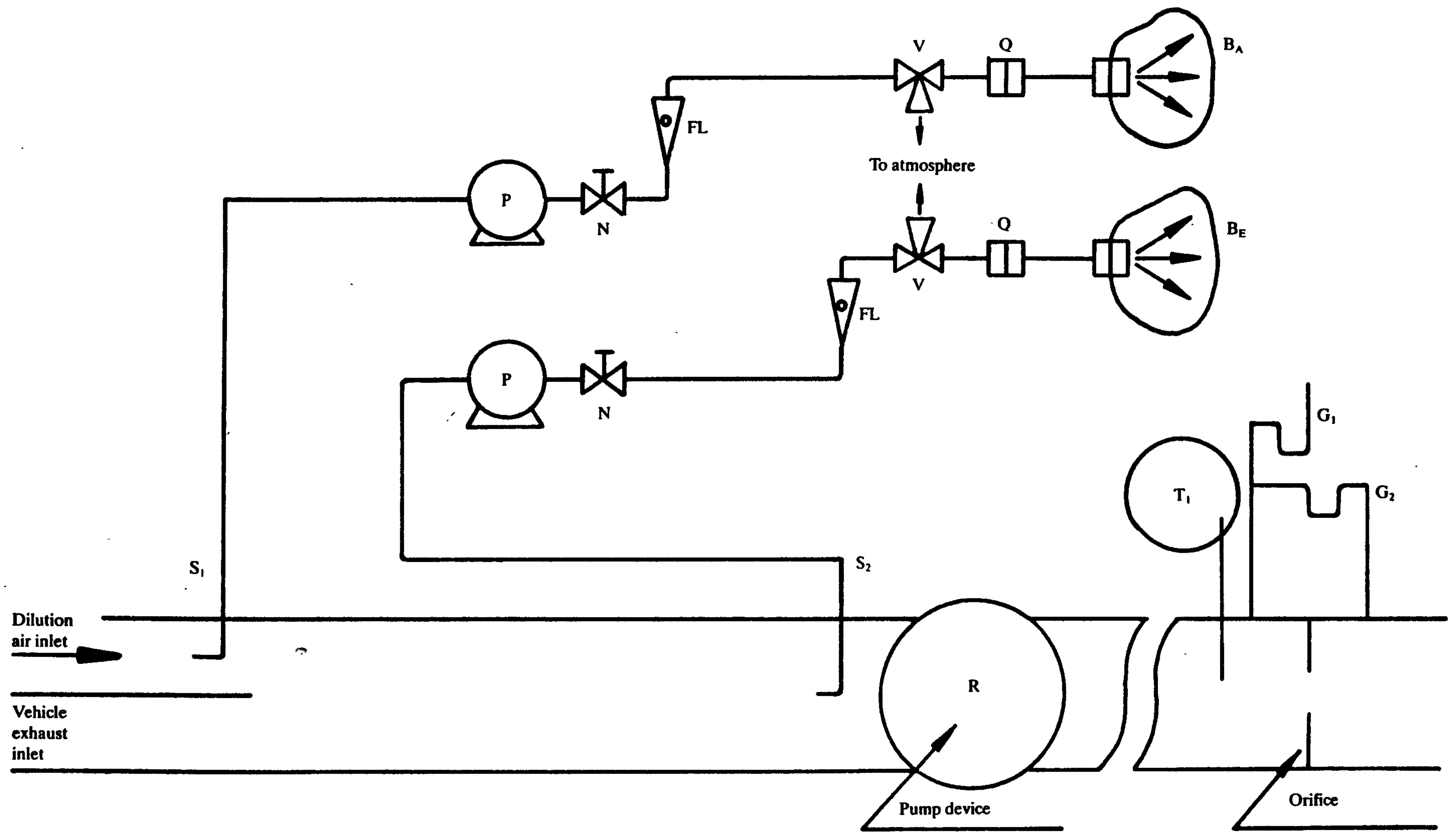
3.3.1.13. Three-way valves (V) to divert a constant flow of gas samples into the sampling bags or to the outside vent.

3.3.1.14. Gas-tight, quick-lock coupling elements (Q) between the three-way valves and the sampling bags; the coupling must close automatically on the sampling-bag side. Other ways of transporting the samples to the analyzer may be used (three-way stopcocks, for instance).

3.3.1.15. Bags (B) for collecting samples of diluted exhaust gas and of dilution air during the test. They must be of sufficient capacity not to impede the sample flow. The bag material must be such as to affect neither the measurements themselves nor the chemical composition of the gas samples (for instance: laminated polyethylene/polyamide films, or fluorinated polyhydrocarbons).

Figure 3

Diagram of a variable dilution device with constant flow control by orifice (CFO-CVS)



APPENDIX 6

METHOD OF CALIBRATING THE EQUIPMENT

1. ESTABLISHMENT OF THE CALIBRATION CURVE

1.1. Each normally used operating range is calibrated in accordance with the requirements of 4.3.3 of Annex III by the following procedure:

1.2. The analyzer calibration curve is established by at least five calibration points spaced as uniformly as possible. The nominal concentration of the calibration gas of the highest concentration must be not less than 80 % of the full scale.

1.3. The calibration curve is calculated by the least squares method. If the resulting polynominal degree is greater than 3, the number of calibration points must be at least equal to this polynomial degree plus 2.

1.4. The calibration curve must not differ by more than 2 % from the nominal value of each calibration gas.

1.5. **Trace of the calibration curve**

From the trace of the calibration curve and the calibration points it is possible to verify that the calibration has been carried out correctly. The different characteristic parameters of the analyzer must be indicated, particularly:

- the scale,
- the sensitivity,
- the zero point,
- the date of carrying out the calibration.

1.6. If it can be shown to the satisfaction of the technical service that alternative technology (e.g. computer, electronically controlled range switch, etc.) can give equivalent accuracy, then these alternatives may be used.

2. VERIFICATION OF THE CALIBRATION

2.1. Each normally used operating range must be checked prior to each analysis in accordance with the following:

2.2. The calibration is checked by using a zero gas and a span gas whose nominal value is near to the supposed value to be analyzed.

2.3. If, for the two points considered, the value found does not differ by more than ± 5 % of the full scale from the theoretical value, the adjustment parameters may be modified. Should this not be the case, a new calibration curve must be established in accordance with 1.

2.4. After testing, zero gas and the same span gas are used for re-checking. The analysis is considered acceptable if the difference between the two measuring results is less than 2 %.

3. EFFICIENCY TEST OF THE NO_x CONVERTER

The efficiency of the converter used for the conversion of NO_2 into NO is tested as follows:

Using the test set up as shown in Figure 1 and the procedure described below, the efficiency of converters can be tested by means of an ozonator.

3.1. Calibrate the CLA in the most common operating range following the manufacturer's specifications using zero and span gas (the NO content of which must amount to about 80 % of the operating range and the NO_2 concentration of the gas mixture to less than 5 % of the NO concentration). The NO_x analyzer must be in the NO mode so that the span gas does not pass through the converter. Record the indicated concentration.

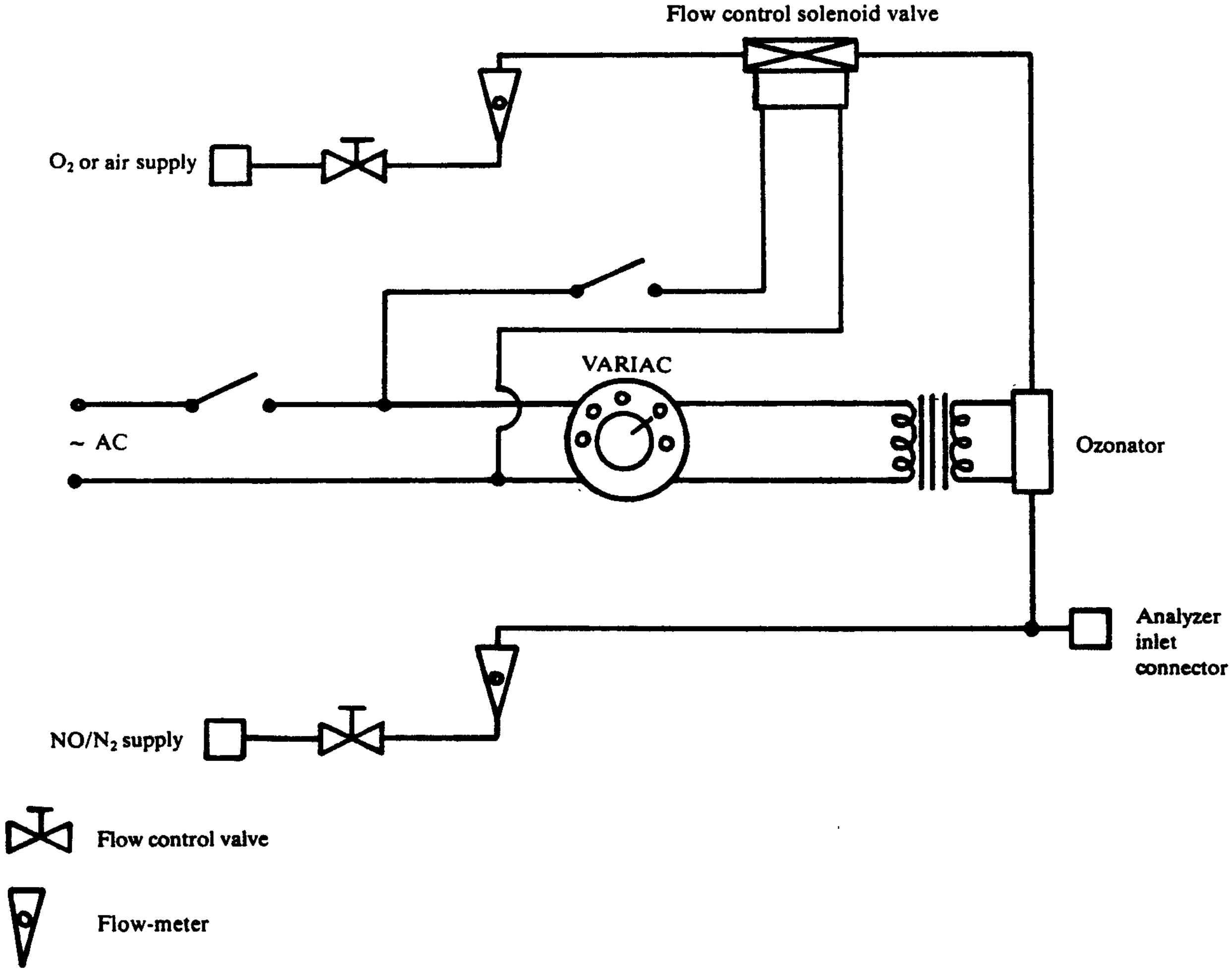
3.2. Via a T-fitting, oxygen or synthetic air is added continuously to the gas flow until the concentration indicated is about 10 % less than the indicated calibration concentration given in 3.1. Record the indicated concentration (C). The ozonator is kept deactivated throughout this process.

3.3. The ozonator is now activated to generate enough ozone to bring the NO concentration down to 20 % (minimum 10 %) of the calibration concentration given in 3.1. Record the indicated concentration (d).

3.4. The NO_x analyzer is then switched to the NO_x mode which means that the gas mixture (consisting of NO, NO_2, O_2 and N_2) now passes through the converter. Record the indicated concentration (a).

3.5. The ozonator is now deactivated. The mixture of gases described in 3.2 passes through the converter into the detector. Record the indicated concentration (b).

Figure 1



3.6. With the ozonator deactivated, the flow of oxygen or synthetic air is also shut off. The NO_x reading of the analyzer must then be no more than 5 % above the figure given in 3.1.

3.7. The efficiency of the NO_x converter is calculated as follows:

$$\text{Efficiency (\%)} = (1 + \frac{a - b}{c - d}) \times 100$$

3.8. The efficiency of the converter must not be less than 95 %.

3.9. The efficiency of the converter must be tested at least once a week.

4. CALIBRATION OF THE CVS SYSTEM

4.1. The CVS system must be calibrated by using an accurate flow-meter and a restricting device. The flow through the system must be measured at various pressure readings and the control parameters of the system measured and related to the flows.

4.1.1. Various types of flow-meter may be used, e.g. calibrated venturi, laminar flow-meter, calibrated turbine-meter, provided that they are dynamic measurement systems and can meet the requirements of 4.2.2 and 4.2.3 of Annex III.

4.1.2. The following sections give details of methods of calibrating PDP and CFV units, using a laminar flow-meter, which gives the required accuracy, together with a statistical check on the calibration validity.

4.2. Calibration of the positive displacement pump (PDP)

4.2.1. The following calibration procedure outlines the equipment, the test configuration and the various parameters which are measured to establish the flow-rate of the CVS pump. All the parameters related to the pump are simultaneously measured with the parameters related to the flow-meter which is connected in series with the pump. The calculated flow-rate (given in m^3/min at pump inlet, absolute pressure and temperature) can then be plotted versus a correlation function which is the value of a specific combination of pump parameters. The linear equation which relates the pump flow and the correlation function is then determined. In the event that a CVS has a multiple speed drive, a calibration for each range used must be performed.

4.2.2. This calibration procedure in based on the measurement of the absolute values of the pump and flow-meter parameters that relate the flow-rate at each point. Three conditions must be maintained to ensure the accuracy and integrity of the calibration curve.

4.2.2.1. The pump pressures must be measured at tappings on the pump rather than at the external piping on the pump inlet and outlet. Pressure taps that are mounted at the top centre and bottom centre of the pump drive headplate are exposed to the actual pump cavity pressures, and therefore reflect the absolute pressure diffentials.

4.2.2.2. Temperature stability must be maintained during the calibration. The laminar flow-meter is sensitive to inlet temperature oscillations which cause the data points to be scattered. Gradual changes of ± 1 °C in temperature are acceptable as long as they occur over a period of several minutes.

4.2.2.3. All connections between the flow-meter and the CVS pump must be free of any leakage.

4.2.3. During an exhaust emission test, the measurement of these same pump parameters enables the user to calculate the flow-rate from the calibration equation.

4.2.3.1. Figure 2 of this Appendix shows one possible test set-up. Variations are permissible, provided that they are approved by the authority granting the approval as being of comparable accuracy. If the set-up shown in Figure 2 of Appendix 5 is used, the following data must be found within the limits of precision given:

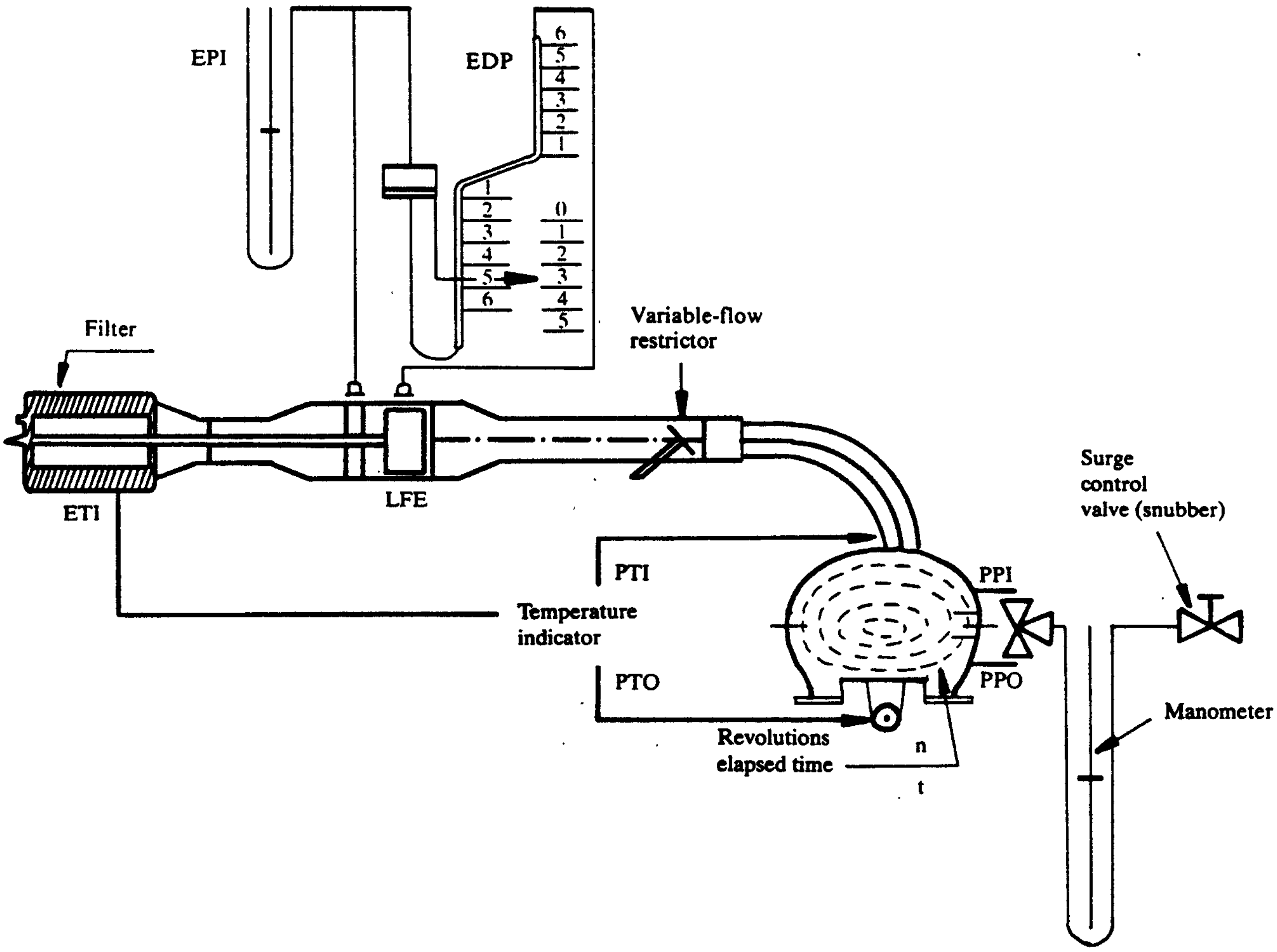
barometric pressure (corrected) (P_B)	± 0,03 kPa
ambient temperature (T)	± 0,2 °C
air temperature at LFE (ETI)	± 0,15 °C
pressure depression upstream of LFE (EPI)	± 0,01 kPa
pressure drop across the LFE matrix (EDP)	± 0,0015 kPa
air temperature at CVS pump inlet (PTI)	± 0,2 °C
air temperature at CVS pump outlet (PTO)	± 0,2 °C
pressure depression at CVS pump inlet (PPI)	± 0,22 kPa
pressure head at CVS pump outlet (PPO)	± 0,22 kPa
pump revolutions during test period (n)	± 1 rev
elapsed time for period (minimum 250 s) (t)	± 0,1 s

4.2.3.2. After the system has been connected as shown in Figure 2, set the variable restrictor in the wide-open position and run the CVS pump for 20 minutes before starting the calibration.

4.2.3.3. Reset the restrictor valve to a more restricted condition in an increment of pump inlet depression (about 1 kPa) that will yield a minimum of six data points for the total calibration. Allow the system to stabilize for three minutes and repeat the data acquisition.

Figure 2

PDP-CVS calibration configuration



4.2.4. *Data analysis*

4.2.4.1. The air flow-rate (Q_S) at each test point is calculated in standard m³/min from the flow-meter data using the manufacturer's prescribed method.

4.2.4.2. The air flow-rate is then converted to pump flow (V_o) in m³/rev at absolute pump inlet temperature and pressure.

$$V_o = \frac{Q_S}{n} \cdot \frac{T_p}{273{,}2} \cdot \frac{101{,}33}{P_p}$$

where:

V_o = pump flow-rate at T_p and P_p given in m³/rev,

Q_S = air flow at 101,33 KPa and 273,2 K given in m³/min,

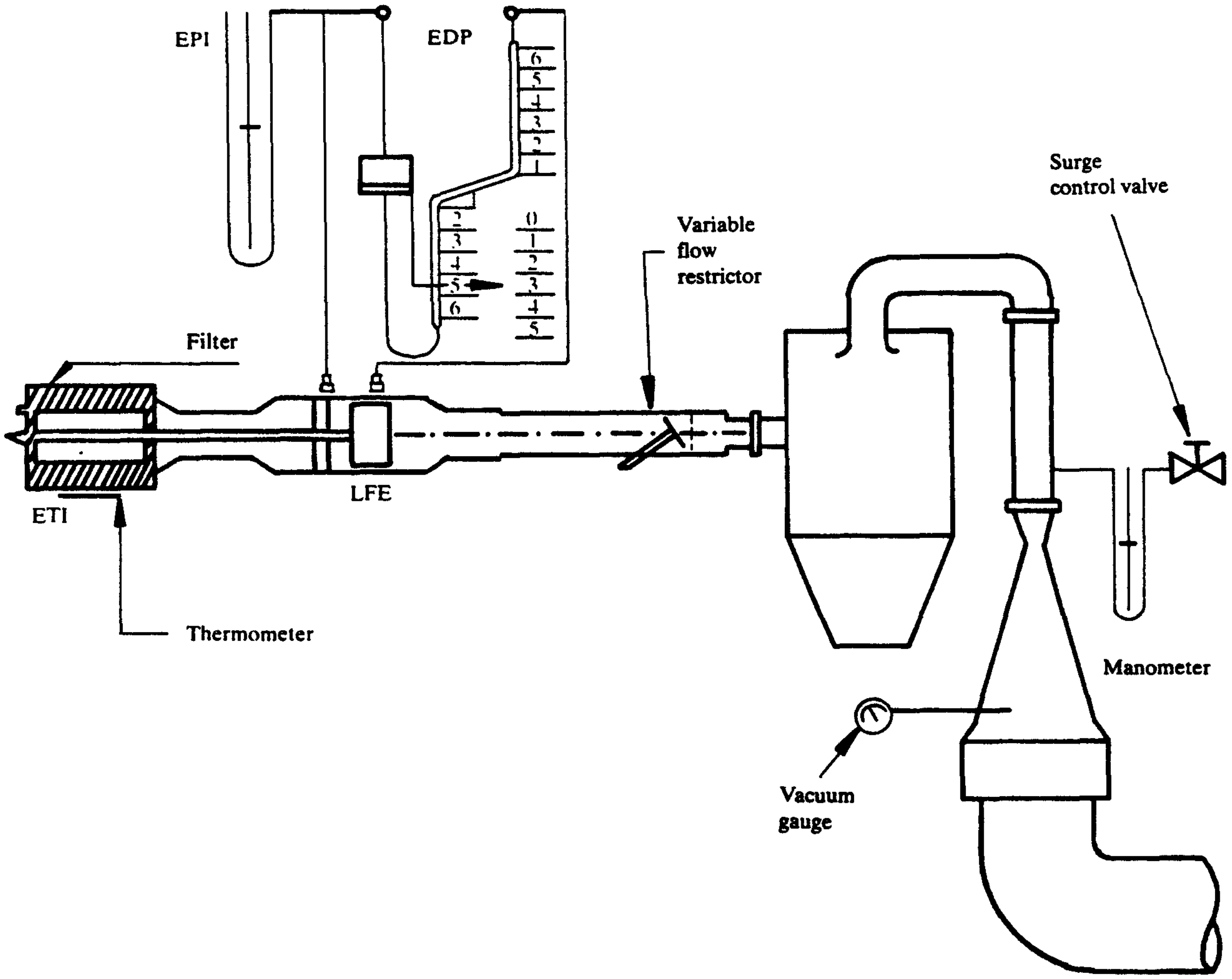
T_P = pump inlet temperature (K),

P_P = absolute pump inlet pressure,

n = pump speed in revolutions per minute.

Figure 3

CFV-CVS calibration configuration



To compensate for the interaction of pump speed pressure variations at the pump and the pump slip rate, the correlation function (X_o) between the pump speed (n), the pressure differential from pump inlet to pump outlet and the absolute pump outlet pressure is then calculated as follows:

$$X_o = \frac{1}{n}\sqrt{\frac{\Delta P_P}{P_e}}$$

where:

x_o = correlation function,

ΔP_P = pressure differential from pump inlet to pump outlet (kPa),

P_e = absolute outlet pressure (PPO + P_B) (kPa).

A linear least-square fit is performed to generate the calibration equations which have the formulae:

$$V_o = D_o - M (X_o)$$

$$n = A - B (\Delta P_P)$$

D_o, M, A and B are the slope-intercept constants describing the lines.

4.2.4.3. A CVS system that has multiple speeds must be calibrated on each speed used. The calibration curves generated for the ranges must be approximately parallel and the intercept values (D_o) must increase as the pump flow range decreases.

If the calibration has been performed carefully, the calculated values from the equation will be within ± 0,5 % of the measured value of V_o. Values of M will vary from one pump to another. Calibration is performed at pump start-up and after major maintenance.

4.3. Calibration of the critical-flow venturi (CFV)

4.3.1. Calibration of the CFV is based upon the flow equation for a critical venturi:

$$Q_s = \frac{K_V \cdot P}{\sqrt{T}}$$

where:

Q_s = flow,

K_v = calibration coefficient,

P = absolute pressure (KPa),

T = absolute temperature (K).

Gas flow is a function of inlet pressure and temperature.

The calibration procedure described below establishes the value of the calibration coefficient at measured values of pressure, temperature and air flow.

4.3.2. The manufacturer's recommended procedure must be followed for calibrating electronic portions of the CFV.

4.3.3. Measurements for flow calibration of the critical flow venturi are required and the following data must be found within the limits of precision given:

barometric pressure (corrected) (P_B)	± 0,03 kPa,
LFE air temperature, flow-meter (ETI)	± 0,15 °C,
pressure depression upstream of LFE (EPI)	± 0,01 kPa,

pressure drop across (EDP) LFE matrix	± 0,0015 kPa,
air flow (Q_s)	± 0,5 %,
CFV inlet depression (PPI)	± 0,02 kPa,
temperature at venturi inlet (T_v)	± 0,2 °C.

4.3.4. The equipment must be set up as shown in Figure 3 and checked for leaks. Any leaks between the flow-measuring device and the critical-flow venturi seriously affect the accuracy of the calibration.

4.3.5. The variable-flow restrictor must be set to the open position, the blower started and the system stabilized. Data from all instruments must be recorded.

4.3.6. The flow restrictor must be varied and at least eight readings across the critical flow range of the venturi must be made.

4.3.7. The data recorded during the calibration must be used in the following calculations. The air flow-rate (Q_s) at each test point is calculated from the flow-meter data using the manufacturer's prescribed method.

Calculate values of the calibration coefficient for each test point:

$$K_v = \frac{Q_s \cdot \sqrt{T_v}}{P_v}$$

where:

Q_s = flow-rate in m^3/min at 273,2 K and 101,33 kPa,

T_v = temperature at the venturi inlet (K),

P_v = absolute pressure at the venturi inlet (kPa).

Plot K_v as a function of venturi inlet pressure. For sonic flow K_v will have a relatively constant value. As pressure decreases (vacuum increases) the venturi become unchoked and K_v decreases. The resultant K_v changes are not permissible.

For a minimum of eight points in the critical region calculate an average K_v and the standard deviation.

If the standard deviation exceeds 0,3 % of the average K_v take corrective action.

APPENDIX 7

TOTAL SYSTEM VERIFICATION

1. To comply with the requirements of 4.7 of Annex III, the total accuracy of the CVS sampling system and analytical system must be determined by introducing a known mass of a pollutant gas into the system whilst it is being operated as if during a normal test and then analyzing and calculating the pollutant mass according to the formulae in Appendix 8 to this Annex except that the density of propane is taken as 1,967 grams per litre at standard conditions. The following two techniques are known to give sufficient accuracy.

2. METERING A CONSTANT FLOW OF PURE GAS (CO OR C_3H_8) USING A CRITICAL FLOW ORIFICE DEVICE

2.1. A known quantity of pure gas (CO or C_3H_8) is fed into the CVS system through the calibrated critical orifice. If the inlet pressure is high enough, the flow-rate (q), which is adjusted by means of the critical flow orifice, is independent of orifice outlet pressure (critical flow). If deviations exceeding 5 % occur, the cause of the malfunction must be located and determined. The CVS system is operated as in an exhaust emission test for about 5 to 10 minutes. The gas collected in the sampling bag is analyzed by the usual equipment and the results compared to the concentration of the gas samples which was known beforehand.

3. METERING A LIMITED QUANTITY OF PURE GAS (CO OR C_3H_8) BY MEANS OF A GRAVIMETRIC TECHNIQUE

3.1. The following gravimetric procedure may be used to verify the CVS system. The weight of a small cylinder filled with either carbon monoxide or propane is determined with a precision of ±0,01 g. For about 5 to 10 minutes, the CVS system is operated as in a normal exhaust emission test, while CO or propane is injected into the system. The quantity of pure gas involved is determined by means of differential weighing. The gas accumulated in the bag is then analyzed by means of the equipment normally used for exhaust-gas analysis. The results are then compared to the concentration figures computed previously.

APPENDIX 8

CALCULATION OF THE MASS EMISSIONS OF POLLUTANTS

The mass emissions of pollutants are calculated by means of the following equation:

$$M_i = V_{mix} \times Q_i \times k_H \times C_i \times 10^{-6} \qquad (1)$$

where:

M_i = mass emission of the pollutant i in grams per test,

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),

k_H = humidity correction factor used for the calculation of the mass emissions of oxides of nitrogen. There is no humidity correction for HC and CO,

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.

1. VOLUME DETERMINATION

1.1. 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.

1.2. 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:

$$V = V_o \times N$$

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.

1.3. Correction of the diluted exhaust-gas volume to standard conditions

The diluted exhaust-gas volume is corrected by means of the following formula:

$$V_{mix} = V \times K_1 \times \frac{P_B - P_1}{T_p} \qquad (2)$$

in which:

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

where:

P_B = barometric pressure in the test room in kPa,

P_1 = vacuum at the inlet to the positive displacement pump in kPa relative to the ambient barometric pressure,

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

2. CALCULATION OF THE CORRECTED CONCENTRATION OF POLLUTANTS IN THE SAMPLING BAG

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

where:

C_i = concentration of the pollutant i in the diluted exhaust gas, expressed in ppm 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,

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

DF = dilution factor.

The dilution factor is calculated as follows:

$$DF = \frac{13{,}4}{c_{CO_2} + (c_{HC} + c_{CO})\,10^{-4}} \qquad (5)$$

In this equation:

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.

3. DETERMINATION OF THE NO HUMIDITY CORRECTION FACTOR

In order to correct the influence of humidity on the results of oxides of nitrogen, the following calculations are applied:

$$k_H = \frac{1}{1 - 0{,}0329\,(H - 10{,}71)} \qquad (6)$$

in which:

$$H = \frac{6{,}211 \times R_a \times P_d}{P_B - P_d \times R_a \times 10^{-2}} \qquad (6)$$

where:

H = absolute humidity expressed in grams of water per kilogram of dry air,

R_a = relative humidity of the ambient air expressed as a percentage,

P_d = saturation vapour pressure at ambient temperature expressed in kPa,

P_B = atmospheric pressure in the room, expressed in kPa.

4. EXAMPLE

4.1. Data

4.1.1. Ambient conditions:

ambient temperature: 23 °C = 296,2 K,

barometric pressure: P_B = 101,33 kPa,

relative humidity: R_a = 60 %,

saturation vapour pressure: P_d = 3,20 kPa of H_2O at 23 °C.

4.1.2. **Volume measured and reduced to standard conditions (paragraph 1)**

$V = 51,961 \text{ m}^3$

4.1.3. Analyzer readings:

	Diluted exhaust sample	Dilution-air sample
HC (1)	92 ppm	3,0 ppm
CO	470 ppm	0 ppm
NO_x	70 ppm	0 ppm
CO_2	1,6 % vol	0,03 % vol

(1) In ppm carbon equivalent.

4.2. Calculation

4.2.1. Humidity correction factor (k_H) (see formulae (6))

$$H = \frac{6,211 \times R_a \times P_d}{P_B - P_d \times R_a \times 10^{-2}}$$

$$H = \frac{6,211 \times 60 \times 3,2}{101,33 - (3,2 \times 0,60)}$$

$$H = 11,9959$$

$$k_H = \frac{1}{1 - 0,0329 \times (H - 10,71)}$$

$$k_H = \frac{1}{1 - 0,0329 \times (11,9959 - 10,71)}$$

$$k_H = 1,0442$$

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

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

$$DF = \frac{13,4}{1,6 + (92 + 4,70) \times 10^{-4}}$$

$$DF = 8,091$$

4.2.3. **Calculation of the corrected concentration of pollutants in the sampling bag:**

HC, mass emissions (see formulae (4) and (1'))

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

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

$$C_i = 89,371$$

$$M_{HC} = C_{HC} \times V_{mix} \times Q_{HC}$$

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

$$M_{HC} = 89,371 \times 51\,961 \times 0,619 \times 10^{-6}$$

$$M_{HC} = 2,88 \frac{g}{test}$$

CO, mass emissions (see formula (1))

$M_{CO} = C_{CO} \times V_{mix} \times Q_{CO}$

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

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

$M_{CO} = 30{,}5 \ \frac{g}{test}$

NO_x, mass emissions (see formula (1))

$M_{NO_x} = C_{NO_x} \times V_{mix} \times Q_{NO_x} \times k_H$

$Q_{NO_x} = 2{,}05$

$M_{NO_x} = 70 \times 51\,961 \times 2{,}05 \times 1{,}0442 \times 10^{-6}$

$M_{NO_x} = 7{,}79 \ \frac{g}{test}$

4.3. HC measurements with diesel engines

To calculate HC-mass emissions for diesel engines the average HC concentration is calculated as follows:

$$c_e = \frac{\int_{t_1}^{t_2} c_{HC} \cdot dt}{t_2 - t_1} \qquad (7)$$

where:

$\int_{t_1}^{t_2} c_{HC} \cdot dt$ = integral of the recording of the heated FID over the test ($t_2 - t_1$),

c_e = concentration of HC measured in the diluted exhaust in ppm of C_1,

c_e is substituted directly for C_{HC} in all relevant equations.

4.4. Example of a calculation

4.4.1. *Data*

Ambient conditions

ambient temperature	23 °C	= 296,2 K
barometric pressure	P_B	= 101,33 kPa
relative humidity	R_a	= 60 %
saturation vapour pressure of H_2O at 23 °C	P_d	= 3,20 kPa

Positive displacement pump (PDP)

pump volume (from calibration data)	V_0	= 2,439 litres per revolution
vacuum	P_i	= 2,80 kPa
gas temperature	T_p	= 51 °C = 324,2 K
number of pump revolutions	n	= 26 000

Analyzer readings

	Diluted exhaust sample	Dilution-air sample
HC	92 ppm	3,0 ppm
CO	470 ppm	0 ppm
NO_x	70 ppm	0 ppm
CO_2	1,6 % vol	0,03 % vol

4.4.2. *Calculation*

4.4.2.1. Gas volume (see formula (2))

$$V_{mix} = K_1 \times V_o \times n \frac{P_B - P_i}{T_P}$$

$$V_{mix} = 2{,}6961 \times 2{,}439 \times 26\,000 \times \frac{98{,}53}{324{,}2}$$

$$V_{mix} = 51\,960{,}89$$

Note

For CFV and similar CVS systems the volume may be read directly from the instrumentation.

4.4.2.2. Humidity correction factor (kH) (see formula (6))

$$H = \frac{6{,}211 \times R_a \times P_d}{P_B - (P_d \times \frac{R_a}{100})}$$

$$H = \frac{6{,}211 \times 60 \times 3{,}2}{101{,}33 - (3{,}2 \times 0{,}60)}$$

$$H = 11{,}99589$$

$$k_H = \frac{1}{1 - 0{,}0329 \times (H - 10{,}71)}$$

$$k_H = \frac{1}{1 - 0{,}0329 \times (11{,}9959 - 10{,}71)}$$

$$k_H = 1{,}0442$$

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

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

$$DF = \frac{13{,}4}{1{,}6 + (92{,}0 + 470)\ 10^{-4}}$$

$$DF = 8{,}091$$

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

HC, mass emissions (see formulae (4) and (1))

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

$$C_i = 92{,}0 - 3\left(1 - \frac{1}{8{,}091}\right)$$

$$C_i = 89{,}372$$

$$M_{HC} = C_{HC} \times V_{mix} \times Q_{HC}$$

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

$$M_{HC} = 89{,}372 \times 51\,961 \times 0{,}619 \times 10^{-6}$$

$M_{HC} = 2{,}87$ g/test HC

ANNEX IV

TYPE II TEST

(Carbon monoxide emission test at idling speed)

1. INTRODUCTION

This Annex describes the procedure for the type II test defined in 5.2.1.2 of Annex I.

2. CONDITIONS OF MEASUREMENT

2.1. The fuel must be the reference fuel, specifications for which are given in Annex VI.

2.2. The type II test must be carried out immediately after the fourth operating cycle of the type I test, with the engine at idling speed, the cold-start device not being used. Immediately before each measurement of the carbon-monoxide content, a type I test operating cycle as described in Annex 2.1 of Annex III must be carried out.

2.3. In the case of vehicles with manually-operated or semi-automatic-shift gearboxes the test must be carried out with the gear lever in the 'neutral' position and with the clutch engaged.

2.4. In the case of vehicles with automatic-shift gear-boxes the test is carried out with the gear selector in either the 'neutral' or the 'parking' position.

2.5. **Components for adjusting the idling speed**

2.5.1. *Definition*

For the purposes of this Directive, 'components for adjusting the idling speed' means controls for changing the idling conditions of the engine which may be easily operated by a mechanic using only the tools described in 2.5.1.1. In particular, devices for calibrating fuel and air flows are not considered as adjustment components if their setting requires the removal of the set-stops, an operation which cannot normally be performed except by a professional mechanic.

2.5.1.1. Tools which may be used to control components for adjusting the idling speed: screwdrivers (ordinary or cross-headed), spanners (ring, open-end or adjustable), pliers, Allen keys.

2.5.2. *Determination of measurement points*

2.5.2.1. A measurement at the setting used for the type I test is performed first.

2.5.2.2. For each adjustment component with a continuous variation, a sufficient number of characteristic positions are determined.

2.5.2.3. The measurement of the carbon-monoxide content of exhaust gases must be carried out for all the possible positions of the adjustment components, but for components with a continuous variation only the positions defined in 2.5.2.2 are adopted.

2.5.2.4. The type II test is considered satisfactory if at least one of the two following conditions is met:

2.5.2.4.1. none of the values measured in accordance with 2.5.2.3 exceeds the limit values;

2.5.2.4.2. the maximum content obtained by continuously varying one of the adjustment components while the other components are kept stable does not exceed the limit value, this condition being met for the various combinations of adjustment components other than the one which was varied continuously.

2.5.2.5. The possible positions of the adjustment components are limited:

2.5.2.5.1. on the one hand, by the larger of the following two values: the lowest idling speed which the engine can reach; the speed recommended by the manufacturer, minus 100 revolutions per minute;

2.5.2.5.2. on the other hand, by the smallest of the following three values: the highest speed the engine can attain by activation of the idling speed components; the speed recommended by the manufacturer, plus 250 revolutions per minute; the cut-in speed of automatic clutches.

2.5.2.6. In addition, settings incompatible with correct running of the engine must not be adopted as measurement settings, In particular, when the engine is equipped with several carburettors all the carburettors must have the same setting.

3. SAMPLING OF GASES

3.1. The sampling probe is placed in the pipe connecting the exhaust with the sampling bag and as close as possible to the exhaust.

3.2. The concentration in CO (C_{CO}) and CO_2 (C_{CO_2}) is determined from the measuring instrument readings or recordings, by use of appropriate calibration curves.

3.3. The corrected concentration for carbon monoxide regarding four-stroke engines is:

$$C_{CO} \text{ corr} = C_{CO} \frac{15}{C_{CO} + C_{CO_2}} \text{ (\% vol)}$$

3.4. The concentration in C_{CO} (see 3.2) measured according to the formulae contained in 3.3 need not be corrected if the total of the concentrations measured (C_{CO} + C_{CO_2}) is at least 15 for four-stroke engines.

ANNEX V

TYPE III TEST

(Verifying emissions of crankcase gases)

1. INTRODUCTION

This Annex describes the procedure for the type III test defined in 5.2.1.3 of Annex I.

2. GENERAL PROVISIONS

2.1. Test III is carried out on the vehicle with gasoline-fuelled engine subjected to the type I and the type II test.

2.2. The engines tested must include leak-proof engines other than those so designed that even a slight leak may cause unacceptable operating faults (such as flat-twin engines).

3. TEST CONDITIONS

3.1. Idling must be regulated in conformity with the manufacturer's recommendations.

3.2. The measurements are performed in the following three sets of conditions of engine operation:

Condition No	Vehicle speed (km/h)
1	Idling
2	50±2
3	50±2

Condition No	Power absorbed by brake
1	Nil
2	That corresponding to the settings for type I tests
3	That for conditions No 2, multiplied by a factor of 1,7

4. TEST METHOD

4.1. For the operation conditions as listed in 3.2 reliable function of the crankcase ventilation system must be checked.

5. METHOD OF VERIFICATION OF THE CRANKCASE VENTILATION SYSTEM

5.1. The engine's apertures must be left as found.

5.2. The pressure in the crankcase is measured at an appropriate location. It is measured at the dipstick hole with an inclined-tube manometer.

5.3. The vehicle is deemed satisfactory if, in every condition of measurement defined in 3.2, the pressure measured in the crankcase does not exceed the atmospheric pressure prevailing at the time of measurement.

5.4. For the test by the method described above, the pressure in the intake manifold is measured to within ± 1 kPa.

5.5. The vehicle speed as indicated at the dynamometer is measured to within ± 2 km/h.

5.6. The pressure measured in the crankcase is measured to within ± 0,01 kPa.

5.7. If in one of the conditions of measurement defined in 3.2 the pressure measured in the crankcase exceeds the atmospheric pressure, an additional test as defined in 6 is performed if so requested by the manufacturer.

6. ADDITIONAL TEST METHOD

6.1. The engine's apertures must be left as found.

6.2. A flexible bag impervious to crankcase gases and having a capacity of approximately five litres is connected to the dipstick hole. The bag must be empty before each measurement.

6.3. The bag must be closed before each measurement. It must be opened to the crankcase for five minutes for each condition of measurement prescribed in 3.2.

6.4. The vehicle is deemed satisfactory if in every condition of measurement defined in 3.2 no visible inflation of the bag occurs.

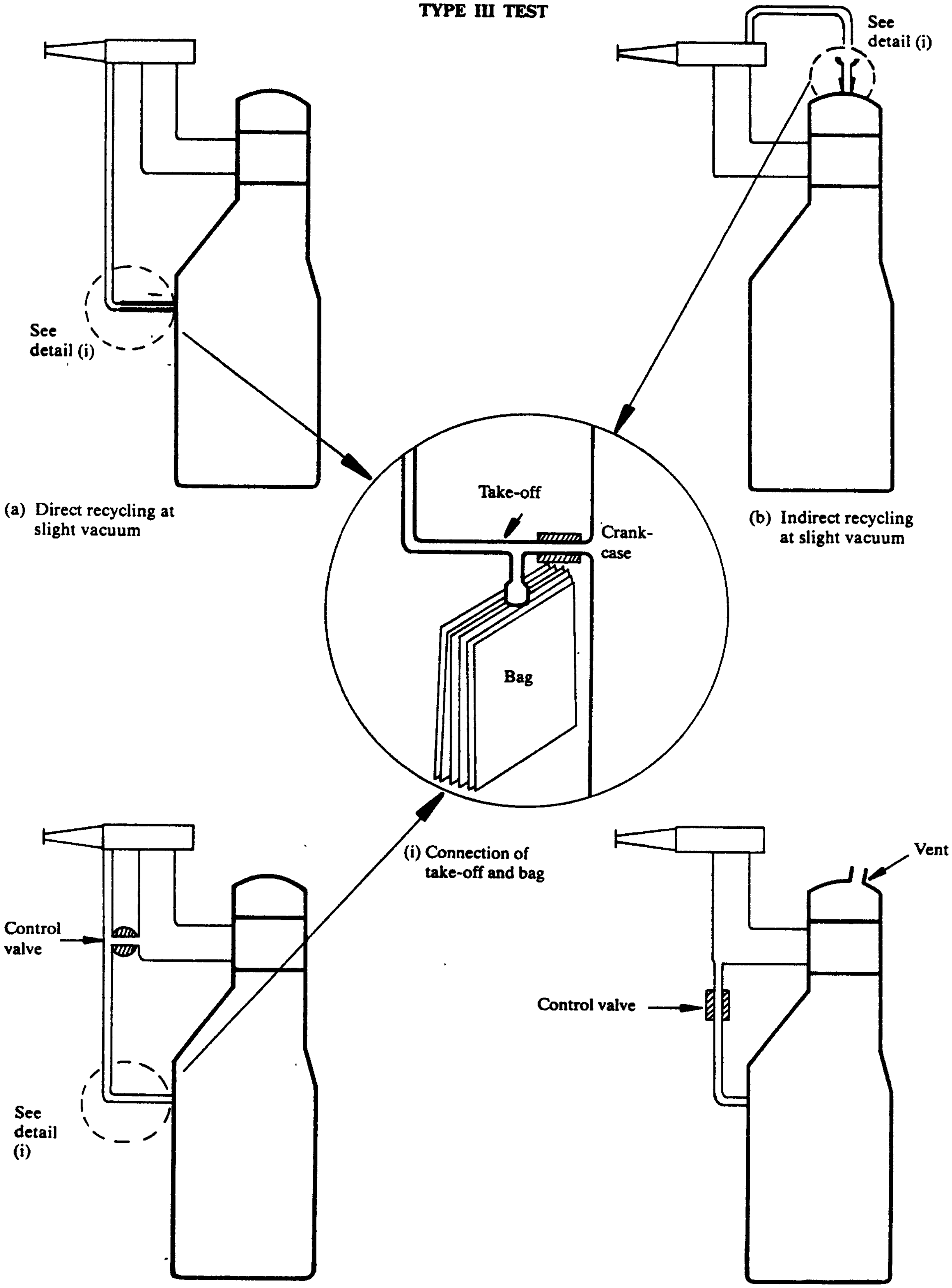
6.5. Remark

6.5.1. If the structural layout of the engine is such that the test cannot be performed by the methods described in 6 above, the measurements must be effected by that method modified as follows:

6.5.2. before the test, all apertures other than that required for the recovery of the gases are closed;

6.5.3. the bag is placed on a suitable take-off which does not introduce any additional loss of pressure and is installed on the recycling circuit of the device directly at the engine-connection aperture.

TYPE III TEST



(a) Direct recycling at slight vacuum

(b) Indirect recycling at slight vacuum

(i) Connection of take-off and bag

(c) Double-circuit direct recycling

(d) Venting of crank case with control valve (the bag must be connected to the vent)

ANNEX VI

SPECIFICATIONS OF REFERENCE FUELS

1. TECHNICAL DATA OF THE REFERENCE FUEL TO BE USED TESTING VEHICLES EQUIPPED WITH A GASOLINE-FUELLED ENGINE

CEC reference fuel RF-01-A-80

Type: Premium gasoline, leaded

	Limits and units	ASTM method
Research octane number	Min. 98,0	2 699
Density at 15 °C	Min. 0,741 kg/litre Max. 0,755	1 298
Reid vapour pressure	Min. 0,56 bar Max. 0,64	323
Distillation		86
Initial boiling point	Min. 24 °C Max. 40	
10 % vol point	Min. 42 Max. 58	
50 % vol point	Min. 90 Max. 110	
90 % vol point	Min. 150 Max. 170	
Final boiling point	Min. 185 Max. 205	
Residue	Max. 2 % vol	
Hydrocarbon analysis		1 319
Olefins	Max. 20 % vol	
Aromatics	Max. 45	
Saturates	Balance	
Oxidation stability	Min. 480 minutes	525
Existent gum	Max. 4 mg/100 ml	381
Sulphur content	Max. 0,04 % mass	1 266, 2 622 or 2 785
Lead content	Min. 0,10 g/litre Max. 0,40 g/litre	3 341
Nature of ocavonger	Motor mix	
Nature of lead alkyl	Not specified	

(1) Equivalent ISO methods will be adopted when issued for all properties listed above.

(2) The figures quoted show the total evaporated quantities (% recovered + % loss).

(3) The blonding of this fuel must involve use of only conventional European refinery components.

(4) The fuel may contain oxidation inhibitors and metal de-activators normally used to stabilize refinery gasoline streams, but detergent/dispersant additives and solvent oils must not be added.

(5) The values quoted in the specification are 'true values'. In establishment of their limit values the terms of ASTM D 3244 'Defining a basis for petroleum product quality disputes' have been applied and in fixing a maximum value, a minimum difference of 2 R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4 R (R = reproducibility).
Notwithstanding this measure, which is necessary for statistical reasons, the manufacturer of a fuel should nevertheless aim at a zero value where the stipulated maximum value is 2 R and at the mean value in the case of quotations of maximum and minimum limits.
Should it be necessary to clarify the question as to whether a fuel meets the requirements of the specification, the terms of ASTM D 3244 should be applied.

2. TECHNICAL DATA OF THE REFERENCE FUEL TO BE USED TESTING VEHICLES EQUIPPED WITH A DIESEL ENGINE

CEC reference fuel RF-03-A-80

Type: Diesel fuel

	Limits and units	ASTM method
Density at 15 °C	Min. 0,835 Max. 0,845	1 298
Cetane Index	Min. 51 Max. 57	976
Distillation (2)		86
50 % vol point	Min. 245 °C	
90 % vol point	Min. 320 Max. 340	
Final boiling point	Max. 370	
Viscosity, 40 °C	Min. 2,5 cSt (mm²/s) Max. 3,5	445
Sulphur content	Min. 0,20 % mass Max. 0,50	1 266, 2 622 or 2 785
Flash point	Min. 55 °C	93
Cold filter plugging point	Max. −5 °C	CEN draft pr EN116 or IP309
Conradson carbon residue on 10 % dist. residue	Max. 0,30 % mass	189
Ash content	Max. 0,01 % mass	482
Water content	Max. 0,05 % mass	95 or 1 744
Copper corrosion, 100 °C	Max. 1	130
Neutralization (strong acid) number	Max. 0,20 mg KOH/g	974

(1) Equivalent ISO methods will be adopted when issued for all properties listed above.

(2) The figures quoted show the total evaporated quantities (% recovered + % loss).

(3) This fuel may be based on straight run and cracked distillates; desulphurization is allowed. It must not contain any metallic additives.

(4) The values quoted in the specification are 'true values'. In establishment of their limit values the terms of ASTM D 3244 'Defining a basis for petroleum product quality disputes' have been applied and in fixing a maximum value, a minimum difference of 2 R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4 R (R = reproducibility).
Notwithstanding this measure, which is necessary for statistical reasons, the manufacturer of a fuel should nevertheless aim at a zero value where the stipulated maximum value is 2 R and at the mean value in the case of quotations of maximum and minimum limits.
Should it be necessary to clarify the question as to whether a fuel meets the requirements of the specification, the terms of ASTM D 3244 should be applied.

(5) If it is required to calculate the thermal efficiency of an engine or vehicle, the calorific value of the fuel can be calculated from:
Specific energy (calorific value) (net) MJ/kg = $(46{,}423 - 8{,}792d^2 + 3{,}170d)\,[1 - (x + y + s)] + 9{,}420s - 2{,}449x$ where:
d is the density at 15 °C,
x is the proportion by mass of water (% divided by 100),
y is the proportion by mass of ash (% divided by 100),
s is the proportion by mass of sulphur (% divided by 100).

ANNEX VII

MODEL

Maximum size: A4 (210 × 297 mm)

Name of administration

ANNEX TO THE EEC VEHICLE TYPE-APPROVAL CERTIFICATE WITH REGARD TO THE EMISSION OF GASEOUS POLLUTANTS FROM THE ENGINE

(Articles 4 (2) and 10 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)

In the light of the amendments made pursuant to Directive 83/351/EEC

EEC type-approval No: ....

1. Category of the vehicle type (M_1, N_1, etc.): ....

2. Trademark or trade name of the vehicle: ....

3. Vehicle type: .... Engine type: ....

4. Manufacturer's name and address: ....

....

5. If applicable, name and address of the manufacturer's authorized representative: ....

....

6. Mass of vehicle in running order: ....

6.1. Reference mass of vehicle: ....

7. Technically permissible maximum mass of vehicle: ....

8. Gearbox: ....

8.1. Manual or automatic (¹) (²)

8.2. Number of gear ratios: ....

8.3. Transmission ratios (¹): First gear N/V: ....

Second gear N/V: ....

Third gear N/V: ....

Fourth gear N/V: ....

Fifth gear N/V: ....

Final drive ratio: ....

Tyres: dimensions: ....

dynamic rolling circumference: ....

Wheel drive: front, rear, 4 × 4 (¹)

(¹) Delete as inapplicable.

(²) In the case of vehicles equipped with automatic-shift gearboxes, give all pertinent technical data.

8.4. Check of performance referred to in 3.1.6 of Annex III to this Directive ....

....

9. Date vehicle submitted for approval: ....

10. Technical service responsible for type-approval tests: ....

11. Date of test report issued by that service: ....

12. Number of test report issued by that service: ....

13. EEC type-approval granted/refused (¹)

14. Results of approval tests:

Inertia equivalent mass: .... kg

Absorbed power P_a: .... kW at 50 km/h

Method of setting: ....

14.1. Test type I (¹):

CO: .... g/test HC: .... g/test NO_x: .... g/test

14.2. Test type II (¹):

CO: .... % vol at: .... idle r/min

14.3. Test type III (¹):

....

15. Gas sampling system used:

15.1. PDP/CVS (¹)

15.2. CFV/CVS (¹)

15.3. CFO/CVS (¹)

16. Place: ....

17. Date: ....

18. Signature: ....

19. The following documents, bearing the EEC type-approval number shown above are attached to this Annex:

— one copy of Annex II to this Directive, duly completed and with the drawings and diagrams referred to attached

— one photograph of the engine and its compartment

— ....

(¹) Delete as inapplicable.

COUNCIL DIRECTIVE

of 16 June 1983

amending 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 gases from positive-ignition engines of motor vehicles

(83/351/EEC)

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 first programme of action of the European Community on the protection of the environment, 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 amended the Directives already adopted to that end;

Whereas Directive 70/220/EEC (⁴) lays down the limit values for carbon monoxide and unburnt hydrocarbon emissions from such engines; whereas these limit values were first reduced by Directive 74/290/EEC (⁵) and supplemented, in accordance with Directive 77/102/EEC (⁶), by limit values for permissible emissions of nitrogen oxides; whereas the limit values for these three pollutants were further lowered by Directive 78/665/EEC (⁷);

Whereas advances in motor vehicle design now enable a reduction in these limit values; whereas this appears desirable as a precaution against possible adverse effects on the environment; whereas during the period under consideration such a reduction will not jeopardize the aims of Community policy in other fields, and in particular in that of the rational use of energy;

Whereas, in view of the increasing use of diesel engines in cars and light commercial vehicles, it is advisable to reduce not only soot emissions, which are covered by Directive 72/306/EEC (⁸), but also the carbon monoxide, unburnt hydrocarbon and nitrogen oxide emissions from such engines; whereas bringing such engines within the scope of Directive 70/220/EEC involves an amendment to the operative part of the said Directive; whereas that amendment also has an effect on the content of the technical Annexes; whereas the Commission has proposed to the Council that in the present Directive it adopt at the same time the amendments to the technical Annexes, by way of derogation from Article 5 of Directive 70/220/EEC,

---

(¹) OJ No C 181, 19. 7. 1982, p. 30.
(²) Opinion delivered on 10 June 1983 (not yet published in the Official Journal).
(³) OJ No C 346, 31. 12. 1982, p. 2.
(⁴) OJ No L 76, 6. 4. 1970, p. 1.
(⁵) OJ No L 159, 15. 6. 1974, p. 61.
(⁶) OJ No L 32, 3. 2. 1977, p. 32.
(⁷) OJ No L 223, 14. 8. 1978, p. 48.
(⁸) OJ No L 190, 20. 8. 1972, p. 1.

HAS ADOPTED THIS DIRECTIVE:

Article 1

Directive 70/220/EEC is hereby amended as follows:

1. The title of Directive 70/220/EEC shall be replaced by the following:

   'Directive 70/220/EEC on the approximation of the laws of the Member States relating to measures to be taken against air pollution by gases from engines of motor vehicles'.

2. Article 1 is replaced by the following:

   'Article 1

   For the purposes of this Directive, "vehicle" means any vehicle with a positive-ignition engine or with a compression-ignition engine, intended for use on the road, with or without bodywork, having at least four wheels, a permissible maximum mass of at least 400 kg and a maximum design speed equal to or exceeding 50 km/h, with the exception of agricultural tractors and machinery and public works vehicles.'

3. The Annexes are replaced by the Annexes to this Directive.

Article 2

1. From 1 December 1983, no Member State may, on grounds relating to air pollution by gases from an engine:

— refuse to grant EEC type-approval, or to issue the documents referred to in the last indent of Article 10 (1) of Directive 70/156/EEC, or to grant national type-approval for a type of motor vehicle, or

— prohibit the entry into service of such vehicles,

where the level of gaseous pollutants emitted from this type of motor vehicle or from such vehicles meets the requirements of Directive 70/220/EEC, as amended by this Directive.

2. From 1 October 1984, Member States:

— may no longer issue the document provided for in the last indent of Article 10 (1) of Directive 70/156/EEC in respect of a type of motor vehicle which emits gaseous pollutants at levels which do not meet the requirements of Directive 70/220/EEC, as amended by this Directive,

— may refuse national type-approval for a type of motor vehicle which emits gaseous pollutants at levels which do not meet the requirements of Directive 70/220/EEC, as amended by this Directive.

3. From 1 October 1986, Member States may prohibit the entry into service of vehicles which emit gaseous pollutants at levels which do not meet the requirements of Directive 70/220/EEC, as amended by this Directive.

Article 3

Member States shall bring into force the necessary provisions in order to comply with this Directive not later than 30 November 1983 and shall forthwith inform the Commission thereof.

Article 4

This Directive is addressed to the Member States.

Done at Luxembourg, 16 June 1983.

For the Council

The President

C.-D. SPRANGER

COUNCIL DECISION

of 26 March 1980

concerning chlorofluorocarbons in the environment

(80/372/EEC)

(as amended by the Act of Accession of Spain and Portugal of 12 June 1985
(OJ L 302, 15.11.85, p. 9))

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 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, as stated in the resolution of the Council of the European Communities and of the representatives of the Governments of the Member States, meeting within the Council, of 17 May 1977 on the continuation and implementation of a European Community policy and action programme on the environment (⁴), it is necessary to review continuously at Community level the impact of chemicals on the envoronment;

Whereas the Council resolution of 30 May 1978 on fluorocarbons in the environment (⁵) states that the problems of the effects of chlorofluorcarbons on the ozone layer and of ultraviolet radiation on health cannot be ignored;

Whereas the Member States, in accordance with the terms of the resolution of 30 May 1978, adopted a common position on 6 December 1978 concerning chlorofluorocarbons in the environment, to be put to the International Conference on chlorofluorocarbons held in Munich from 6 to 8 December 1978; whereas that conference adopted certain recommendations, in particular recommendation III;

Whereas, in accordance with the common position of Member States of 6 December 1978 and in accordance with recommendation III of the Munich Conference, a significant reduction should, as a precautionary measure, be achieved in the next few years in the use of chlorofluorocarbons giving rise to emissions; whereas such a reduction should be sought on the basis of a policy with particular reference to the use of chlorofluorocarbons in aerosols;

Whereas during the first half of 1980 the measures to be taken will be re-examined in the light of the scientific and economic data available and such further measures as may prove necessary in the light of this re-examination will be adopted as soon as possible and in any event no later than 30 June 1981;

Whereas, since the specific powers of action required to adopt this Decision have not been provided for in the Treaty, it is necessary to invoke Article 235 thereof,

HAS ADOPTED THIS DECISION:

Article 1

1. Member States shall take all appropriate measures to ensure that industry situated in their territories does not increase its chlorofluorocarbon production capacity F-11 (CCl_3F) and F-12 (CCl_2F_2).

2. Member States shall take all appropriate measures to ensure that not later than 31 December 1981 industry situated in their territories achieves a reduction of at least 30 % compared with 1976 levels in the use of these chlorofluorocarbons in the filling of aerosol cans.

Article 2

In the course of the first half of 1980, the measures taken will be re-examined in the light of the scientific and economic data available. To this end, Member States shall, subject to considerations of commercial confidentiality, provide the Commission with the results of any study or research available to them. The Council shall adopt, as soon as possible and in any event no later than 30 June 1981, on a proposal from the Commission, such further measures as may be necessary in the light of this re-examination.

Article 3

This Decision is adressed to the Member States.

Done at Brussels, 26 March 1980.

For the Council

The President

G. MARCORA

For the purposes of applying Article 1 (2) of that Decision to Portugal, 1977 shall be taken as the reference year for calculating the reduction in use of chlorofluorocarbons.

(¹) OJ No C 136, 31. 5. 1979, p. 7.
(²) OJ No C 4, 7. 1. 1980, p. 68.
(³) Opinion delivered on 21 November 1979 (not yet published in the Official Journal).
(⁴) OJ No C 139, 13. 6. 1977, p. 1.
(⁵) OJ No C 133, 7. 6. 1978, p. 1.

COUNCIL DECISION

of 15 November 1982

on the consolidation of precautionary measures concerning chlorofluorocarbons in the environment

(82/795/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 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 Council Decision 80/372/EEC of 26 March 1980 concerning chlorofluorocarbons in the environment (4) provided for zero growth in production capacity and a reduction in the use of chlorofluorocarbons F-11 and F-12 in the filling of aerosol cans; whereas that Decision provided for a re-examination of the measures taken, in the light of the available scientific and economic data;

Whereas that re-examination has shown that it is necessary for the Community to continue to pursue a preventive policy; whereas the precautionary measures already taken need to be maintained and consolidated;

Whereas Article 1 (1) of Decision 80/372/EEC should be applied on the basis of a precise and harmonized definition of the production capacity of chlorofluorocarbons F-11 and F-12; whereas, on the basis of that definition, the 1980 total production capacity has been calculated for the Community as a whole;

Whereas, in preparation for periodic reviews of Community policy on the subject, the Commission should collect and compare appropriate statistical information on the production and use of chlorofluorocarbons;

Whereas, as a precautionary measure, the emissions of chlorofluorocarbons in the synthetic foam, refrigeration and solvents sectors should be limited; whereas, to this end, appropriate action should be undertaken;

Whereas during the first half of 1983 the measures to be taken should be re-examined in the light of the scientific and economic data available and such further measures as may prove necessary in the light of this re-examination should be adopted as soon as possible and not later than 31 December 1983;

Whereas, since the specific powers of action required to adopt this Decision have not been provided for in the Treaty, it is necessary to invoke Article 235 thereof,

HAS ADOPTED THIS DECISION:

Article 1

Member States shall take all appropriate measures to ensure that Article 1 (1) of Decision 80/372/EEC is applied on the basis of the definition of production capacity and the reference figure given in the Annex.

Article 2

1. Member States shall take all appropriate measures to facilitate the periodic collection by the Commission of the appropriate statistical information on the production and use of the chlorofluorocarbons F-11 and F-12.

2. Member States shall cooperate with the Commission in actions aimed at reducing chlorofluorocarbon losses and developing the best practicable technologies in order to limit emissions in the synthetic foam, refrigeration and solvents sectors.

Article 3

The measures taken in pursuance of Decision 80/372/EEC and this Decision shall be re-examined, not later than 30 June 1983 in the light of the scientific and economic data available. To this end, Member States shall, subject to considerations of commercial confidentiality, provide the Commission with the results of any study or research available to them. The Council shall adopt, as soon as possible and in any

---

(1) OJ No C 269, 21. 10. 1981, p. 5.
(2) OJ No C 125, 17. 5. 1982, p. 167.
(3) OJ No C 348, 31. 12. 1981, p. 19.
(4) OJ No L 90, 3. 4. 1980, p. 45.

event not later than 31 December 1983, on a proposal from the Commission, such further measures as may be necessary in the light of this re-examination.

Article 4

This Decision is addressed to the Member States.

Done at Brussels, 15 November 1982.

For the Council
The President
N. A. KOFOED

ANNEX

Definition of production capacity and reference figure for chlorofluorocarbons F-11 and F-12

1. Production capacity is defined as full capacity in 24 hours of continuous service, multiplied by the average number of days per year the plants are able to run under normal conditions of maintenance and safe operability.

   It is expressed in tonnes per year.

2. The reference figure for the total Community production capacity, including all 10 Community producers, is 480 000 tonnes per year based on a weighted mean of 332 working days per year. This includes all lines producing chlorofluorocarbons F-11 and F-12 on 26 March 1980, either exclusively or on a seasonal basis.

COUNCIL DIRECTIVE

of 3 December 1982

on a limit value for lead in the air

(82/884/EEC)

(as amended by the Act of Accession of Spain and Portugal of 12 June 1985
(OJ L 302, 15.11.85, p. 9))

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 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 one of the essential tasks of the European Economic Community is to promote throughout the Community a harmonious development of economic activities and a continuous and balanced expansion, which cannot be imagined in the absence of a campaign to combat pollution and nuisances or of an improvement in the quality of life and the protection of the environment;

Whereas the use of lead is currently causing lead contamination of many areas of the environment;

Whereas inhaled lead contributes significantly to the total body burden of lead;

Whereas the protection of human health against the hazards of lead requires that the individual's exposure to lead in the air be monitored;

Whereas the first (⁴) and second (⁵) programme of action of the European Communities on the environment state that this pollutant should receive priority consideration; whereas the said programmes provide for the coordination of national programmes in this field and for the harmonization of national policies within the Community on the basis of a common long-term plan aiming at improving the quality of life; whereas since the specific powers of action required to this end have not been provided for in the Treaty, it is necessary to invoke Article 235 thereof;

Whereas insufficient technical and scientific information is available to enable the Council to lay down specific standards for the environment generally; whereas the adoption of limit values for the protection of human health will contribute to the protection of the environment as well;

Whereas it is desirable to fix a limit value for lead in the air;

Whereas the measures taken pursuant to this Directive must be economically feasible and compatible with balanced development; whereas in consequence a sufficient time limit should be laid down for its implementation; whereas account should also be taken of the provisions of Council Directive 78/611/EEC of 29 June 1978 on the approximation of the laws of the Member States concerning the lead content of petrol (⁶);

Whereas it is desirable to monitor the quality of the air in places where people may be exposed continuously and for a long period and where there is a risk that the limit value may not be observed;

Whereas it is important that the Commission should obtain information concerning the sites used for sampling, the sampling and analysis procedures used to determine the concentration of lead in the air, the places where the limit value laid down in the Directive has been exceeded and the concentrations measured in these places as well as the measures taken to avoid a repetition of the occurrence;

Whereas each year as from the second year after the implementation of this Directive the Commission should publish a summary report on the implemen-

---

(¹) OJ No C 154, 7. 7. 1975, p. 29.
(²) OJ No C 28, 9. 2. 1976, p. 31.
(³) OJ No C 50, 4. 3. 1976, p. 9.
(⁴) OJ No C 112, 20. 12. 1973, p. 1.
(⁵) OJ No C 139, 13. 6. 1977, p. 1.
(⁶) OJ No L 197, 22. 7. 1978, p. 19.

tation of national provisions adopted pursuant to the Directive;

Whereas the application of the measures taken pursuant to this Directive should not lead to a noticeable deterioration of the quality of the air where the level of lead pollution observed when the Directive is implemented is lower than the limit value fixed;

Whereas, to implement the Directive, it is desirable to comply with the characteristics adopted in the Annex for choosing the sampling method; whereas, to analyze the samples taken, it is desirable to use the reference method adopted in the Annex or any other method for which the Commission has previously had proof that it provides equivalent results;

Whereas further development of the characteristics to be complied with for choosing a sampling method and the reference method of analysis, set out in the Annex to this Directive, may be desirable in the light of technical and scientific progress achieved in this field; whereas, to facilitate the implementation of the necessary work, it is desirable to provide for a procedure introducing close cooperation between the Member States and the Commission within a committee responsible for adapting the Directive to scientific and technical progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. This Directive shall fix a limit value for lead in the air specifically in order to help protect human beings against the effects of lead in the environment.

2. This Directive shall not apply to occupational exposure.

Article 2

1. For the purpose of this Directive, 'limit value' means the concentration of lead in the air which, subject to the conditions laid down hereinafter, must not be exceeded.

2. The limit value shall be 2 micrograms Pb/m^3 expressed as an annual mean concentration.

3. Member States may, at any time, fix a value more stringent than that laid down in this Directive.

Article 3

1. Member States shall take the necessary measures to ensure that five years after notification of this Directive, the concentration of lead in the air, measured in accordance with Article 4, is not greater than the limit value given in Article 2.

2. Where a Member State considers that the limit value fixed in Article 2 (2) may be exceeded in certain places four years after notification of this Directive, it shall inform the Commission thereof.

3. The Member States concerned shall, within two years of the implementation of this Directive, forward to the Commission plans for the progressive improvement of the quality of the air in such places. These plans, drawn up on the basis of relevant information as to the nature, origin and development of the pollution, shall in particular describe the measures already taken or envisaged and the procedures implemented or planned by the Member States concerned. The objective of these measures and procedures must be to bring the concentration of lead in the air in those places below the level of the limit value fixed in Article 2 (2) or down to that level, as soon as possible and at the latest seven years after notification of this Directive. These measures and procedures must take into account the provisions of Directive 78/611/EEC and the results of its application.

Article 4

Member States shall ensure that sampling stations are installed and operated at places where individuals may be exposed continually for a long period and where they consider that Articles 1 and 2 are likely not to be observed.

Article 5

1. For the purposes of applying this Directive, the Member States shall provide the Commission at its request with information on:

- the sites used for sampling,
- the sampling and analysis procedures used to determine the concentration of lead in the air.

2. Member States shall inform the Commission not later than 1 July of each year, beginning in the calendar year following the implementation of this Directive, of the places in which the limit value fixed in Article 2 (2) has been exceeded in the previous calendar year and of the concentrations recorded.

3. They shall also notify the Commission, not later than during the calendar year following that in which the limit values were exceeded, of the measures they have taken to avoid recurrence.

Article 6

The Commission shall each year publish a summary report on the application of this Directive, commencing in the second year following its implementation.

Article 7

Application of the measures taken pursuant to this Directive must not bring about a significant deterioration in the quality of the air where the level of pollution by lead, at the time of implementation of this Directive, is low in relation to the limit value fixed in Article 2 (2).

Article 8

For the purposes of applying this Directive, Member States shall comply with the characteristics laid down in the Annex for choosing the sampling method; for analyzing the samples taken, Member States shall use the reference method mentioned in the Annex or any other method which they prove to the Commission beforehand produces equivalent results.

Article 9

The procedure in Articles 10 and 11 for the adaptation of this Directive to scientific and technical progress shall relate to the characteristics to be complied with for choosing a sampling method and the reference method referred to in the Annex.

This adaptation must not have the effect of directly or indirectly modifying the application of the actual concentration value fixed in Article 2 (2).

Article 10

1. A committee on the adaptation of this Directive to scientific and technical progress hereinafter called 'the committee', is hereby set up; it shall consist of representatives of the Member States with a Commission representative as chairman.

2. The committee shall adopt its own rules of procedure.

Article 11

1. Where the procedure laid down in this Article is to be followed, the matter shall be referred to the committee by its chairman, either on his own initiative or at the request of a representative of a Member State.

2. The Commission representative shall submit to the committee a draft of the measures to be taken. The committee shall give its opinion on that draft within a time limit set by the chairman having regard to the urgency of the matter. Opinions shall be delivered by a majority of 54 votes, the votes of the Member States being weighted as provided in Article 148 (2) of the Treaty. The chairman shall not vote.

3. Where the measures envisaged are in accordance with the opinion of the committee, the Commission shall adopt them.

Where the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall without delay submit to the Council a proposal on the measures to be taken. The Council shall act by a qualified majority.

If within three months of the proposal being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 12

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within 24 months of its notification and shall forthwith inform the Commission thereof.

2. Member States shall forward to the Commission the texts of the provisions of national law which they adopt in the field governed by this Directive.

Article 13

This Directive is addressed to the Member States.

Done at Brussels, 3 December 1982.

For the Council

The President

Ch. CHRISTENSEN

ANNEX

CHARACTERISTICS TO BE COMPLIED WITH FOR CHOOSING A SAMPLING METHOD AND A REFERENCE METHOD FOR ANALYZING THE CONCENTRATION OF LEAD IN THE AIR

The atmospheric particles shall be collected on the filter of a sample for subsequent determination of lead content.

A. Characteristics to be complied with for choosing the sampling method

1. *Filter*

The filter shall have a collection efficiency at the face velocity used in the sampling of not less than 99 % for all particles of a mean aerodynamic diameter of 0·3 μm.

2. *Sampler efficiency*

The sampler efficiency is defined as the ratio of the mass concentration of the particles in the air, as collected on the filter, to the concentration in the atmosphere. The efficiency of a sampler may not be less than the values given in the following table and must be independent of wind direction.

Minimum acceptable efficiencies (%) for a sampler

Wind speed	*Particle size (aerodynamic diameter)*	
	5 μm	10 μm
2 ms^{-1}	95	65
4 ms^{-1}	95	60
6 ms^{-1}	85	40

3. *Aspiration flow rate of sampling*

The aspiration flow rate of sampling must remain constant to within ± 5 % of the nominal value throughout a sampling period.

4. *Location*

As far as possible the sampling stations (or samplers) must be located in such a way as to be representative of the zones in which measurements must be made.

5. *Operation*

Sampling must be continuous although breaks of a few minutes each day or week are permissible to enable filters to be changed. An annual mean value will not be considered valid unless sampling has occurred on a minimum of 10 working days per month, during the first five years after the notification of the Directive and on a minimum of 15 working days per month thereafter, as far as possible, evenly spread over the period under consideration. The mean annual value is calculated by dividing the sum of the valid daily values by the number of days on which valid values have been obtained.

B. Reference method of analysis

The reference method of analysis shall be atomic absorption spectrometry in which the analytical error for the determination of lead in the collected particles is less than a value corresponding to an atmospheric concentration of 0·1 μg m^{-3} of lead (5 % of the 2 μg m^{-3} limit value). This analytical error should be maintained within the specified range by an appropriate calibration frequency.

COUNCIL DIRECTIVE

of 20 March 1985

on the approximation of the laws of the Member States concerning the lead content of petrol

(85/210/EEC)

(as amended by Council Directive 85/581/EEC of 20 December 1985 adapting, on account of the accession of Spain and Portugal, Directive 85/210/EEC on the approximation of the laws of the Member States concerning lead content of petrol (OJ L 372, 31.12.85, p. 37))

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 protection and improvement of public health and of the environment are at present, and will in the future be, one of the items of major concern for all industrialized countries; whereas the effects on public health and the environment of pollution caused by substances emitted in the exhaust gas of vehicles must be regarded as serious owing to the continuous increase in the volume of motor vehicle traffic;

Whereas Council Directive 78/611/EEC of 29 June 1978 on the approximation of the laws of the Member States concerning the lead content of petrol (⁴) fixed a maximum value for the permitted lead-compound content of petrol of between 0,40 and 0,15 g/l;

Whereas the third action programme on the environment, the general approach of which was approved in the resolution of 7 February 1983 (⁵) by the Council and the representatives of the governments of the Member States meeting within the Council, provides for further efforts to reduce considerably the present levels of exhaust pollution;

Whereas existing or future disparities in the national laws of the Member States concerning the composition of petrol and in particular the rules governing the limitations on the lead content and on the benzene content of motor vehicle petrol may directly affect the functioning of the common market;

Whereas refining technology allows for a lowering of the lead content of leaded petrol to 0,15 g Pb/l without adverse effects on the quality of petrol;

Whereas the reduction and, ultimately, the elimination of lead in petrol will improve the health protection of the population, particularly in areas with dense traffic; whereas the early introduction of unleaded petrol is also desirable to permit, where appropriate, the application of certain anti-pollution technologies for drastically reducing polluting emissions from motor vehicles, in particular nitrogen oxides and unburned hydrocarbons;

Whereas for a certain time leaded petrol must continue to be available on Member States' markets alongside unleaded petrol, in order to satisfy, given the prevailing economic and technical conditions, the requirements of a large proportion of the existing vehicle fleet;

(¹) OJ No C 178, 6. 7. 1984, p. 5.
(²) OJ No C 12, 14. 1. 1985, p. 56.
(³) OJ No C 25, 28. 1. 1985, p. 46.
(⁴) OJ No L 197, 20. 7. 1978, p. 19.
(⁵) OJ No C 46, 17. 2. 1983, p. 1.

Whereas, owing to the importance of preventive measures against adverse effects on public health and the environment, Member States should be enabled to introduce unleaded petrol on to their markets before the compulsory date laid down for the Community as a whole;

Whereas the protection of public health also requires a limitation on the benzene content of petrol;

Whereas the quality of unleaded 'premium' petrol in terms of minimum research and motor octane numbers should be guaranteed in order to ensure satisfactory operation throughout the Community of motor vehicles designed to be fuelled by such petrol;

Whereas it should be possible to market another unleaded 'regular' petrol with lower octane ratings;

Whereas lead is only an additive to petrol; whereas the reduction or elimination of lead must not have the effect of significantly increasing other pollutants contained in the exhaust gases of motor vehicles as a consequence of modifications in the composition of petrol;

Whereas the reduction of lead content and the introduction of unleaded petrol at a given date must in no way affect the free circulation, or the putting on the market, of petrol within the Community;

Whereas a regular check at the final distribution stage, on the lead and benzene content of petrol is required to ensure that consumers receive the appropriate type of petrol;

Whereas a certain proportion of the existing motor vehicle fleet could run on unleaded petrol; whereas the Member States should therefore be requested to take all appropriate measures compatible with the Treaty to promote the widest possible use of unleaded petrol;

Whereas further examination of some aspects of the measures taken to reduce the concentrations of lead or other polluting substitutes in the atmosphere should be continued at Community level; whereas Member States should, where appropriate, provide the Commission with all relevant information;

Whereas the subsequent development of reference methods for measuring the lead and benzene content of petrol and for calculating octane ratings referred to in this Directive may be desirable in the light of scientific and technical progress in this area; whereas, in order to facilitate implementation of the work necessary to this end, a procedure should be set up to establish close cooperation between the Member States and the Commission within a Committee on Adaptation to Scientific and Technical Progress;

Whereas, by reason of their geographical position and the possible consequences for their oil markets of applying this Directive, the French overseas departments should be excluded from its scope,

HAS ADOPTED THIS DIRECTIVE:

Article 1

For the purposes of this Directive:

(a) 'petrol' shall mean any volatile mineral oil intended for the operation of internal combustion spark-ignited engines used for the propulsion of vehicles;

(b) 'unleaded petrol' shall mean any petrol the contamination of which by lead compounds calculated in terms of lead, does not exceed 0,013 g Pb/l;

(c) 'leaded petrol' shall mean all petrol other than unleaded petrol. This shall have a maximum permitted lead-compound content, calculated in terms of lead, of not more than 0,40 g Pb/l and not less than 0,15 g Pb/l.

Article 2

1. As from the entry into force of this Directive, and subject to paragraphs 2 and 4, Member States shall continue to ensure the availability and balanced distribution of leaded petrol within their territories.

2. If, as the result of a sudden change in the supply of crude oil or petroleum products, it becomes difficult for a Member State to apply the limit on the maximum lead content of leaded petrol, that Member State may, after having informed the Commission, authorize a higher limit within its territory for a period of four months. The Council, acting by a qualified majority on a proposal from the Commission, may extend this period.

3. Member States shall, as soon as they consider it appropriate, reduce to 0,15 g Pb/litre the permitted lead-compound content, calculated in terms of lead, of leaded petrol put on their markets.

4. Member States may prohibit the marketing in their territory of leaded petrol having a motor octane number (MON) lower than 85 at the pump and a research octane number (RON) lower than 95 at the pump if such a measure is justified on grounds of the protection of human health and the environment and promotes the availability and balanced distribution of unleaded petrol within their territory in accordance with Article 3 (1).

5. If a Member State introduces into its rules the prohibition referred to in paragraph 4, it shall give at least six months' notice to the Commission and to the public. The Commission shall immediately inform the other Member States. Within three months of the date on which it receives notification from the Member State, the Commission shall examine the measures envisaged to ensure that they comply with this Directive and with other provisions of Community law.

Article 3

1. Subject to paragraphs 2 and 3, Member States shall take the necessary measures to ensure the availability and balanced distribution within their territories of unleaded petrol from 1 October 1989.

The first subparagraph shall not preclude measures being taken to introduce unleaded petrol on the market of a Member State from a date earlier than 1 October 1989.

2. Member States may, with the Commission's agreement, derogate from the first subparagraph of paragraph 1 for a period of four months if, as a result of a sudden change in the supply of crude oil or petroleum products, it becomes impossible to meet the demand for unleaded petrol of the quality specified in Article 5 (1). However, every effort must be made to maintain a minimum distribution network for unleaded petrol. The period of four months may be extended by the Council acting by a qualified majority on a proposal from the Commission.

3. Until 1 April 1990, Member States may, by way of derogation, allow the contamination of unleaded petrol by lead compounds to exceed 0,013 g Pb/l provided it does not exceed 0,020 g Pb/l. Until that date, all pumps carrying unleaded petrol should be clearly labelled to show that the lead content does not exceed either 0,020 or 0,013 g Pb/l, together with any appropriate supplementary advice.

Article 4

From 1 October 1989 the benzene content of leaded petrol and of unleaded petrol shall not exceed 5,0 % by volume.

Where recourse is had to the second subparagraph of Article 3 (1), this benzene limit shall apply to unleaded petrol from the date chosen at national level for the earlier introduction of such petrol.

Article 5

1. Subject to paragraph 2, unleaded petrol made available pursuant to Article 3 of this Directive shall have a minimum motor octane number (MON) of 85,0 and a minimum research octane number (RON) of 95,0 at the pump ('premium').

2. Paragraph 1 shall not preclude the introduction on to the market of a Member State of another unleaded petrol with lower octane numbers than those provided for in paragraph 1 ('regular').

Article 6

Member States shall take all appropriate steps to ensure that neither the reduction of the lead content of petrol nor the introduction of unleaded petrol causes a significant increase in the quality and/or quantity of pollutants in the gases emitted from motor vehicles.

Article 7

1. Subject to paragraph 2, Member States shall not prevent or restrict, on grounds of lead or benzene content, the free circulation and marketing of petrol which complies with this Directive.

2. When a Member State applies Article 2 (3), the maximum permitted lead content of leaded petrol placed on its market shall be fixed at 0,15 g Pb/l.

Article 8

1. Member States shall take appropriate measures to ensure compliance, at the final distribution stage, with the provisions relating to the maximum lead and benzene content of petrol, and to the quality of petrol as regards octane rating.

2. Where a Member State establishes that petrol fails to comply with Articles 1, 2, 4 and 5 it shall without undue delay take the necessary measures to ensure compliance with those provisions.

Article 9

1. The lead content of petrol shall be established in accordance with the procedures set out in section I of the Annex.

2. The benzene content of leaded and unleaded petrol shall be established in accordance with the procedure set out in Section II of the Annex.

3. The octane ratings (MON and RON) of unleaded petrol shall be determined in accordance with the procedure set out in Section III of the Annex.

Article 10

The procedures laid down in Articles 11 and 12 for the adaptation of this Directive to technical progress shall cover the subsequent development of the reference methods of analysis referred to in the Annex, taking into account in particular other equivalent methods.

Such adaptation must not result in any direct or indirect modification of the limit values laid down in this Directive.

Article 11

1. For the purposes of applying Article 10, a Committee on the adaptation of this Directive to scientific and technical progress, hereinafter called 'the Committee', shall be set up; it shall consist of representatives of the Member States, with a Commission representative as chairman.

2. The Committee shall adopt its own rules of procedure.

Article 12

1. Where the procedure laid down in this Article is invoked, the Committee shall be convened by the chairman, either on his own initiative or at the request of the representative of a Member State.

2. The Commission representative shall submit a draft of the measures to be taken to the Committee. The Committee shall give its opinion on the draft within a time limit set by the chairman having regard to the urgency of the matter. Decisions shall be taken by a majority of 54 votes, the votes of the Member States being weighted as provided in Article 148 (2) of the Treaty. The chairman shall not vote.

3. The Commission shall adopt the proposed measures if they are consistent with the opinion of the Committee,

Where the proposed measures are not consistent with the opinion of the Committee, or if no opinion is delivered, the Commission shall without delay submit to the Council a proposal on the measures to be taken. The Council shall decide by a qualified majority.

If, within three months of the proposal being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 13

Member States shall take appropriate measures to ensure as far as possible that leaded petrol is not used in motor vehicles designed to run on unleaded petrol.

Article 14

Member States are invited, for the purpose of applying Article 3, to promote the widest possible use of unleaded petrol in all existing vehicles capable of running on such fuel. To that end, they are invited to take such measures as they consider appropriate which are compatible with the Treaty.

Article 15

1. Member States shall supply the Commission, as early as possible, with information on:

- — the date of introduction of unleaded petrol on the market in accordance with Article 3,
- — the measures envisaged pursuant to Article 14.

2. At the request of the Commission, Member States shall supply:

(a) information which they have available on the annual quantities of leaded and unleaded petrol supplied to the internal Community market;

(b) a summary of the results of the measures taken in accordance with Article 8 (1);

(c) information which they have available on the effects on the application of this Directive, and in particular Article 6, on:

  - — the development of the concentrations of lead and polluting substitutes in the atmosphere,
  - — energy policy, in particular in the refinery and distribution sector.

Article 16

1. Member States shall take the measures necessary to comply with this Directive at the latest on 1 January 1986. They shall forthwith inform the Commission thereof.

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

Article 17

Directive 78/611/EEC shall cease to be applicable on 31 December 1985.

Article 18

This Directive shall not apply to the French overseas departments.

Article 19

This Directive is addressed to the Member States.

Done at Brussels, 20 March 1985.

For the Council
The President
A. BIONDI

ANNEX

REFERENCE METHODS

As regards the reference methods, the versions in the various languages published by ISO and ASTM respectively shall be authentic, as shall other language versions which the Commission certifies as conforming to them.

I. Reference method for measuring the lead content of petrol

A. *Leaded petrol*

For the measurement of the lead content of petrol, the reference method shall be that laid down in ISO 3830 (edition approved in 1981).

B. *Unleaded petrol*

For the measurement of the trace lead content of petrol, the reference method shall be that laid down in ASTM D. 3237 (approved edition dated 31 August 1979) using atomic absorption spectrometry.

II. Reference method for measuring the benzene content of petrol

For the measurement of the benzene content of petrol, the reference method shall be that laid down in ASTM D. 2267 (edition approved in 1978) using gas chromatographic determination with polar column and internal standard.

III. Reference methods for the determination of octane ratings

The octane ratings (motor octane number and research octane number) shall be determined by the methods described in ISO 5164 and ISO 5163 respectively (editions approved in 1977).

IV. Interpretation of results

The results of individual measurements shall be interpreted on the basis of the method described in ISO 4259 (published in 1979).

COUNCIL DIRECTIVE

of 7 March 1985

on air quality standards for nitrogen dioxide

(85/203/EEC)

(as amended by Council Directive 85/580/EEC of 20 December 1985 adapting, on account of the accession of Spain and Portugal, Directive 85/203/EEC on air quality standards for nitrogen dioxide (OJ L 372, 31.12.85, p. 36))

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Articles 100 and 235 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 programmes of action of the European Communities on the environment of 1973 (4), 1977 (5) and 1982 (6) provide that priority is to be given to measures against nitrogen dioxide because of its noxiousness and having regard to the current state of knowledge of its effects on human health and the environment;

Whereas insufficient technical and scientific information is available to enable the Council to lay down specific standards for the environment generally and whereas the adoption of limit values for the protection of human health will contribute to the protection of the environment as well;

Whereas any discrepancy between the provisions already applicable or being drawn up in the various Member States with regard to nitrogen dioxide in the air could give rise to unequal conditions of competition and could in consequence directly affect the functioning of the common market; whereas, therefore, the approximation of laws prescribed in Article 100 of the Treaty should be carried out in this area;

Whereas one of the basic tasks of the Community is to promote throughout the Community a harmonious development of economic activities and a continued and balanced expansion, which is inconceivable without an attack on pollution and nuisance or an improvement in the quality of life and the protection of the environment; whereas, since the Treaty has not provided the necessary powers, recourse must be had to Article 235 of the Treaty;

Whereas, in order to protect in particular human health and the environment, it is necessary to set for nitrogen dioxide a limit value which must not be exceeded in the territory of the Member States during specified periods and whereas this value should be based on the results of work carried out for the World Health Organization, particularly with regard to the dose/effect relationships established for this pollutant;

Whereas, despite the measures taken, it may not be possible to comply with the limit value in certain zones; whereas the Member States may be allowed temporary derogations on condition that they forward to the Commission plans for the gradual improvement of the quality of the air in these zones;

Whereas it is expected that the Council will shortly establish a further legal act enabling Member States to

---

(1) OJ No C 258, 27. 9. 1983, p. 3.
(2) OJ No C 337, 17. 12. 1984, p. 434.
(3) OJ No C 206, 6. 8. 1984, p. 1.
(4) OJ No C 112, 20. 12. 1973, p. 1.
(5) OJ No C 139, 13. 6. 1977, p. 1.
(6) OJ No C 46, 17. 2. 1983, p. 1.

impose significantly lower limit values for exhaust gases from motor vehicles;

Whereas the measures taken pursuant to this Directive must be economically feasible and compatible with balanced development;

Whereas nitrogen dioxide is also a precursor in the formation of photochemical oxidants which can be harmful to man and the environment and whereas preventive action can help reduce their formation;

Whereas it is necessary to establish measuring stations to monitor compliance with the limit value for nitrogen dioxide and whereas it is desirable that these stations also measure nitric oxide which is an intermediary step in the formation of nitrogen dioxide;

Whereas, in view of the existence of different methods of analysis in the Member States, it is necessary to permit, under certain conditions, the use of methods of analysis other than the reference method laid down in the Directive;

Whereas, in addition to the limit value, there is a need to provide for guide values to improve the protection of human health and contribute to the long-term protection of the environment;

Whereas subsequent changes in the reference method of analysis referred to in this Directive may be desirable in the light of technical and scientific progress in this area; whereas, in order to facilitate the implementation of the work necessary to this end, a procedure should be set up to establish close cooperation between Member States and the Commission within a Committee on Adaptation to Scientific and Technical Progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. The purpose of this Directive is to:

- fix a limit value (Annex I) for nitrogen dioxide in the atmosphere specifically to help protect human beings against the effects of nitrogen dioxide in the environment,
- lay down guide values (Annex II) for nitrogen dioxide in the atmosphere in order to improve the protection of human health and contribute to the long-term protection of the environment.

2. This Directive shall not apply to exposure at work or inside buildings.

Article 2

For the purposes of this Directive:

- 'limit value' means the concentration of nitrogen dioxide as defined in the table in Annex I which must not be exceeded throughout the territory of the Member States during specified periods and under the conditions laid down in the following Articles,
- 'guide values' means the concentrations of nitrogen dioxide as given in Annex II considered over specified periods and intended, in particular, to serve as reference points for the establishment of specific schemes within zones determined by the Member States.

Article 3

1. Member States shall take the necessary measures to ensure that as from 1 July 1987 the concentrations of nitrogen dioxide in the atmosphere measured in accordance with Annex III are not greater than the limit value given in Annex I.

2. However, when in particular circumstances the nitrogen dioxide concentrations in the atmosphere in certain zones are likely, despite the measures taken, to exceed the limit value in Annex I after 1 July 1987, the Member State concerned shall inform the Commission thereof before 1 July 1987.

It shall forward plans for the gradual improvement of the quality of the air in these zones to the Commission as soon as possible. These plans, drawn up on the basis of relevant information on the nature, origin and development of this pollution, shall describe, in particular, the measures taken or to be taken and the procedures implemented or to be implemented by the Member State concerned. These measures and procedures must aim at reducing the nitrogen dioxide concentrations in the atmosphere within these zones to values not exceeding the limit value given in Annex I as rapidly as possible and by 1 January 1994 at the latest.

Article 4

1. In the zones in which the Member State concerned considers it necessary to limit or prevent a foreseeable increase in pollution by nitrogen dioxide in the wake of urban or industrial development in particular, it may fix values lower than the limit value in Annex I.

2. In zones which the Member State concerned considers should be afforded special environmental protection, it may fix values which are generally lower than the guide values in Annex II.

Article 5

Member States may, at any time, fix values more stringent than those laid down in this Directive.

Article 6

Member States shall establish measuring stations to supply the data necessary for the application of this Directive in accordance with the specifications in Annex III, in particular in zones where the limit value is exceeded or likely to be exceeded and in the zones referred to in Article 4.

Such stations may also measure concentrations of nitric oxide.

Article 7

1. From 1 July 1987 Member States shall inform the Commission, not later than six months after the end (31 December) of the annual reference period, of instances in which the limit value laid down in Annex I has been exceeded and of the concentrations recorded.

2. Member States shall also notify the Commission, not later than one year after the end of the annual reference period, of the reasons for such instances and of the measures they have taken to deal with them.

3. In addition, Member States shall inform the Commission, at its request, of:

- the concentrations they have measured,
- the limit values, deadlines and timetables they have laid down,
- any appropriate measures they have taken,

concerning the zones referred to in Article 4 (1) and (2).

This information must also be made available to the public.

Article 8

The Commission shall publish periodically a summary report on the application of this Directive.

Article 9

The application of the measures taken pursuant to this Directive must not lead to a significant deterioration in the quality of the air in zones, outside urban areas, where the level of pollution by nitrogen dioxide at the time of implementation of this Directive is low in relation to the limit value laid down in Annex I.

Article 10

In applying this Directive, Member States shall use:

- either the reference method of analysis referred to in Annex IV,
- or any other method of analysis which the Commission has been shown is equivalent to the reference method.

Article 11

1. Where a Member State intends to fix, in a region near the border with one or more other Member States, values for concentrations of nitrogen dioxide in the atmosphere in accordance with Article 4 (1) and (2), it shall hold prior consultations with the Member States concerned. The Commission shall be informed and may attend such consultations.

2. Where the limit value given in Annex I or the values referred to in Article 4 (1) and (2) – provided that the latter values have been the subject of consultations in accordance with paragraph 1 – are or are likely to be exceeded following significant pollution which originates or may originate in another Member State, the Member States concerned shall hold consultations with a view to remedying the situation. The Commission shall be informed and may attend such consultations.

Article 12

The amendments necessary to adapt the specifications in Annex IV to technical progress shall be adopted in accordance with the procedure described in Article 14. These amendments shall not be such as to alter, directly or indirectly, the limit value laid down in Annex I.

Article 13

1. For the purposes of Article 12, a Committee on the Adaptation of this Directive to Scientific and Technical Progress, hereinafter called 'the Committee', shall be set

up, composed of representatives of the Member States with a Commission representative as Chairman.

2. The Committee shall adopt its own rules of procedure.

Article 14

1. Where the procedure laid down in this Article is to be followed, matters shall be referred to the Committee by its Chairman, either on his own initiative or at the request of the representative of a Member State.

2. The Commission representative shall submit a draft of the measures to be taken to the Committee. The Committee shall give its opinion on the draft within a time limit set by the Chairman having regard to the urgency of the matter. Decisions shall be taken by a majority of 54 votes, the votes of the Member States being weighted as provided in Article 148 (2) of the Treaty. The Chairman shall not vote.

3. The Commission shall adopt the proposed measures if they are consistent with the opinion of the Committee.

Where the proposed measures are not consistent with the opinion of the Committee, or if no opinion is delivered, the Commission shall without delay submit to the Council a proposal on the measures to be taken. The Council shall decide by a qualified majority.

If, within three months of the proposal being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 15

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 1 January 1987 at the latest and shall forthwith inform the Commission thereof.

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

Article 16

This Directive is addressed to the Member States.

Done at Brussels, 7 March 1985.

For the Council

The President

A. BIONDI

ANNEX I

LIMIT VALUE FOR NITROGEN DIOXIDE

(The value limit shall be expressed in µg/m³. The volume must be standardized at the following conditions of temperature and pressure: 293° K and 101,3 kPa)

Reference period (¹)	Limit value for nitrogen dioxide
Year	200
	98th percentile calculated from the mean values per hour or per period of less than an hour recorded throughout the year (²)

(¹) The annual reference period begins on 1 January in any given calendar year and ends on 31 December.

(²) To ensure that the validity of the calculation of the 98th percentile is recognized, 75 % of the possible values must be available and, as far as possible, distributed uniformly throughout the year in question for that particular measurement site.

In cases where the values measured on certain sites are not available over a period exceeding 10 days, the calculated percentile must mention this fact.

The calculation of the 98th percentile on the basis of the values recorded throughout the year is to be carried out as follows: the 98th percentile must be calculated from the values actually measured. The measured values should be rounded off to the nearest µg/m³. All the values are to be listed in increasing order for each site:

$$X_1 \leqslant X_2 \leqslant X_3 \leqslant \ldots\ldots\ldots \leqslant X_k \leqslant \ldots\ldots\ldots \leqslant X_{N-1} \leqslant X_N$$

The 98th percentile is the value of the component of rank k where k is calculated from the following formula:

$$k = (q \times N)$$

where q is equal to 0,98 for the 98th percentile and to 0,50 for the 50th percentile, N being the number of values actually measured. The value of (q × N) should be rounded off to the nearest whole number.

Where measuring equipment does not yet allow the production of discrete values but provides only classes of values higher than 1 µg/m³, the Member State concerned may, for the calculation of the percentile, use an interpolation, provided that the interpolation formula is accepted by the Commission and that the classes of values are not higher than 10 µg/m³. This temporary waiver is only valid for equipment currently installed for a time span not exceeding the life of the equipment and in any case limited to 10 years from the application of this Directive.

ANNEX II

GUIDE VALUES FOR NITROGEN DIOXIDE

(The value limit shall be expressed in µg/m³. The volume must be standardized at the following conditions of temperature and pressure: 293° K and 101,3 kPa)

Reference period	Guide values for nitrogen dioxide
Year	50
	50th percentile calculated from the mean values per hour or per period of less than an hour recorded throughout the year
	135
	98th percentile calculated from the mean values per hour or per period of less than an hour recorded throughout the year

The formula given in footnote (²) of Annex I must be used in calculating these percentiles, the value of q being 0,50 for the 50th percentile and 0,98 for the 98th percentile.

ANNEX III

MONITORING THE CONCENTRATION OF NITROGEN DIOXIDE

1. The purpose of measuring NO_2 concentrations in the environment is to assess the individual risk of exposure in excess of the limit value as closely as possible; measurement points should accordingly be chosen by the Member States wherever possible from among sites where this risk is likely to be the greatest.

   Two separate cases need to be considered:

   1.1. zones predominantly affected by pollution from motor vehicles and therefore limited to the vicinity of roads carrying heavy traffic;

   1.2. more extensive zones in which discharges from fixed sources also make a significant contribution to pollution.

2. In the case of 1.1, the measurement points should be selected so as to:

   — cover examples of the main types of zone predominantly affected by pollution from motor vehicles, particularly 'canyon' streets carrying heavy traffic and major intersections,

   — be, as far as possible, those in which NO_2 concentrations, as specified in paragraph 1, are likely to be among the highest.

3. The number of stations to be set up for the zones defined in paragraph 1.2 should reflect:

   — the extent of the polluted zone,

   — the uneven spatial distribution of the pollution.

   The choice of sites should not exclude 'canyon' streets carrying heavy traffic and major intersections as defined in paragraph 2 if there is a danger of the limit value being exceeded owing to substantial pollution from fixed sources of combustion.

4. The final reading of the instruments should be processed in such a way that an hourly mean or a mean of less than an hour may be calculated in accordance with the provisions of Annex I. In order to enable possible checks to be made, data should be stored where:

   — the limit value has not been exceeded, until the next periodic report by the Commission is drawn up as provided for in Article 8,

   — the limit value has been exceeded, until the measures called for in Article 3 have been taken.

ANNEX IV

REFERENCE METHOD OF ANALYSIS TO BE USED FOR THE PURPOSES OF THIS DIRECTIVE

The reference method of analysis used to determine nitrogen oxides shall be the chemiluminescence method described in ISO standard DIS 7996.

For these methods the language versions published by the ISO and any other versions certified by the Commission as being in line with them shall be considered authentic.

In using the measurement methods, the following points should be taken into consideration:

1. The sampling head should be at a distance of at least 0,5 m from buildings in order to avoid a screening effect.
2. The sampling line (pipes and connections) should be of inert materials (e.g. glass, PTFE, stainless steel) which do not alter the NO_2 concentration.
3. The sampling line between the sampling head and the instrument should be as short as possible. The time taken for gas volume samples to pass through the sampling line should not exceed 10 seconds.
4. The sampling head entry must be protected against rain and insects. If a pre-filter is used, it should be selected and maintained (regular cleaning) so as to minimize its influence on the NO_2 concentration.
5. Condensation in the sampling line must be avoided.
6. The sampling line should be cleaned regularly, taking local conditions into account.
7. Sampling should not be influenced by gas discharges from the instrument or discharges from the calibration system.
8. Sampling at the sampling head should not be influenced by adjoining installations (the air-conditioning or data transmission equipment).
9. All the necessary precautions must be taken to prevent temperature variations from producing an excessive percentage of errors of measurement.
10. The instruments should be calibrated regularly.
11. The sampling line must be air-tight and the flow-rate must be inspected regularly.

COUNCIL DIRECTIVE

of 24 November 1975

on the approximation of the laws of the Member States relating to the sulphur content of certain liquid fuels

(75/716/EEC)

(as amended by Council Directive 87/219/EEC of 30 March 1987 on the approximation of the laws of the Member States relating to the sulphur content of certain liquid fuels
(OJ L 91, 30.3.87, p. 19))

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;

Having regard to the Opinion of the European Parliament (1);

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

Whereas the laws, regulations or administrative provisions in force in the Member States lay down limits with respect to the sulphur content of liquid fuels; whereas these provisions differ from one Member State to another;

Whereas the differences in these laws oblige Community oil companies to adjust the maximum sulphur content of these products, depending on which Member State is being supplied; whereas the aforementioned differences thus constitute a barrier to trade in these products, thereby directly influencing the establishment and functioning of the common market;

Whereas certain Member States have notified the Commission of projects to limit and progressively reduce the sulphur content of fuels so as to achieve a reduction in sulphur dioxide emissions;

Whereas, in view of the considerable effect of the sulphur content of some liquid fuels on public health and the environment and with account being taken of the aforementioned projects, the sulphur content of gas oils must be progressively and significantly reduced at Community level;

Whereas this Directive is a first step towards reducing the sulphur content of liquid fuels and applies to gas oils only;

Whereas, to take account of the technical and economic consequences of reducing and limiting the sulphur content of gas oils and the local circumstances prevailing in the Member States, it will be necessary to define as from 1 October 1976 two types of gas oil, one for general use and the other for use restricted to zones which may be defined by the Member States;

Whereas a simplified procedure should be set up for revising the sulphur content for the two types of gas oil laid down as from 1980 in order to take account of any appreciable developments over the next few years in environmental requirements or desulphurization technology, or of substantial changes in the economic situation in the Community as regards the supply of crude oil; whereas, however, such revision could take place only before 1 October 1977 as the industry must know several years in advance the sulphur content which shall apply in order to draw up its programmes for desulphurization plant;

---

(1) OJ No C 76, 3. 7. 1974, p. 46.
(2) OJ No C 16, 23. 1. 1975, p. 6.

Whereas a sudden change in crude oil supplies leading to an increase in its average sulphur content may, in view of the available desulphurization capacity, jeopardize supplies to consumers in a Member State ; whereas it would therefore seem advisable to authorize that Member State to derogate under certain conditions from the sulphur content limits laid down in respect of its own market ;

Whereas the second stage of the programme for reducing the sulphur content of gas oil raises particular technical and economic problems for Ireland ; whereas an exemption for Ireland of limited validity ought not to have a depressing effect on trade in gas oil, since at the present time the refinery installations in Ireland do not cover more than part of its internal needs for gas oil and any exports by Ireland to another Member State in the future must comply with the provisions of the Directive applicable in that Member State ; whereas a five-year exemption should be granted to Ireland before it passes on to the second stage ;

Whereas checks should be carried out to ascertain the sulphur content of gas oils placed on the market ; whereas a uniform method should be adopted for the purpose,

HAS ADOPTED THIS DIRECTIVE :

Article 1

1. For the purposes of this Directive, gas oil shall mean any petroleum product falling under subheading 27.10 C I of the Common Customs Tariff (10 December 1984 edition) or any petroleum product which, by reason of its distillation limits, falls into the category of middle distillates intended for use as fuel and of which at least 85 % by volume, including distillation losses, distils at 350 °C.

2. Paragraph 1 shall not apply to gas oils :

— used by shipping,

— contained in the fuel tanks of inland waterway vessels or of motor vehicles travelling from one zone to another or crossing a frontier between a third country and a Member State,

— intended for processing in the refining industry.

Article 2

1. Member States shall take all necessary steps to ensure that gas oils can be marketed in the Community only if their sulphur compound content, expressed in sulphur, does not exceed 0,3 % by weight as from 1 January 1989.

2. Should environmental requirements or the state of desulphurization technology change appreciably or should the economic situation in the Community as regards the supply of crude oil change substantially, the Commission may, on its own initiative or at the request of a Member State, propose amendments in accordance with the conditions laid down by the Treaty, to the sulphur content indicated in paragraph 1.

3. If, as the result of a sudden change in the supply of crude oil or petroleum products, it becomes difficult for a Member State to apply the limit on the maximum sulphur content of gas oil, that Member State may, after informing the Commission, authorize a higher limit within its territory for a period of four months. The Council, acting by a qualified majority on a proposal from the Commission, may extend this period.

Article 3

The Member States may implement the provisions of Article 2 (1) more rapidly than is provided for therein.

Article 4

Without prejudice to Article 5, the Member States may not, as from the date of application laid down in Article 2, due account being taken of Article 3, prohibit, restrict or impede the marketing of gas oils, on the grounds of sulphur content, provided they comply with the requirements of this Directive.

Article 5

1. Member States may require the use of gas oils with a sulphur content equal to 0,2 % by weight :

— within the zones they have determined under Article 4 of Council Directive 80/779/EEC of 15 July 1980 on air quality limit values and guide values for sulphur dioxide and suspended particulates (1) ; as last amended by the Act of Accession of Spain and Portugal,

— wherever Article 5 of the same Directive is applicable,

— where damage to the environment or to the national heritage caused by total sulphur dioxide emissions requires the sulphur content of gas oil to be fixed at a lower value than that provided for in Article 2.

2. Member States shall inform the other Member States and the Commission of any measures which they contemplate taking in respect of paragraph 1 and of their grounds for taking them.

Marketing of any gas oil with a sulphur content of less than 0,2 % may not be prohibited.

Article 6

The Commission shall monitor the effects of applying this Directive.

Three years at the latest after the notification (²) of this Directive, in the light of any new information available on the atmospheric sulphur dioxide pollution levels recorded, on progress towards defining air quality objectives, on the state of the environment and on the harmful effects of air pollution, and on condition on the gas oil market, the Commission shall submit a report to the Council accompanied by an appropriate proposal with a view to the establishment of a single value.

The Council, acting in accordance with the provisions of the Treaty, shall decide on the Commission proposal before 1 December 1991.

Article 7

1. Member States shall take the necessary measures to check by sampling the sulphur content of gas oils which are marketed.

2. The reference method adopted for determining the sulphur content of gas oils which are marketed is defined by method IP 336. The statistical interpretation of the results of the checks made to determine the sulphur content of the gas oils marketed shall be made according to standard ISO 4259 (1979 edition).

Article 8

1. Member States shall implement the necessary laws, regulations and administrative provisions for compliance with this Directive within nine months of its notification and shall forthwith inform the Commission thereof.

2. Member States shall ensure that the text of national legislation which they adopt in the field covered by this Directive is communicated to the Commission.

Article 9

This Directive is addressed to the Member States.

Done at Brussels, 24 November 1975.

For the Council

The President

B. VISENTINI

(¹) OJ No L 229, 30. 8. 1980, p. 30.

(²) This Directive was notified to the Member States on 2 April 1987.

COUNCIL DIRECTIVE

of 15 July 1980

on air quality limit values and guide values for sulphur dioxide and suspended particulates

(80/779/EEC)

(as amended by Council Directive 81/857/EEC of 19 October 1981 adapting, consequent upon the accession of Greece, Directive 80/779/EEC on air quality limit values and guide values for sulphur dioxide and suspended particulates (OJ L 319, 7.11.81, p. 18) and the Act of Accession of Spain and Portugal of 12 June 1985 (OJ L 302, 15.11.85, p. 9))

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Articles 100 and 235 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament (¹),

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

Whereas the European Communities' programmes of action on the environment of 1973 (³) and 1977 (⁴) provide that priority is to be given to measures against sulphur dioxide and suspended particulates because of their toxicity and the current state of knowledge of their effects on human health and the environment;

Whereas, since any discrepancy between the provisions already applicable or being prepared in the various Member States with regard to sulphur dioxide and suspended particulates could give rise to unequal conditions of competition and could consequently directly affect the functioning of the common market, the legislative provisions in this area should be harmonized as prescribed in Article 100 of the Treaty;

Whereas one of the basic tasks of the European Economic Community is to promote throughout the Community a harmonious development of economic activities and a continued and balanced expansion; whereas such an achievement is inconceivable without measures to combat pollution, improve the quality of life and protect the environment; whereas, since the Treaty has not provided the necessary powers in this field, Article 235 of the Treaty must be invoked;

Whereas, in order to protect human health in particular, it is necessary to set for these two pollutants limit values which must not be exceeded in the territory of the Member States during specified periods; whereas these values should be based on the findings reached in the framework of the WHO, particularly with regard to the dose/effect relationships established for sulphur dioxide and suspended particulates taken together;

Whereas, despite the measures taken, it may not be possible to comply with these limit values in certain zones; whereas the Member States must therefore be allowed temporary derogations on condition that they forward to the Commission plans for the progressive improvement of the quality of the air in those zones;

Whereas guide values should also be set to serve as long-term precautions for health and the environment and as reference points for the establishment of specific schemes within zones determined by the Member States;

Whereas the measures taken pursuant to this Directive must be economically feasible and compatible with balanced development;

Whereas it is necessary to establish suitable monitoring of air quality and particularly of observance of the limit values; whereas the Member States should therefore be obliged to establish measuring stations to supply the data necessary for the application of the Directive;

Whereas since different sampling and analysis methods are applied in the Member States, it is necessary to permit, under certain conditions, the use of sampling and measurement methods other than the reference methods laid down in the Directive;

Whereas, since some Member States use particular methods of sampling and analysis which cannot easily be correlated with the reference methods, it is necessary that the Directive specify different limit values which are to be respected where such methods are used; whereas the Member States concerned should also carry out parallel measurements at a series of representative

---

(¹) OJ No C 83, 4. 4. 1977, p. 44.
(²) OJ No C 204, 30. 8. 1976, p. 34.
(³) OJ No C 112, 20. 12. 1973, p. 1.
(⁴) OJ No C 139, 13. 6. 1977, p. 1.

stations using the reference methods in addition to their own methods of measurement; whereas the Commission must make further proposals in the light of these parallel measurements and of the need to avoid discriminatory provisions;

Whereas the subsequent development of reference methods of sampling and analysis referred to in this Directive may be desirable in the light of technical and scientific progress in this area; whereas in order to facilitate implementation of the work necessary to this end, a procedure should be set up to establish close cooperation between the Member States and the Commission within a Committee on Adaptation to Scientific and Technical Progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

The purpose of this Directive is to fix limit values (Annex I) and guide values (Annex II) for sulphur dioxide and suspended particulates in the atmosphere and the conditions for their application in order to improve:

— the protection of human health,

— the protection of the environment.

Article 2

1. 'Limit values' means:

— the concentrations of sulphur dioxide and suspended particulates considered simultaneously in accordance with Table A in Annex I, and

— the concentrations of suspended particulates considered separately in accordance with Table B in Annex I,

which, in order to protect human health in particular, must not be exceeded throughout the territory of the Member States during specified periods and under the conditions laid down in the following Articles.

2. 'Guide values' means the concentrations of sulphur dioxide and suspended particulates over specified periods which are given in Annex II and are intended to serve as:

— long-term precautions for health and the environment,

— reference points for the establishment of specific schemes within zones determined by the Member States.

Article 3

1. Member States shall take appropriate measures to ensure that as from 1 April 1983 the concentrations of sulphur dioxide and suspended particulates in the atmosphere are not greater than the limit values given in Annex I, without prejudice to the following provisions.

2. Where a Member State considers that there is a likelihood that, despite the measures taken, the concentrations of sulphur dioxide and suspended particulates in the atmosphere might, after 1 April 1983, exceed in certain zones the limit values given in Annex I, it shall inform the Commission thereof before 1 October 1982.

It shall at the same time forward to the Commission plans for the progressive improvement of the quality of the air in those zones. These plans, drawn up on the basis of relevant information on the nature, origin and evolution of the pollution, shall describe in particular the measures taken or to be taken and the procedures implemented or to be implemented by the Member State concerned. These measures and procedures must bring the concentrations of sulphur dioxide and suspended particulates in the atmosphere within these zones to values below or equal to the limit values given in Annex I as soon as possible and by 1 April 1993 at the latest.

Article 4

1. In the zones in which the Member State concerned considers it necessary to limit or prevent a foreseeable increase in pollution by sulphur dioxide and suspended particulates in the wake of development, in particular urban or industrial development, the Member State shall, taking the guide values in Annex II as a reference point, fix values which must be lower than the limit values in Annex I.

2. In zones on its territory which the Member State concerned considers should be afforded special environmental protection, the Member State shall fix values which are generally lower than the guide values in Annex II.

3. Member States shall inform the Commission of the values, deadlines and timetables they have laid down for the zones referred to in paragraphs 1 and 2, and of any appropriate measures they have taken.

Article 5

In addition to the provisions referred to in Article 3 (1) and Article 4 (1), Member States shall, with the object of taking further precautions for the protection of health and the environment, endeavour to move towards the guide values in Annex II wherever the measured concentrations are higher than these values.

Article 6

Member States shall establish measuring stations designed to supply the data necessary for the application of this Directive, in particular in zones where the limit values referred to in Article 3 (1) are likely to be approached or exceeded and in the zones referred to in Article 3 (2); the stations must be located at sites where pollution is thought to be greatest and where the measured concentrations are representative of local conditions.

Article 7

1. Following the entry into force of this Directive, Member States shall inform the Commission, not later than six months after the end (31 March) of the annual reference period, of instances in which the limit values laid down in Annex I have been exceeded and of the concentrations recorded.

2. They shall also notify the Commission, not later than one year after the end of the annual reference period, of the reasons for such instances and of the measures they have taken to avoid their recurrence.

3. In addition, Member States shall forward information to the Commission, at its request, on the concentrations of sulphur dioxide and suspended particulates in any zones they have designated pursuant to Article 4 (1) and (2).

Article 8

The Commission shall each year publish a summary report on the application of this Directive.

Article 9

Application of the measures taken pursuant to this Directive must not bring about a significant deterioration in the quality of the air where the level of pollution by sulphur dioxide and suspended particulates at the time of implementation of this Directive is low in relation to the limit values set out in Annex I.

Article 10

1. For the purposes of applying this Directive, the Member States shall use either the reference methods of sampling and analysis referred to in Annex III or any other method of sampling and analysis in respect of which they demonstrate to the Commission at regular intervals:

— either that it ensures satisfactory correlation of results with those obtained using the reference method;

— or that measurements taken in parallel with the reference method at a series of representative stations chosen in accordance with the requirements laid down in Article 6 show that there is a reasonably stable relationship between the results obtained using that method and those obtained using the reference method.

2. Without prejudice to the provisions of this Directive, a Member State may also use, pending the decision of the Council on the proposals from the Commission referred to in paragraph 4, the sampling and analysis methods laid down in Annex IV and the values associated with these methods also laid down in Annex IV in substitution for the limit values set out in Annex I.

3. A Member State which decides to avail itself of the provisions of paragraph 2 must however take measurements in parallel at a series of representative measuring stations, chosen in accordance with the requirements of Article 6, in order to verify the corresponding stringency of the limit values set out in Annex IV and Annex I. The results of these parallel measurements, including in particular instances in which the limit values laid down in Annex I have been exceeded and the concentrations recorded, shall be forwarded to the Commission at regular intervals, and at least twice a year, for incorporation in the annual report provided for in Article 8.

4. The Commission shall, after five years, but within six years of the expiry of the limit of 24 months specified in Article 15 (1), submit a report to the Council on the results of the parallel measurements carried out under paragraph 3 and shall, having regard in particular to these results and to the need to avoid discriminatory provisions, make proposals relating to paragraph 2 and Annex IV. In the report provided for in Article 8 the Commission will indicate whether it has noted instances in which the limit values fixed in Annex I have been exceeded to a significant extent on repeated occasions.

5. The Commission shall, in selected locations in the Member States and in cooperation with the latter, carry out studies on the sampling and analysis of sulphur dioxide, and of black smoke and suspended particulates. These studies shall be designed in particular to promote the harmonization of methods of sampling and analysis of these pollutants.

Article 11

1. Where Member States fix in border regions values for concentrations of sulphur dioxide and suspended particulates in the atmosphere in accordance with Article 4 (1) and (2), they shall hold prior consultations. The Commission may attend such consultations.

2. Where the limit values given in Annex I or the values referred to in Article 4 (1) and (2), inasmuch as

the latter values have been the subject of consultations in accordance with paragraph 1, are or might be exceeded following significant pollution which originates or may have originated in another Member State, the Member States concerned shall hold consultations with a view to remedying the situation. The Commission may attend such consultations.

Article 12

The procedure laid down in Articles 13 and 14 for the adaptation on this Directive to technical progress shall cover the subsequent development of the reference methods of sampling and analysis referred to in Annex III. This adaptation must not result in any direct or indirect modification of effective concentration values given in Annexes I and II.

Article 13

1. For the purpose of Article 12 a Committee on the adaptation of this Directive to scientific and technical progress, hereinafter called 'the Committee', shall be set up; it shall consist of representatives of the Member States, with a Commission representative as chairman.

2. The Committee shall adopt its own rules of procedure.

Article 14

1. Where the procedure laid down in this Article is invoked, the Committee shall be convened by the chairman, either on his own initiative or at the request of the representative of a Member State.

2. The Commission representative shall submit a draft of the measures to be taken to the Committee. The Committee shall give its opinion on the draft within a time limit set by the chairman having regard to the urgency of the matter. Decisions shall be taken by a majority of 54 votes, the votes of the Member States being weighted as provided in Article 148 (2) of the Treaty. The chairman shall not vote.

3. The Commission shall adopt the proposed measures if they are consistent with the opinion of the Committee.

Where the proposed measures are not consistent with the opinion of the Committee, or if no opinion is delivered, the Commission shall without delay submit to the Council a proposal on the measures to be taken. The Council shall decide by a qualified majority.

If within three months of the proposal being submitted to it the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 15

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within 24 months of its notification and shall forthwith inform the Commission thereof.

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

Article 16

This Directive is addressed to the Member States.

Done at Brussels, 15 July 1980.

For the Council

The President

J. SANTER

ANNEX I

LIMIT VALUES FOR SULPHUR DIOXIDE AND SUSPENDED PARTICULATES

(As measured by the black-smoke method)

TABLE A

Limit values for sulphur dioxide expressed in µg/m^3 with the associated values for suspended particulates (as measured by the black-smoke method (¹)) expressed in µg/m^3

Reference period	Limit value for sulphur dioxide	Associated value for suspended particulates
Year	80 (median of daily mean values taken throughout the year)	> 40 (median of daily mean values taken throughout the year)
	120 (median of daily mean values taken throughout the year)	≤ 40 (median of daily mean values taken throughout the year)
Winter (1 October to 31 March)	130 (median of daily mean values taken throughout the winter)	> 60 (median of daily mean values taken throughout the winter)
	180 (median of daily mean values taken throughout the winter)	≤ 60 (median of daily mean values taken throughout the winter)
Year (made up of units of measuring periods of 24 hours)	250 (²) (98 percentile of all daily mean values taken throughout the year)	> 150 (98 percentile of all daily mean values taken throughout the year)
	350 (²) (98 percentile of all daily mean values taken throughout the year)	≤ 150 (98 percentile of all daily mean values taken throughout the year)

(¹) The results of the measurements of black smoke taken by the OECD method have been converted into gravimetric units as described by the OECD (see Annex III).

(²) Member States must take all appropriate steps to ensure that this value is not exceeded for more than three consecutive days. Moreover, Member States must endeavour to prevent and to reduce any such instances in which this value has been exceeded.

TABLE B

Limit values for suspended particulates (as measured by the black-smoke method (¹)) expressed in $\mu g/m^3$

Reference period	Limit value for suspended particulates
Year	80 (median of daily mean values taken throughout the year)
Winter (1 October to 31 March)	130 (median of daily mean values taken throughout the winter)
Year (made up of units of measuring periods of 24 hours)	250 (²) (98 percentile of all daily mean values taken throughout the year)

(¹) The results of the measurements of black smoke taken by the OECD method have been converted into gravimetric units as described by the OECD (see Annex III).

(²) Member States must take all appropriate steps to ensure that this value is not exceeded for more than three consecutive days. Moreover, Member States must endeavour to prevent and to reduce any such instances in which this value has been exceeded.

ANNEX II

GUIDE VALUES FOR SULPHUR DIOXIDE AND SUSPENDED PARTICULATES

(as measured by the black-smoke method)

TABLE A

(Guide values for sulphur dioxide expressed in $\mu g/m^3$

Reference period	Guide value for sulphur dioxide
Year	40 to 60 (arithmetic mean of daily mean values taken throughout the year)
24 hours	100 to 150 (daily mean value)

TABLE B

Guide values for suspended particulates (as measured by the black-smoke method (¹)) expressed in $\mu g/m^3$

Reference period	Guide value for suspended particulates
Year	40 to 60 (arithmetic mean of daily mean values taken throughout the year)
24 hours	100 to 150 (daily mean value)

(¹) The results of the measurements of black smoke taken by the OECD method have been converted into gravimetric units as described by the OECD (see Annex III).

ANNEX III

REFERENCE METHODS OF SAMPLING AND ANALYSIS TO BE EMPLOYED WITHIN THE CONTEXT OF THIS DIRECTIVE

A. SULPHUR DIOXIDE

The reference method of sampling for the determination of sulphur dioxide uses the equipment described in International Standard ISO-4219, first edition 1979/09/15. The sampling period is normally 24 hours.

The reference method of analysis is that described in detail in Annex V; it is based on Draft International Standard ISO DP-6767, revised February 1979 : 'Air quality — determination of the mass concentration of sulphur dioxide in ambient air — tetrachloromercurate (TCM)/pararosaniline'. This method of analysis is based on the principle of the colorimetric reaction with pararosaniline.

B. SUSPENDED PARTICULATES

For the determination of black smoke and its conversion into gravimetric units, the method standardized by the OECD working party on methods of measuring air pollution and survey techniques (1964) is considered to be the reference method.

For the above-noted methods, standardized respectively by ISO and OECD, the linguistic versions published by these organizations will be regarded as authentic together with the other versions which the Commission will certify as being in conformity therewith.

ANNEX IV

LIMIT VALUES FOR SULPHUR DIOXIDE AND SUSPENDED PARTICULATES (AS MEASURED BY A GRAVIMETRIC METHOD) APPLICABLE WITHIN THE CONTEXT OF ARTICLE 10 (2)

TABLE A

Limit values for sulphur dioxide expressed in µg/m³

Reference period	Limit value for sulphur dioxide
Year	140 (arithmetic mean of 30 minute values taken throughout the year)
Year (made up of units of measuring periods of 30 minutes)	400 (95 percentile of all 30 minute values taken throughout the year)

TABLE B

Limit values for suspended particulates (as measured by the gravimetric method described in (ii) below) expressed in µg/m³

Reference period	Limit value for suspended particulates
Year	150 (arithmetic mean of daily mean values taken throughout the year)
Year (made up of units of measuring periods of 24 hours)	300 (95 percentile of all daily mean values taken throughout the year)

The methods of sampling and analysis applicable within the context of Article 10 (2) are with respect to:

(i) **Sulphur dioxide**

— *Method of sampling:* measuring stations permitting 'random' sampling are used with a grid network of the type represented by Figure 1. At each point of the network at least 13 samples per year are taken between 8 a.m. and 4 p.m. on working days. The different samples are collected for 30 minutes continuous duration at regular intervals throughout the year, for example as follows:

On the first day, samples are taken at the points marked 'a' in Figure 1, on the second day on the points marked 'b', on the third day at the points marked 'c' and on the fourth day at the points marked 'd'. These samplings are repeated for each point at intervals of four weeks for different periods of 30 minutes chosen 'at random'.

— Evaluation period:	one year,
— number of points:	16 in a grid network,
— sampling duration:	30 minutes continuous between 8 a.m. and 4 p.m. on working days,
— number of samples per point:	at least 13,
— total number of samples:	at least 208.

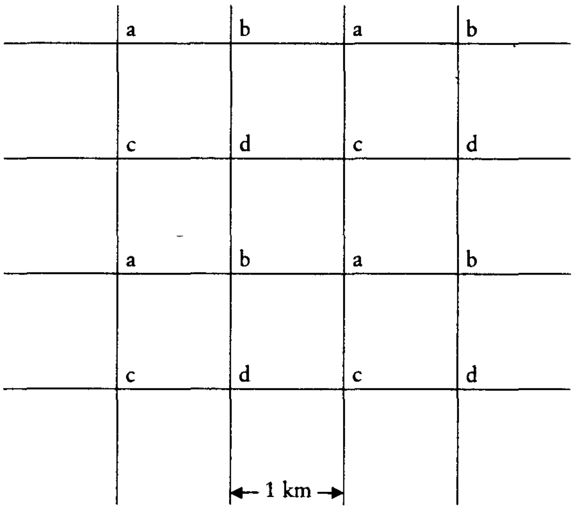


Figure 1

Sampling scheme

— *Method of analysis:* the reference method of Annex III. The procedure set out in Article 10 (1) applies.

(ii) **Suspended particulates**

— *Method of sampling:*

1. The suspended particulates are collected on a filter composed of either membrane or glass-fibre.
2. The sampling system consists of:
   - — a filter,
   - — a filter support,
   - — a pump,
   - — a volumetric gasmeter.
3. The sampling system does not include a fractionating device.
4. The sampling duration is 24 hours.
5. The filter is protected against direct deposition of particles by sedimentation and against the direct influence of atmospheric conditions.
6. The filters used should have an efficiency of more than 99 % for particles having an aerodynamic diameter of 0·3 µm.
7. The air velocity at the surface of the filter is between 33 and 55 cm/sec inclusive. The reduction in the speed throughout the sampling duration must not exceed 5 % if glass-fibre filters are used or 25 % if membrane filters are used.
8. The number of samplings made throughout the year must be at least 100, uniformly spread throughout this period.

— *Method of analysis:*

(a) Analysis is by weighing.

(b) 1. Membrane filters are to be conditioned, before and after sampling, by holding them at a constant temperature between 90 and 100 °C for two hours and subsequently storing them in a dessicator for two hours before weighing.

(b) 2. Glass-fibre filters are to be conditioned, before and after sampling, by holding them for a period of 24 hours in an atmosphere at 20 °C and 50 % relative humidity before weighing.

ANNEX V

REFERENCE METHOD OF ANALYSIS FOR SULPHUR DIOXIDE

Air quality — Determination of the mass concentration of sulphur dioxide in ambient air — Tetrachloromercurate (TCM)/pararosaniline method

1. SCOPE

This draft international standard specifies a spectrophotometric method for the determination of the mass concentration of sulphur dioxide in ambient air. The standard comprises methods for both sampling and analysis.

2. FIELD OF APPLICATION

With the procedure described in this standard, atmospheric sulphur dioxide concentrations between 7 and 1 150 µg/m³ can be determined.

Note

If higher concentrations have to be determined aliquots of the sample solution or smaller air samples than specified in this standard can be taken. In this case the absorption efficiency of the concentrations under study.

Interferences from heavy metals, oxides of nitrogen, ozone and reduced sulphur compounds (e.g. hydrogen sulphide and mercaptanes) are eliminated or minimized. Sulphuric acid and sulphates do not interfere. No interference of sulphur trioxide has been experimentally ascertained, since this presumably becomes hydrated to sulphuric acid in the absorbing solution.

3. PRINCIPLE

A measured air sample is drawn through a solution of sodium tetrachloromercurate (TCM) and the sulphur dioxide present in the air is absorbed by formation of a dichlorosulphitomercurate complex.

The sample solution is treated with a solution of sulphamic acid to destroy the nitrite anion formed by the oxides of nitrogen present in the air. It is then treated with solutions of formaldehyde and acid-bleached pararosaniline containing phosphoric acid to obtain a pH of 1·6 ± 0·1.

Pararosaniline, formaldehyde and the bisulphite anion react to form the intensely coloured pararosaniline methyl sulphonic acid, which behaves as a two-colour indicator ($\lambda_{max} = 548$ nm at pH 1·6 ± 0·1).

The concentration of sulphur dioxide is taken from a calibration graph prepared on the basis of calibration gas mixtures (6.3.1). According to the equipment available in the laboratory it may be convenient in certain cases, for routine checks to replace the calibration gas mixtures by sodium bisulphite solutions of known concentration. However, this procedure should only be used after a proper calibration with a permeation device.

4. REAGENTS

4.1. All reagents shall be of analytical quality (pro analysi).

Unless otherwise indicated, references to water shall mean distilled water. The water must be free from oxidants and should preferably be double-distilled from an all-glass apparatus.

4.2. Absorbing solution: 0·04 moles/l sodium tetrachloromercurate (TCM).

Dissolve 10·9 g of mercury (II) chloride, 4·7 g of sodium chloride and 0·07 g of ethylendiamine tetracetic acid disodium salt (EDTA) in water and dilute to 1 litre.

The solution is stable for several months and should be discarded if a precipitate is formed.

Notes

1. The amount of EDTA added eliminates possible interferences from heavy metals up to 60 µg of iron (III), 10 µg of manganese (II), 10 µg of chromium (III), 10 µg of copper (II) and 22 µg of vanadium (V) in 10 ml of absorbing solution.
2. The solution is highly poisonous and should be handled as such. A method for recovering the mercury after the analysis is given in Annex C. If any absorbing solution is spilt on the skin, it must be flushed off with water immediately.

4.3. **Hydrochloric acid, 1 mole/l**

Dilute 86 ml of concentrated hydrochloric acid, HCl ($\rho = 1{\cdot}19$ g/ml, to 1 litre.

4.4. **Pararosaniline hydrochloride, 0·2 % stock solution**

Dissolve 0·2 g of pararosaniline hydrochloride, $C_{19}H_{17}N_3{\cdot}HCl$ in 100 ml of hydrochloric acid (4.3).

Note

Pararosaniline hydrochloride used in the preparation of the stock solution must have a purity higher than 95 % (see Annex D) and exhibit a maximum absorption at 540 nm in acetic acid — sodium acetate buffer (0·1 moles/l). Furthermore, the absorbance of the reagent blank should not exceed 0·10 when the blank is prepared according to the procedure described in section 6.2.

Reagents that do not meet these requirements must be rejected or purified. The purification can be achieved by crystallization or extraction (see Annex D).

4.5. **Phosphoric acid, 3 moles/l**

Dilute 205 ml of concentrated phosphoric acid, H_3PO_4, ($\rho = 1{\cdot}69$ g/ml) with water to 1 litre.

4.6. **Pararosaniline reagent solution**

Pipet 20 ml of the pararosaniline hydrochloride stock solution (4.4) and 25 ml of phosphoric acid (4.5) into a 250 ml volumetric flask and make up to the mark with water.

This reagent is stable for several months if stored in the dark.

4.7. **Formaldehyde, working solution**

Pipet 5 ml of a 40 % formaldehyde solution, HCHO, into a 1 litre volumetric flask and make up to the mark with water. Prepare daily.

4.8. **Sulphamic acid, 0·6 % working solution**

Dissolve 0·6 g of sulphamic acid, NH_2SO_3H, in 100 ml water. This solution is stable for a few days if protected from air.

4.9. **Sodium bisulphite solution. Stock solution**

Dissolve 0·3 g of sodium metabisulphite, $Na_2S_2O_5$, in 500 ml of freshly boiled and cooled distilled water (double-distilled water that has been deaerated is preffered). The solution contains from 320 to 400 µg of sulphur dioxide equivalents per millilitre. The actual concentration is determined by adding an excess of iodine to an aliquot of the solution and back titrating with standardized sodium thiosulphate solution (see Annex B).

The solution is unstable.

4.10. **Sodium bisulphite standard solution**

Immediately after the standardization of the sodium bisulphite stock solution (4.9), pipet 2·0 ml of the solution into a 100 ml volumetric flask and make up to the mark with the sodium tetrachloromercurate solution (4.2).

This solution is stable for 30 days if stored at 5 °C. Stored at room temperature, it will be stable for one day only.

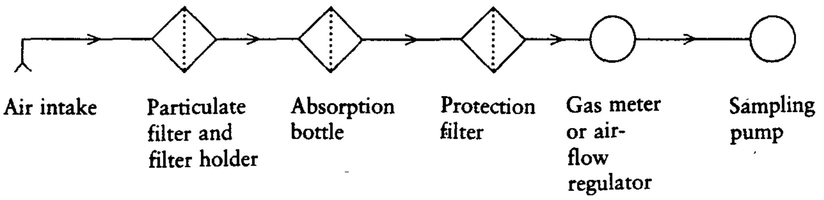
5. APPARATUS

5.1. Sampling equipment

The equipment to be used for sampling is specified in ISO/DIS 4219, Air Quality — Determination of gaseous compounds in ambient air — Sampling equipment as shown in Figure 1.

Figure 1

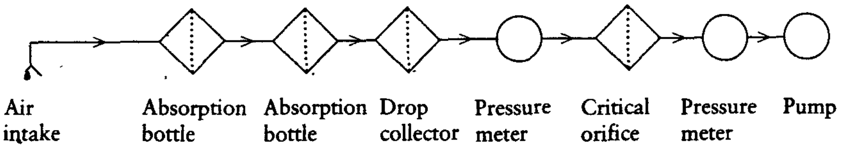
Block diagram of sampling equipment



Alternatively to the gas meter a hypodermic needle can be used as a critical orifice in a thermostated box. In this case, the pump must be able to reach $p_d/p_u \leq 0{\cdot}5$, p_d and p_u being the pressures downstream and upstream the needle respectively (see 5.5).

Figure 2

The equipment is shown in Figure 2.



5.2. Absorption bottles

Satisfactory absorption bottles should have an absorption efficiency for sulphur dioxide of at least 95 %. Examples of suitable absorption bottles are given in Annex A.

The absorption efficiency varies with the geometry of the bottle, the size of the gas bubbles and their contact time with the solution. It can be determined by inserting a second absorption bottle in series to the first one into the sampling system and relating the amount of sulphur dioxide found in the first bottle to the sum of the sulphur dioxide amount in the two bottles. When working with midget impingers under the conditions described in section 6.1, the absorption efficiency has been found to be better than 98 %.

The use of mixtures of sulphur dioxide and air for calibration, as described in clause 6.3.1, automatically gives the absorption efficiency of the system.

5.3. Hydrogen sulphide absorber

A glass tube filled with quarz wool impregnated with a solution containing 0·5 % of silver sulphate, Ag_2SO_4, and 2·5 % of potassium hydrogen sulphate, $KHSO_4$. The impregnation is made by passing the solution twice through the tube and then drying the quartz wool by heating in a nitrogen stream.

5.4. Sample bottles

Polyethylene bottles, 100 ml, for transferring the exposed absorption solutions to the laboratory.

5.5. Manometer

Two manometers accurate to 1 000 Pa, for measurement of pressures when using a critical orifice instead of a gas meter.

5.6. Spectrophotometer or colorimeter

A spectrophotometer or colorimeter suitable for measuring the absorbance at about 550 nm. With a spectrophotometer, a wavelength of 548 nm should be used. If a colorimeter is used, the filter should have its transmittance maximum at about 550 nm. Reagent blank problems may occur with apparatus having a greater spectral band width than 20 nm.

When measuring the absorbance use the same cell for samples and standard solutions. If more than one cell is used, the cells must be spectrophotometrically matched.

6. PROCEDURE

6.1. Sampling

Transfer 10 ml of the TCM solution (4.2) to an absorption bottle and insert it into the sampling system (Figure 1). Shield the absorbing solution from direct sunlight during the sampling by covering the absorption bottle with a suitable wrapping, such as aluminium foil, to prevent decomposition. The duration and flow rate of the aspiration depend on the concentration of sulphur dioxide in the air.

With midget impingers, the volume flow rate should be between 0·5 l/min and 1 l/min. The minimum quantity of air aspirated should be 25 litres.

To obtain the best results, flow rate and sampling time should be chosen to achieve an absorption of 0·5 to 3·0 µg (0·2 to 1·2 µl at 25 °C and 101·325 kPa) of sulphur dioxide per ml of absorbing solution.

If the air is believed to contain hydrogen sulphide this must be removed by a hydrogen sulphide absorber (5.3). Place the absorber between the particulate filter and the absorption bottle.

After sampling, determine the volume of air sampled, and note the atmospheric temperature and pressure (7.1, Note). If the sample must be stored for more than 24 hours before analysis, keep it at 5 °C.

Note

If the sample solution shows a precipitate, it is probably due to the reaction of Hg II with a reduced sulphur compound. Remove the precipitate by filtration or centrifugation before the analysis.

6.2. Analysis

Samples must be left for at least 20 minutes after sampling to allow trapped ozone to decompose. Then transfer the sample solution quantitatively to a 25 ml volumetric flask, using about 5 ml of water for rinsing.

Prepare a blank by adding 10 ml of unexposed absorbing solution (4.2) to a 25 ml volumetric flask, add the reagents as described below and read the absorbance against distilled water using 10 mm cells. Compare this value with the one recorded for the blank obtained when preparing the calibration curve. Differences of more than 10 % between the two values indicate contamination of the distilled water or the reagents or decomposition of the latter, in which case fresh reagents must be prepared.

Add 1 ml of the sulphamic acid solution (4.8) to each flask and allow to react for 10 minutes to destroy the nitrate from oxides of nitrogen. Then accurately pipet 2 ml of the formaldehyde solution (4.7) and 5 ml of the pararosaniline reagent (4.6) into the flasks. Make up to the mark with freshly boiled and cooled distilled water and store in a thermostat at 20 °C. After 30 to 60 minutes measure the absorbance of the sample and the blank with distilled water in the reference cell.

Do not let the coloured solution remain in the cell as a film of dye will then be deposited on the walls.

Note

Fixed time intervals between the addition of each reagent e.g. one minute ensure a better reproducibility of the colour development.

Solutions with absorbances exceeding that of the highest concentration used for calibration can be diluted up to sixfold with the reagent blank in order to obtain an on-scale reading. This reading, however, is only an indicative within ± 10 % of the true absorbance value.

6.3. Calibration

6.3.1. Calibration with a mixture of sulphur dioxide and air

Mixtures of sulphur dioxide and air are prepared according to ISO/DIS 6349.

In order to prepare the calibration graph, which is a plot of absorbance versus sulphur dioxide concentration, at least four different concentration levels of sulphur dioxide within the range prescribed in section 2 are needed.

The sampling procedure and the analytical procedure as described under 6.1 and 6.2, respectively, are applied to each of the calibration gas mixtures. The absorbance values are plotted against the given sulphur dioxide concentrations, and a calibration graph is prepared.

6.3.2. *Calibration with sodium bisulphite solution*

Pipet graduated amounts of the sodium bisulphite standard solution (4.10), 0, 1·0, 2·0, 3·0, 4·0 and 5·0 ml, into a series of 25 ml volumetric flasks. Add sufficient sodium tetrachloromercurate solution (4.2) to each flask to bring the volume to approximately 10 ml. Then add the reagents as described in 6.2. Measure the absorbances with distilled water in the reference cell. For higher precision it is necessary to use a constant-temperature bath. The temperature at the calibration should not differ from the temperature at the analysis by more than ± 1 °C.

Plot the absorbances of the solutions (as ordinates) against the microgrammes of sulphur dioxide calculated according to Annex B. A linear relationship is obtained. The intercept with the vertical axis of the line best fitting the points is usually within 0·02 absorbance units of the blank (zero standard) reading if 10 mm cells are used. Evaluate the calibration factor (reciprocal of the slope of the line). This calibration factor can be used for calculating the results, provided there are no radical changes in temperature or pH. At least one control sample is recommended per series of determinations to ensure the reliability of this factor.

7. EXPRESSION OF RESULTS

7.1. Calculation

Calculate the mass concentration of sulphur dioxide as follows:

$$SO_2 = \frac{f(a_s - a_b)}{V}$$

where

SO_2 = mass concentration of sulphur dioxide in micrograms per cubic metre

f = calibration factor (see 6.3.2)

a_s = Absorbance of the sample solution

a_b = absorbance of the blank

V = volume of air sampled, in cubic metres

Note

If the mass sulphur dioxide concentration at reference conditions (25 °C, 1 bar) is needed, the volume of air sampled, V, must be replaced by the corresponding value of volume under reference conditions, V_R:

$$V_R = \frac{298\ V\ p}{273 + T}$$

where

p = barometric pressure, in bar

T = Temperature of air sample, in °C.

7.2. Detection limit

The detection limit of sulphur dioxide in 10 ml of TCM sampling solution is between 0·2 and 1·0 μg (based on twice the standard deviation). This corresponds to mass concentrations of sulphur dioxide of between 7 and 33 $\mu g/m^3$ (0·02 — 0·011 ppm) in air sample of 30 litres (e.g. one hour sampling at 0·5 l/min).

7.3. Precision and accuracy

The precision and accuracy of the method has not yet been determined to any degree of certainty over a variety of concentrations of sulphur dioxide, nor is the absolute collection efficiency known for the wide variety of possible systems of sampling and testing.

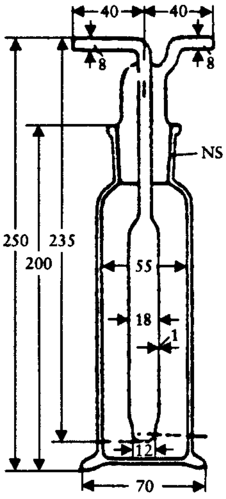
The relative standard deviation of a comparable TCM-method for replication has been found to be 17 $\mu g/m^3$ at a concentration of 1 000 $\mu g/m^3$ (1).

8. LITERATURE

(1) H. C. McKee, R. E. Childers, O. Saenz: Collaborative Study of Reference Method for Determination of Sulphur Dioxide in the Atmosphere (Pararosaniline Method). Contract CPA 70—40, SwRI Project 21—2811. Environmental Protection Agency, Research Triangle Park, N. C., September 1971.

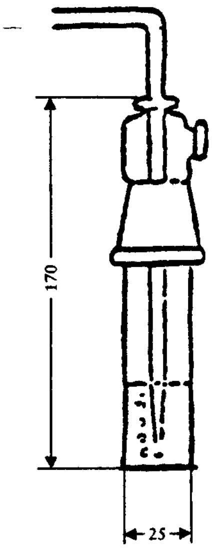
ANNEX A

ABSORBER MODELS



Muenke-flask

75 ml four holes, one in bottom,
each 1·5 Ø



Midget impinger

ANNEX B

STANDARDIZATION OF THE SODIUM BISULPHITE STOCK SOLUTION (4.9)

B.1. Reagents

B.1.1. *Iodine solution, 0·05 moles/l*

Stock solution

Weigh 12·7 g of iodine, I_2, into a 250 ml beaker, add 40 g of potassium iodide, KI, and 25 ml of water. Stir until all is dissolved and transfer the solution quantitatively to a 1 litre volumetric flask. Dilute to the mark with water.

B.1.2. *Iodine working solution, approximately 0·005 moles/l*

Dilute 50 ml of the iodine stock solution (B. 1.1) to 500 ml with water.

B.1.3. *Starch indicator solution, 0·2 %*

Triturate 0·4 g of soluble starch and 0·002 g of mercury (II) iodide, HgI_2 (preservative), with a little water, and add the paste slowly to 200 ml of boiling water. Continue the boiling until the solution is clear, cool and transfer to a glass stoppered bottle.

B.1.4. *Sodium thiosulphate solution, approximately 0·1 moles/l*

Dissolve 25 g of sodium thiosulphate, $Na_2S_2O_3{\cdot}5\ H_2O$, in 1 litre of freshly boiled and distilled water and add 0·1 g of sodium carbonate to the solution. Allow the solution to stand for one day before standardizing.

To standardize, weigh 1·5 g of potassium iodate, KIO_3, primary standard grade, dried at 180 °C into a 500 ml volumetric flask and dilute to the mark with water. To a 500 ml iodine flask, pipet 50 ml of the iodate solution. Add 2 g of potassium iodide and 10 ml of a 1 : 10 dilution of concentrated hydrochloric acid. Stopper the flask. After five minutes titrate with sodium thiosulphate solution to a pale yellow colour. Add 5 ml of the starch indicator and complete the titration. Calculate the molarity of the sodium thiosulphate solution, M, as follows

$$M = \frac{\text{g } KIO_3 \times 10^3 \times 0{\cdot}1}{\text{ml sodium thiosulphate solution} \times 35{\cdot}67}$$

B.1.5. *Sodium thiosulphate solution, approximately 0·01 moles/l*

Dilute 50·0 ml of the sodium thiosulphate solution (B.1.4) to 500 ml with water and mix. The solution is not stable and must be prepared fresh on the day it is to be used by diluting the standardized sodium thiosulphate solution (B.1.4).

B.2. Procedure

Add 25 ml of water to a 500 ml flask and pipet 50 ml of the iodine solution (B 1.2) into the flask (here designated flask A/blank). Pipet 25 ml of the sodium bisulphite stock solution (4.9) to a second 500 ml flask and pipet 50 ml of iodine solution (B.1.2) into this flask (here designated B/sample). Stopper the flasks and allow to react for five minutes. By means of a burette containing sodium thiosulphate solution (B.1.5), titrate each flask in turn to a pale yellow colour. Then add 5 ml of starch solution (B.1.3) and continue the titration until the blue colour disappears. Calculate the concentration of sulphur dioxide in the sodium bisulphite stock solution (4.9):

$$SO_2\ (\mu g/ml) = \frac{(A-B) \times M \times K}{V}$$

A = volume of sodium thiosulphate solution (B.1.5) required for the titration of the blank, in millilitres.

B = volume of sodium thiosulphate solution (B.1.5) required for the titration of the sample, in millilitres.

M = Molarity of the sodium thiosulphate solution (= 0·01).

K = micro equivalent weight for sulphur dioxide = 32·030.

V = sodium bisulphite stock solution taken, in millilitres.

The concentration of sulphur dioxide in the bisulphite standard solution (4.10) is found by dividing the result by 50.

ANNEX C

REMOVAL OF MERCURY FROM RESIDUAL SOLUTIONS

This Annex describes a method for the removal of mercury from the residual solutions received when using the absorbing solution (4.2).

C.1. **Reagents**

C.1.1. Sodium hydroxide solution, approximately 400 g of NaOH per litre

C.1.2. Hydrogen peroxide, H_2O_2, approximately 30 %, technical quality

C.1.3. Sodium sulphide, $Na_2S{\cdot}9H_2O$ technical quality

C.2. **Procedure**

Collect in a polyethylene container with a volume of about 50 litres the residual solutions, whose mercury content is too high to allow them to be discarded through the sink. When the collected volume reaches approximately 40 litres, add in the following order, while stirring by means of air bubbling through the solution, a volume of sodium hydroxide solution (C.1.1) sufficient for neutralizing followed by 400 ml more. Add 100 g of sodium sulphide (C.1.3) and after 10 minutes, slowly 400 ml of hydrogen peroxide solution (C.1.2).

Leave the mixture for 24 hours and then draw off and discard the clear liquid. Transfer the residue to another container.

ANNEX D

PROPERTIES AND PURIFICATION OF PARAROSANILINE HYDROCHLORIDE

D.1. **Test for the purity of the reagent**

Dilute 1 ml of the PRA solution (4.4) to 100 ml with distilled water. Transfer 5 ml to a 50 ml volumetric flask and add 5 ml of a 0·1 M acetic acid-sodium acetate buffer solution. Dilute to the mark with water and mix.

Wait one hour and then measure the absorbance of the solution in a spectrophotometer at 540 nm in a 10 mm cell.

Calculate the concentration of pararosaniline (PRA) as follows:

$$\%\ \text{PRA} = \frac{\text{absorbance} \times \text{K}}{100\ \text{mg}}$$

where:

K = 21 300.

If the purity of the pararosaniline is below 95 %, the reagent must be purified by one of the procedures described in D.2 and D.3.

D.2. Purification by extraction

In a 250 ml separatory funnel, equilibrate 100 ml each of 1-butanol and 1 M HCl. Weigh 0·1 g of pararosaniline hydrochloride (PRA) into a beaker. Add 50 ml of the equilibrated acid and let stand for several minutes. Add 50 ml of the equilibrated 1-butanol to a 125 ml separatory funnel. Transfer the acid solution containing the dye to the funnel and extract. The violet impurity will transfer to the organic phase. Transfer the lower (aqueous) phase into another separatory funnel and add 20 ml portions of 1-butanol. This is usually sufficient to remove almost all the violet impurity which contributes to the reagent blank. If the violet impurity still appears in the 1-butanol phase after five extractions, discard this batch of dye.

After the final extraction, filter the aqueous phase through a cotton plug into a 50 ml volumetric flask and bring to volume with 1 M HCl. This stock reagent will be yellowish red.

Note

Certain batches of 1-butanol contain oxidants that create a sulphur dioxide demand. Check by shaking 20 ml of 1-butanol with 5 ml of a 15 % potassium-iodide solution. If a yellow colour appears in the alcohol phase, redistill the 1-butanol from silver oxide.

D.3. Purification by recrystallization

Dissolve 1 g of pararosaniline hydrochloride in 250 ml of 2·5 M hydrochloric acid. Let the solution stand for two hours at room temperature. After filtration, the pararosaniline is reprecipitated by addition of a small excess of 2·5 M sodium hydroxide solution.

Collect the precipitate on a filter funnel (porosity 3). The filtrate should be colourless. Wash the precipitate with distilled water to remove excess sodium hydroxide and the sodium chloride formed.

Dissolve the precipitate in 70 ml of methanol heated to boiling and finally add 300 ml of water at 80 °C. Let the solution stand at room temperature. The pararosaniline reprecipitates slowly. The yield of recrystallization is about 64 %. Pararosaniline gets dark between 200 and 205 °C and decomposes at 285 °C.

Literature

H. G. C. King and U. G. Pruden: The determination of sulphur dioxide with rosaline dyes. Analyst 94, 43—48 (1969).

COUNCIL DECISION

of 11 June 1981

on the conclusion of the Convention on long-range transboundary air pollution

(81/462/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament (¹),

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

Whereas the aim of the Community environment policy as stated in the Declaration of the Council of the European Communities and of the representatives of the Governments of the Member States meeting in the Council of 22 November 1973 on the programme of action of the European Communities on the environment (³), supplemented by the resolution of the Council of the European Communities and of the representatives of the Governments of the Member States meeting within the Council of 17 May 1977 on the continuation and implementation of a European Community policy and action programme on the environment (⁴), namely the improvement of the quality and setting of life, of the surroundings and living conditions of the peoples of the Community, implies, in particular, preventing, reducing and as far as possible, eliminating pollution and nuisances as well as seeking common solutions to environmental problems with States outside the Community, particularly in international organizations;

Whereas one of the principles of the said environment policy is that, in accordance with the declaration of the United Nations Conference on the Human Environment adopted in Stockholm in 1972, care should be taken to ensure that activities carried out in one State do not cause any degradation of the environment in another;

Whereas the Community participated in the negotiations, within the framework of the Economic Commission for Europe, of a Convention and resolution on long-range transboundary air pollution;

Whereas on 14 November 1979 the Community signed the Convention on long-range transboundary air pollution and approved the resolution on long-range transboundary air pollution in which the signatories to the Convention decided to initiate the provisional implementation of the Convention, within the framework of the Economic Commission for Europe on an interim basis, and undertook to carry out the

---

(¹) OJ No C 59, 10. 3. 1980, p. 71.
(²) OJ No C 72, 24. 3. 1980, p. 25.
(³) OJ No C 112, 20. 12. 1973, p. 1.
(⁴) OJ No C 139, 13. 6. 1977, p. 1.

obligations of the Convention to the maximum extent possible pending its entry into force;

Whereas the Community's participation in the implementation of this Convention is necessary in order to attain one of the objectives of the Community; whereas the necessary powers are not provided for by the provisions of the Treaty other than Article 235;

Whereas the Community will participate in the implementation of the said Convention by exercising its competence as resulting from the existing common rules as well as those acquired as a result of future acts adopted by the Council, and by using the results of Community actions (research, exchange of information) in the fields concerned;

Whereas it is necessary for the Community to that extent to conclude the said Convention,

HAS DECIDED AS FOLLOWS:

Article 1

The Convention on long-range transboundary air pollution is hereby approved on behalf of the European Economic Community.

The texts of the said Convention and of the resolution on long-range transboundary air pollution are annexed to this Decision.

Article 2

The President of the Council shall deposit the act as provided for in Article 15 of the Convention (¹).

Done at Luxembourg, 11 June 1981.

For the Council

The President

L. GINJAAR

(¹) The date of entry into force of the Convention will be published in the *Official Journal of the European Communities* by the General Secretariat of the Council.

CONVENTION

on long-range transboundary air pollution

THE PARTIES TO THE PRESENT CONVENTION,

DETERMINED to promote relations and cooperation in the field of environmental protection,

AWARE of the significance of the activities of the United Nations Economic Commission for Europe in strengthening such relations and cooperation, particularly in the field of air pollution including long-range transport of air pollutants,

RECOGNIZING the contribution of the Economic Commission for Europe to the multilateral implementation of the pertinent provisions of the Final Act of the Conference on security and cooperation in Europe,

COGNIZANT of the references in the chapter on environment of the Final Act of the Conference on security and cooperation in Europe calling for cooperation to control air pollution and its effects, including long-range transport of air pollutants, and to the development through international cooperation of an extensive programme for the monitoring and evaluation of long-range transport of air pollutants, starting with sulphur dioxide and with possible extension to other pollutants,

CONSIDERING the pertinent provisions of the Declaration of the United Nations Conference on the human environment, and in particular principle 21, which expresses the common conviction that States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction,

RECOGNIZING the existence of possible adverse effects, in the short and long term, of air pollution including transboundary air pollution,

CONCERNED that a rise in the level of emissions of air pollutants within the region as forecast may increase such adverse effects,

RECOGNIZING the need to study the implications of the long-range transport of air pollutants and the need to seek solutions for the problems identified,

AFFIRMING their willingness to reinforce active international cooperation to develop appropriate national policies and by means of exchange of information, consultation, research and monitoring, to coordinate national action for combating air pollution including long-range transboundary air pollution,

HAVE AGREED as follows:

Definitions

Article 1

For the purposes of the present Convention:

(a) 'air pollution' means the introduction by man, directly or indirectly, of substances or energy into the air resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems and material property and impair or interfere with amenities and other legitimate uses of the environment, and 'air pollutants' shall be construed accordingly;

(b) 'long-range transboundary air pollution' means air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one State and which has adverse effects in the area under the jurisdiction of another State at such a distance that it is not generally possible to distinguish the contribution of individual emission sources or groups of sources.

Fundamental principles

Article 2

The Contracting Parties, taking due account of the facts and problems involved, are determined to protect man and his environment against air pollution and shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution.

Article 3

The Contracting Parties, within the framework of the present Convention, shall, by means of exchanges of information, consultation, research and monitoring, develop without undue delay policies and strategies which shall serve as a means of combating the discharge of air pollutants, taking into account efforts already made at national and international level.

Article 4

The Contracting Parties shall exchange information on and review their policies, scientific activities and technical measures aimed at combating, as far as possible, the discharge of air pollutants which may have adverse effects, thereby contributing to the reduction of air pollution including long-range transboundary air pollution.

Article 5

Consultations shall be held, upon request, at an early stage between, on the one hand, Contracting Parties which are actually affected by or exposed to a significant risk of long-range transboundary air pollution and, on the other hand, Contracting Parties within which and subject to whose jurisdiction a significant contribution to long-range transboundary air pollution originates, or could originate, in connexion with activities carried on or contemplated therein.

Air-quality management

Article 6

Taking into account Articles 2 to 5, the on-going research, exchange of information and monitoring and the results thereof, the cost and effectiveness of local and other remedies and in order to combat air pollution, in particular that originating from new or rebuilt installations, each Contracting Party undertakes to develop the best policies and strategies including air-quality management systems and, as part of them, control measures compatible with balanced development, in particular by using the best available technology which is economically feasible and low- and non-waste technology.

Research and development

Article 7

The Contracting Parties, as appropriate to their needs, shall initiate and cooperate in the conduct of research into and/or development of:

(a) existing and proposed technologies for reducing emissions of sulphur compounds and other major air pollutants, including technical and economic feasibility, and environmental consequences;

(b) instrumentation and other techniques for monitoring and measuring emission rates and ambient concentrations of air pollutants;

(c) improved models for a better understanding of the transmission of long-range transboundary air pollutants;

(d) the effects of sulphur compounds and other major air pollutants on human health and the environment, including agriculture, forestry, materials, aquatic and other natural ecosystems and visibility, with a view to establishing a scientific basis for dose/effect relationships designed to protect the environment;

(e) the economic, social and environmental assessment of alternative measures for attaining environmental objectives, including the reduction of long-range transboundary air pollution;

(f) education and training programmes related to the environmental aspects of pollution by sulphur compounds and other major air pollutants.

Exchange of information

Article 8

The Contracting Parties, within the framework of the Executive Body referred to in Article 10 and bilaterally, shall, in their common interests, exchange available information on:

(a) data on emissions at periods of time to be agreed upon, of agreed air pollutants, starting with sulphur dioxide, coming from grid-units of agreed size, or on the fluxes of agreed air pollutants, starting with sulphur dioxide, across national borders, at distances and at periods of time to be agreed upon;

(b) major changes in national policies and in general industrial development, and their potential impact, which would be likely to cause significant changes in long-range transboundary air pollution;

(c) control technologies for reducing air pollution relevant to long-range transboundary air pollution;

(d) the projected cost of the emission control of sulphur compounds and other major air pollutants on a national scale;

(e) meteorological and physico-chemical data relating to the processes during transmission;

(f) physico-chemical and biological data relating to the effects of long-range transboundary air pollution and the extent of the damage (¹) which these data indicate can be attributed to long-range transboundary air pollution;

(g) national, sub-regional and regional policies and strategies for the control of sulphur compounds and other major air pollutants.

Implementation and further development of the cooperative programme for the monitoring and evaluation of the long-range transmission of air pollutants in Europe

Article 9

The Contracting Parties stress the need for the implementation of the existing 'cooperative programme for the monitoring and evaluation of the long-range transmission of air pollutants in Europe' (hereinafter referred to as EMEP) and, with regard to the further development of this programme, agree to emphasize:

(a) the desirability of Contracting Parties joining in and fully implementing EMEP which, as a first step, is based on the monitoring of sulphur dioxide and related substances;

(b) the need to use comparable or standardized procedures for monitoring whenever possible;

(c) the desirability of basing the monitoring programme on the framework of both national and international programmes. The establishment of monitoring stations and the collection of data shall be carried out under the national jurisdiction of the country in which the monitoring stations are located;

(d) the desirability of establishing a framework for a cooperative environmental monitoring programme, based on and taking into account present and future national, sub-regional, regional and other international programmes;

(¹) The present Convention does not contain a rule on State liability as to damage.

(e) the need to exchange data on emissions at periods of time to be agreed upon, of agreed air pollutants, starting with sulphur dioxide, coming from grid-units of agreed size; or on the fluxes of agreed air pollutants, starting with sulphur dioxide, across national borders, at distances and at periods of time to be agreed upon. The method, including the model, used to determine the fluxes, as well as the method, including the model, used to determine the transmission of air pollutants based on the emissions per grid-unit, shall be made available and periodically reviewed, in order to improve the methods and the models;

(f) their willingness to continue the exchange and periodic updating of national data on total emissions of agreed air pollutants, starting with sulphur dioxide;

(g) the need to provide meteorological and physico-chemical data relating to processes during transmission;

(h) the need to monitor chemical components in other media such as water, soil and vegetation, as well as a similar monitoring programme to record effects on health and environment;

(i) the desirability of extending the national EMEP networks to make them operational for control and surveillance purposes.

Executive Body

Article 10

1. The representatives of the Contracting Parties shall, within the framework of the Senior Advisers to Economic Commission for Europe Governments on Environmental Problems, constitute the Executive Body of the present Convention, and shall meet at least annually in that capacity.

2. The Executive Body shall:

(a) review the implementation of the present Convention;

(b) establish, as appropriate, working groups to consider matters related to the implementation and development of the present Convention and to this end to prepare appropriate studies and other documentation and to submit recommendations to be considered by the Executive Body;

(c) fulfil such other functions as may be appropriate under the provisions of the present Convention.

3. The Executive Body shall utilize the Steering Body for the EMEP to play an integral part in the operation of the present Convention, in particular with regard to data collection and scientific cooperation.

4. The Executive Body, in discharging its functions, shall, when it deems appropriate, also make use of information from other relevant international organizations.

Secretariat

Article 11

The Executive Secretary of the Economic Commission for Europe shall carry out, for the Executive Body, the following secretariat functions:

(a) to convene and prepare the meetings of the Executive Body;

(b) to transmit to the Contracting Parties reports and other information received in accordance with the provisions of the present Convention;

(c) to discharge the functions consigned by the Executive Body.

Amendments to the Convention

Article 12

1. Any Contracting Party may propose amendments to the present Convention.

2. The text of proposed amendments shall be submitted in writing to the Executive Secretary of the Economic Commission for Europe, who shall communicate them to all Contracting Parties. The Executive Body shall discuss proposed amendments at its next annual meeting provided that such proposals have been circulated by the Executive Secretary of the Economic Commission for Europe to the Contracting Parties at least 90 days in advance.

3. An amendment to the present Convention shall be adopted by consensus of the representatives of the Contracting Parties, and shall enter into force for the Contracting Parties which have accepted it on the 90th day after the date on which two-thirds of the Contracting Parties have deposited their instruments of acceptance with the depositary. Thereafter, the amendment shall enter into force for any other Contracting Party on the 90th day after the date on which that Contracting Party deposits its instrument of acceptance of the amendment.

Settlement of disputes

Article 13

If a dispute arises between two or more Contracting Parties to the present Convention as to the interpretation or application of the Convention, they shall seek a solution by negotiation or by any other method of dispute settlement acceptable to the Parties to the dispute.

Signature

Article 14

1. The present Convention shall be open for signature at the United Nations Office at Geneva from 13 to 16 November 1979 on the occasion of the High-Level Meeting within the framework of the Economic Commission for Europe on the Protection of the Environment, by the member States of the Economic Commission for Europe as well as States having consultative status with the Economic Commission for Europe, pursuant to paragraph 8 of Economic and Social Council Resolution 36 (IV) of 28 March 1947, and by regional economic integration organizations, constituted by sovereign States, members of the Economic Commission for Europe, which have competence in respect of the negotiation, conclusion and application of international agreements in matters covered by the present Convention.

2. In matters within their competence, such regional economic integration organizations shall, on their own behalf, exercise the rights and fulfil the responsibilities which the present Convention attributes to their member States. In such cases, the member States of these organizations shall not be entitled to exercise such rights individually.

Ratification, acceptance, approval and accession

Article 15

1. The present Convention shall be subject to ratification, acceptance or approval.

2. The present Convention shall be open for accession as from 17 November 1979 by the States and organizations referred to in Article 14 (1).

3. The instruments of ratification, acceptance, approval or accession shall be deposited with the Secretary-General of the United Nations, who will perform the functions of the depositary.

Entry into force

Article 16

1. The present Convention shall enter into force on the 90th day after the date of deposit of the 24th instrument of ratification, acceptance, approval or accession.

2. For each Contracting Party which ratifies, accepts or approves the present Convention or accedes thereto after the deposit of the 24th instrument of ratification, acceptance, approval or accession, the Convention shall enter into force on the 90th day after the date of deposit by such Contracting Party of its instrument of ratification, acceptance, approval or accession.

Withdrawal

Article 17

At any time after five years from the date on which the present Convention has come into force with respect to a Contracting Party, that Contracting Party may withdraw from the Convention by giving written notification to the depositary. Any such withdrawal shall take effect on the 90th day after the date of its receipt by the depositary.

Authentic texts

Article 18

The original of the present Convention, of which the English, French and Russian texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

RESOLUTION

on long-range transboundary air pollution

The Signatories to the Convention on long-range transboundary air pollution of 13 November 1979,

Decide that they shall, within the framework of the Economic Commission for Europe and the Senior Advisers to ECE Governments on Environmental Problems, initiate, as soon as possible and on an interim basis, the provisional implementation of the Convention on long-range transboundary air pollution; they undertake to carry out the obligations arising from the Convention to the maximum extent possible pending its entry into force;

Agree that the necessary authority should be given to the Economic Commission for Europe and to its Executive Secretary to provide for a sufficient secretariat and, in the framework of the existing budgetary structure, for the appropriate financial means;

Further decide to develop without delay further cooperation in problem areas within the scope of the Convention. In particular they will seek to bring closer together their policies and strategies for combating air pollution including long-range transboundary air pollution;

Declare that such strategies and policies shall be aimed at limiting, and, as far as possible, gradually reducing and preventing air pollution, including long-range transboundary air pollution. These shall be implemented progressively and the designated competent body shall review regularly the progress achieved at national level. To this end the signatories will attach highest priority to the completion of a document setting out the strategies and policies of each of the signatories for the abatement of air pollution caused by sulphur compounds.

COUNCIL DECISION

of 12 June 1986

on the conclusion of the Protocol to the 1979 Convention on long-range transboundary air pollution on long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP)

(86/277/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

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

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

Whereas, by Decision 81/462/EEC (³), the Community approved the Convention on long-range transboundary air pollution;

Whereas the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP), which is to be implemented under the Convention, is the principal means of obtaining information about the quantities emitted and possibly transmitted across national frontiers;

Whereas, on 24 May 1984, the Commission was authorized to take part, on behalf of the Community, in the negotiations on the Protocol to the Convention on long-term financing of the EMEP;

Whereas the negotiations culminated in the adoption of the final text of the Protocol and in the fixing of the cost-sharing formula for the EMEP;

Whereas, as authorized by the Council on 25 September 1984, the Protocol was signed by the Community on 28 September 1984 at the second meeting of the Executive Body of the Convention,

HAS DECIDED AS FOLLOWS:

Article 1

The Protocol to the 1979 Convention on long-range transboundary air pollution on long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP) is hereby approved on behalf of the European Economic Community.

The text of the Protocol is attached to this Decision.

Article 2

The President of the Council shall deposit the act of approval provided for in Article 9 of the Protocol.

Done at Luxembourg, 12 June 1986.

For the Council

The President

P. WINSEMIUS

(¹) OJ No C 321, 13. 12. 1985, p. 5.

(²) OJ No C 88, 14. 4. 1986, p. 109.

(³) OJ No L 171, 27. 6. 1981, p. 11.

PROTOCOL

to the 1979 Convention on long-range transboundary air pollution on long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP)

THE CONTRACTING PARTIES,

Recalling that the Convention on long-range transboundary air pollution (hereinafter referred to as 'the Convention') entered into force on 16 March 1983,

Aware of the importance of the cooperative programme for the monitoring and evaluation of the long-range transmission of air pollutants in Europe (hereinafter referred to as EMEP), as provided for in Articles 9 and 10 of the Convention,

Cognizant of the positive results achieved so far in the implementation of EMEP,

Recognizing that the implementation of EMEP has hitherto been made possible by financial means provided by the United Nations environment programme (UNEP) and by voluntary contributions from governments,

Bearing in mind that since the UNEP contribution will continue only until the end of 1984, and that since this contribution together with the voluntary contributions from governments have been inadequate to support fully the EMEP work plan, it will therefore be necessary to provide for long-term funding after 1984,

Considering the appeal of the Economic Commission for Europe to ECE member governments, contained in its decision B (XXXVIII), to make available, on a basis to be agreed at the first meeting of the Executive Body for the Convention (hereinafter referred to as the 'Executive Body'), the financial resources to enable the Executive Body to carry out its activities, in particular as regards the work of EMEP,

Noting that the Convention does not contain any provisions for financing EMEP and that it is, therefore, necessary to make appropriate arrangements regarding this matter,

Considering the elements to guide the drafting of a formal instrument supplementing the Convention, as listed in recommendations adopted by the Executive Body at its first session (7 to 10 June 1983),

HAVE AGREED AS FOLLOWS:

Article 1

Definitions

For the purposes of the present Protocol:

1. 'UN assessment rate' means a Contracting Party's rate for the financial year in question in the scale of assessments for the apportionment of the expenses of the United Nations.
2. 'Financial year' means the financial year of the United Nations; and 'annual basis' and 'annual costs' shall be construed accordingly.
3. 'General Trust Fund' means the General Trust Fund for the financing of the implementation of the Convention on long-range transboundary air pollution, which has been established by the Secretary-General of the United Nations.
4. 'Geographical scope of EMEP' means the area within which, coordinated by the international centres of EMEP (¹), monitoring is carried out.

Article 2

Financing of EMEP

The financing of EMEP shall cover the annual costs of the international centres cooperating within EMEP for the activities appearing in the work programme of the Steering Body of EMEP.

Article 3

Contributions

1. In accordance with the provisions of this Article the financing of EMEP shall consist of mandatory contributions, supplemented by voluntary contributions.

(¹) The international centres are at present: the Chemical Coordinating Centre, the Meteorological Synthesizing Centre-East and the Meteorological Synthesizing Centre-West.

Contributions may be made in convertible currency, non-convertible currency, or in kind.

2. Mandatory contributions shall be made on an annual basis by all Contracting Parties to the present Protocol which are within the geographical scope of EMEP.

3. Voluntary contributions may be made by the Contracting Parties or Signatories to the present Protocol, even if their territory lies outside the geographical scope of EMEP, as well as, subject to approval by the Executive Body, on the recommendation of the Steering Body of EMEP, by any other country, organization or individual which wishes to contribute to the work programme.

4. The annual costs of the work programme shall be covered by the mandatory contributions. Contributions in cash and in kind, such as those provided by host countries for international centres, shall be specified in the work programme. Voluntary contributions may, subject to the approval by the executive Body, on the recommendation of the Steering Body, be utilized either for reducing the mandatory contributions or for financing specific activities within the scope of EMEP.

5. Mandatory and voluntary contributions in cash shall be deposited in the General Trust Fund.

Article 4

Sharing of costs

1. Mandatory contributions shall be made in accordance with the terms of the Annex to the present Protocol.

2. The Executive Body shall consider the need to amend the Annex:

(a) if the annual budget of EMEP increases by a factor of two and a half times the level of the annual budget adopted for the year of entry into force of the present Protocol or for the year of last amendment of the Annex, whichever is later; or

(b) if the Executive Body, on the recommendation of the Steering Body, designates a new international centre; or

(c) six years after the entry into force of the present Protocol, or six years after the last amendment to the Annex, whichever is later.

3. Amendments to the Annex shall be adopted by consensus of the Executive Body.

Article 5

Annual budget

An annual budget for EMEP shall be drawn up by the Steering Body of EMEP, and shall be adopted by the Executive Body not later than one year in advance of the financial year to which it applies.

Article 6

Amendments to the Protocol

1. Any Contracting Party to the present Protocol may propose amendments to it.

2. The text of proposed amendments shall be submitted in writing to the Executive Secretary of the Economic Commission for Europe, who shall communicate them to all Contracting Parties to the Protocol. The Executive Body shall discuss the proposed amendments at its next annual meeting provided that such proposals have been circulated by the Executive Secretary of the Economic Commission for Europe to the Contracting Parties to the Protocol at least 90 days in advance.

3. An amendment to the present Protocol, other than an amendment to its Annex, shall be adopted by consensus of the representatives of the Contracting Parties to the Protocol, and shall enter into force for the Contracting Parties to the Protocol which have accepted it on the 90th day after the date on which two-thirds of those Contracting Parties have deposited with the depositary their instruments of acceptance of the amendment. The amendment shall enter into force for any other Contracting Party on the 90th day after the date on which that Contracting Party deposits its instrument of acceptance of the amendment.

Article 7

Settlement of disputes

If a dispute arises between two or more Contracting Parties to the present Protocol as to its interpretation or application, they shall seek a solution by negotiation or by any other method of dispute settlement acceptable to the parties to the dispute.

Article 8

Signature

1. The present Protocol shall be open for signature at the United Nations Office in Geneva from 28 September 1984 until 5 October 1984 inclusive, then at the Headquarters of the United Nations in New York until 4 April 1985, by the member States of the Economic Commission for Europe as well as States having consultative status with the Economic Commission for Europe, pursuant to paragraph 8 of Economic and Social Council resolution 36 (IV) of 28 March 1947, and by regional economic integration

organizations, constituted by sovereign States members of the Economic Commission for Europe, which have competence in respect of the negotiation, conclusion and application of international agreements in matters covered by the present Protocol, provided that the States and organizations concerned are parties to the Convention.

2. In matters within their competence, such regional economic integration organizations shall, on their own behalf, exercise the rights and fulfil the responsibilities which the present Protocol attributes to their member States. In such cases, the member States of these organizations shall not be entitled to exercise such rights individually.

Article 9

Ratification, acceptance, approval and accession

1. The present Protocol shall be subject to ratification, acceptance or approval by Signatories.

2. The present Protocol shall be open for accession as from 5 October 1984 by the States and organizations referred to in Article 8, paragraph 1.

3. The instruments of ratification, acceptance, approval or accession shall be deposited with the Secretary-General of the United Nations, who will perform the functions of the depositary.

Article 10

Entry into force

1. The present Protocol shall enter into force on the 90th day following the date on which:

(a) instruments of ratification, acceptance, approval or accession have been deposited by at least 19 States and organizations referred to in Article 8 (1) which are within the geographical scope of EMEP; and

(b) the aggregate of the UN assessment rates for such States and organizations exceeds 40 %.

2. For each State and organization referred to in Article 8 (1) which ratifies, accepts or approves the present Protocol or accedes thereto after the requirements for entry into force laid down in paragraph 1 above have been met, the Protocol shall enter into force on the 90th day after the date of deposit by such State or organization of its instrument of ratification, acceptance, approval or accession.

Article 11

Withdrawal

1. At any time after five years from the date on which the present Protocol has come into force with respect to a Contracting Party, that Contracting Party may withdraw from it by giving written notification to the depositary. Any such withdrawal shall take effect on the 90th day after the date of its receipt by the depositary.

2. Withdrawal shall not affect the financial obligations of the withdrawing Party until the date on which the withdrawal takes effect.

Article 12

Authentic texts

The original of the present Protocol, of which the English, French and Russian texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

In witness whereof the undersigned, being duly authorized thereto, have signed the present Protocol.

Done at Geneva, this twenty-eighth day of September one thousand nine hundred and eighty-four.

ANNEX

referred to in Article 4 of the Protocol to the 1979 Convention on long-range transboundary air pollution on long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP)

Mandatory contributions for sharing of costs for financing the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP), shall be calculated according to the following scale:

	%
Austria	1,59
Bulgaria	0,35
Belorussian SSR	0,71
Czechoslovakia	1,54
Finland	1,07
German Democratic Republic	2,74
Holy See	0,02
Hungary	0,45
Iceland	0,06
Liechtenstein	0,02
Norway	1,13
Poland	1,42
Portugal	0,30
Romania	0,37
San Marino	0,02
Spain	3,54
Sweden	2,66
Switzerland	2,26
Turkey	0,60
Ukrainian SSR	2,60
USSR	20,78
Yugoslavia	0,60
Member States the European Economic Community:	
Belgium	2,36
Denmark	1,38
France	11,99
Germany, Federal Republic of	15,73
Greece	1,00
Ireland	0,50
Italy	6,89
Luxembourg	0,10
Netherlands	3,28
United Kingdom	8,61
European Economic Community	3,33
Total	100,00

The order in which the Contracting Parties are listed in this Annex is specifically made in relation to the cost-sharing system agreed upon by the Executive Body for the Convention. Accordingly, the listing is a feature which is specific to the Protocol on the financing of EMEP.

COUNCIL DECISION

of 24 June 1982

establishing a reciprocal exchange of information and data from networks and individual stations measuring air pollution within the Member States

(82/459/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament (¹),

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

Whereas the first and second action programmes of the European Communities on the environment (³) make provision for the establishment of a procedure for the exchange of information between surveillance and monitoring networks;

Whereas this procedure is necessary to combat pollution and nuisances, this being one of the Community objectives concerning the improvement of the quality of life and the harmonious development of economic activities throughout the Community; whereas the specific powers necessary to this end are not provided by the Treaty;

Whereas by Council Decision 75/441/EEC (⁴) the Council established a common procedure for the exchange of information between the surveillance and monitoring networks based on data relating to atmospheric pollution by sulphur compounds and suspended particulates; whereas this procedure, amongst other things, has served as a pilot study for the elaboration of a system to answer the specific needs of the Community;

Whereas the accumulated experience of the pilot study is employed to establish a more complete exchange of information and data incorporating additional air pollutants, thus stimulating and enhancing progress towards the harmonization of the measurement methods;

Whereas the Commission will examine, in consultation with Member States, the need for, and scope of, all intercomparison programmes to be proposed by it; whereas such programmes may cover different equipment, methods of sampling and analysis as well as reference materials commonly used for the relevant pollutants so that the comparability of the data obtained by different stations and methods may be improved;

Whereas the use of homogeneous time-scales for the data collection and homogeneous presentation of results will facilitate the comparison of the levels recorded for each pollutant;

Whereas the exchange of the results of the pollution-level measurements provides one way of keeping abreast of long-term trends and improvements resulting from existing and future national or Community legislation;

Whereas such results constitute information relevant to determining the locations of epidemiological surveys destined to provide a better understanding of the harmful effects of air pollution on human health;

Whereas the transport of pollutants over long distances necessitates surveillance at regional, national, Community and global levels;

(¹) OJ No C 125, 17. 5. 1982, p. 165.

(²) OJ No C 64, 15. 3. 1982, p. 15.

(³) OJ No C 112, 29. 12. 1973, p. 3 and OJ No C 139, 13. 6. 1977, p. 3.

(⁴) OJ No L 194, 25. 7. 1975, p. 40.

Whereas certain information and data constitute an input to the Global Environmental Monitoring System (GEMS) which is part of the United Nations Environmental Programme,

HAS ADOPTED THIS DECISION:

Article 1

A reciprocal exchange of information and data from networks and individual stations measuring air pollution, hereinafter referred to as 'reciprocal exchange', is hereby established. It shall apply to the individual results of measurements obtained by fixed stations which have been operating, or are planned to operate, continuously over a sufficiently representative period of time.

Article 2

1. This Decision relates to the following pollutants to the extent that they are measured at stations in the Member States:

(a) sulphur compounds measured as:
  - sulphur dioxide, or
  - strong acidity, expressed in accordance with Annex I, paragraph 1;

(b) suspended particulates, expressed in accordance with Annex I, paragraph 1, measured as:
  - suspended particulate matter, or
  - black smoke;

(c) suspended particulates of heavy metals, e.g. lead, cadmium, etc.,

(d) nitrogen oxides measured as:
  - nitrogen dioxide (NO_2), and
  - either total oxides of nitrogen (NO_x)
  - or nitrogen monoxide (NO);

(e) carbon monoxide;

(f) ozone.

2. The first data to be communicated shall be:

- for the pollutants in paragraph 1 (a) and (b): those obtained from 1 January 1979 in order to maintain continuity with the data collected previously,
- for the pollutants in paragraph 1 (c) and (d): those obtained from 1 October 1980,
- for the pollutants in paragraph 1 (e) and (f): those obtained from 1 October 1982.

3. Member States may include other pollutants after technical discussions with the Commission.

Article 3

Each Member State shall designate a National Coordinator and inform the Commission of the name of the person, or body, responsible for the selection of stations, the collection and transmission of information and data relating to the stations and pollutants as well as for liaison with the Commission in all related aspects. Until the Commission is advised otherwise, the person or body designated by each Member State under Article 4 (1) of Decision 75/441/EEC shall be deemed to be the National Coordinator.

Article 4

1. The stations participating in the exchange of information procedure laid down in Decision 75/441/EEC shall be included in the system of reciprocal exchange. Member States shall select from the available stations those which may be added to this system and shall notify the Commission of their choice. Each station selected shall be representative, as far as possible, of the conditions obtaining around that sampling point for the pollutant being considered.

2. In selecting stations, priority shall be given to those which utilize more than one sampling or analytical technique to measure a given pollutant so as to assist in the assessment of appropriate techniques and the comparability between them.

3. The stations selected should reflect, where possible, the different types of urbanization, topography and climatology, as well as the different pollution levels prevailing upon the territory of the Member State concerned.

4. Where a station selected under Decision 75/441/EEC has ceased, or ceases, to operate, the Member State concerned shall endeavour to select another suitable station and shall, if they are available, provide the relevant data for at least the two preceding years.

5. All stations and pollutants which are added under this system of reciprocal exchange, all changes in the measurement techniques utilized and all other relevant changes shall be communicated to the Commission by means of the Description Form contained in Annex II.

Article 5

1. The measurement results for each pollutant shall be expressed in accordance with Annex I and shall be transmitted to the Commission in a fixed and previously agreed format as quickly as possible and, at the latest, within six months of the end of the annual measurement period.

2. The Commission shall insert all information and data received by Member States in the computer files and shall prepare tabular presentations for the use of the Member State concerned, if so requested.

3. The data should normally be transmitted on magnetic tape, accompanied by an interpretative print-out which contains tape density, code, tape labels, headers, trailers and a few blocks of data. In this case, the data accepted into the computer files of the Commission will be considered as correct.

Data which are transmitted on forms and then accepted into the computer files shall be considered as provisional until the Member State concerned notifies the Commission that these data are correct.

Article 6

1. Member States shall endeavour to:

- inform the Commission of any known programmes or studies on the intercomparison of equipment, measurement methods or reference materials which are planned or being conducted on their territory,
- make available to the Commission sufficient numbers of any relevant reports relating to such programmes or studies,
- suggest any laboratories with the requisite experience or facilities to participate in intercomparison programmes.

The Commission shall distribute such information to all Member States.

2. On the basis of the information referred to in paragraph 1 and all other relevant information, the Commission shall examine, in consultation with the Member States, the need for and scope of all intercomparison programmes to be proposed by it. Such programmes, which are designed with a view to improving the comparability of data, may include, as appropriate, equipment and methods of sampling and analysis as well as the reference materials which are used for the relevant pollutants.

Article 7

The Commission shall prepare annual reports on the operation of this reciprocal exchange, in an appropriate presentation, defined in consultation with the National Coordinators, on the basis of the data referred to herein and all other relevant information made available to it. These reports shall be distributed to the Member States and then published by the Commission.

Article 8

Decision 75/441/EEC shall be repealed as from 1 October 1982.

Article 9

This Decision shall apply from 1 October 1982.

It shall cease to apply at the end of seven years from the date of notification unless the Council, on a proposal from the Commission, decides otherwise.

Article 10

This Decision is addressed to the Member States.

Done at Luxembourg, 24 June 1982.

For the Council
The President
F. AERTS

ANNEX I

MEASUREMENT RESULTS, UNITS, DECIMAL PLACES AND AVERAGING TIMES

1. Measurement results

The results of the measurements shall be expressed as follows:

- strong acidity as sulphur dioxide equivalent;
- suspended particulate matter as measured by a direct gravimetric technique, by beta-ray or by electron absorption, or by a nephelometric technique, in gravimetric units;
- black smoke as determined by reflectance or absorbance, converted into gravimetric equivalent.

2. Units, decimal places and averaging times

The following units shall be used to record the measurement results for each pollutant:

Pollutant	*Units*
Sulphur compounds	$\mu g/m^3$
Suspended particulates	$\mu g/m^3$
Suspended particulates of heavy metals	$\mu g/m^3$
Nitrogen oxides (NO_2, NO_x, NO)	$\mu g/m^3$
Carbon monoxide	mg/m^3
Ozone	$\mu g/m^3$

The recommended decimal places and recommended averaging times should be used when transmitting the data. The computer files will, however, retain the decimal places and averaging times submitted with the original data but, in the interest of uniformity, the tabular presentations will normally be printed using the recommended decimal places.

Pollutant	*Recommended decimal places*	*Recommended averaging times*
Sulphur compounds	Integer	24 h
Suspended particulates	Integer	24 h
Suspended particulates of heavy metals	3	24 h
Nitrogen oxides (NO_2, NO_x, NO)	Integer	1 h
Carbon monoxide	1	1 h
Ozone	Integer	1 h

ANNEX II

DESCRIPTION FORM

relating to the reciprocal exchange of information and data from networks and individual stations measuring air pollution within the Member States

NOTE: The answers to questions marked * are optional. In most questions the appropriate answer should be circled. The figures in parentheses are for Commission use only.

1. General

1.1. Member State: .... (0.01-2 + .15-40)

1.2. Responsible Authority and Contact, Address: .... (0.41-75)

....

....

....

Telephone: .... Telex: ....

2. Urban area

2.1. Class of town by number of inhabitants: (0.03)

> 2 million	1	1 – 2 million	2
0·5 – 1 million	3	0·1 – 0·5 million	4
1000 – 0·1 million	5	< 1000 ('rural area')	6

2.2. Name of town: .... (0.04-5 + .15-40)

Urban area: .... (0.41-75)

3. Station

3.1. Station name: .... (0.08-10 + .15-40)

Address: ....

....

....

3.2. Type of area: (0.76)

Undefined	0	Urban	1
Suburban	2	'Rural'	3

3.3. Type of zone: (0.77)

Undefined	0	Industrial	1
Commercial	2	Industrial + Commercial	3
Residential	4	Industrial + Residential	5
Commercial + Residential	6	Industrial + Commercial + Residential ('mixed')	7

*3.4. Traffic density around station: (0.78)

Undefined	0	Very light	1	Light	2
Moderate	3	Heavy	4		

*3.5. The overall level of pollution at this station, based on either a knowledge of all the pollutants measured or on an arbitrary scale, could be considered as: (0.79)

Undefined	0	High	1
Average	2	Low	3

3.6. Geographic coordinates in degrees, minutes and seconds or in decimal degrees:

Longitude .... E or W Greenwich (2.16-24)

Latitude .... N (2.25-33)

3.7. The station is a part of which type of network? (3.16)

Single station	S	Local	L	Regional	R
National	N	Community	C	International	I

*3.8. Date when the station first operated for any pollutant:

Year .... Month .... Day .... (3.17-22)

3.9. Altitude above mean sea level, metres: .... (3.23-27)

*3.10. Estimated area of representativity, km²: .... (3.28-30)

*3.11. Station reference numbers (maximum 10 characters):

Local .... (3.31-40)

National .... (3.41-50)

Other .... (3.51-60)

*3.12. Main sources of pollution: (4.16-75)

....

....

....

Approximate distance from station, km: .... (4.76-80)

3.13. Closest local sources of pollution: (5.16-75)

....

....

....

Approximate distance from station, km: .... (5.76-80)

*3.14. Comments on the site or station: (6.16-80)

....

....

....

4. **Pollutants measured at station** (0.11-12)

Sulphur dioxide	01	Black smoke	02
Suspended particulates	03	Strong acidity	04
Carbon monoxide	06	Nitrogen monoxide	07
Nitrogen dioxide	08	Total oxides of nitrogen	12
Ozone	14	Particulate lead	19
Particulate cadmium	28		

Others: ....

....

5. **Meteorological parameters**

5.1. Measured at the station: (0.11-12)

Wind velocity	81	Wind direction	82
Average temperature (°C)	83	Maximum temperature (°C)	84
Minimum temperature (°C)	85	Relative humidity (%)	86
Barometric pressure (mb)	87	Sunshine hours	88
Rainfall (mm)	89	Atmospheric stability	90
Cloud coverage (%)	91		

5.2. Measured at some distance from station: (0.11-12 = 80)

Wind velocity? Wind direction? Average temperature? Maximum temperature? Minimum temperature? Relative humidity? Barometric pressure? Hours of sunshine? Rainfall? Atmospheric stability? Cloud coverage?

Others: .... (0.15-75)

Distance from station, km: .... (0.76-79)

SPECIFIC POLLUTANTS

(complete one sheet per pollutant)

Urban area .... Station

1. Pollutant: .... (0.11-12 = PL)

2. Methods: (0.13-14 = TM)

2.1. Sampling method: ....
.... (0.15-75)

2.2. Analytical method: ....
.... (0.15-75)

*3. The contribution of this pollutant to the overall pollution level at this station could be considered as:

Undefined	0	High	1	
Average	2	Low	3	(0.79)

4. Calibration:

4.1. Calibration technique/method: ....
.... (1.16-75)

4.2. Calibration frequency .... days/weeks/months (1.76-80)

5. Normal duration of sampling .... h/min (7.16-20)
(For continuous, non-integrating equipment put 'c')

6. Time of day when first sample begins ...... h ...... (7.21-24)

*7. Time of day when last sample ends .... h ...... (7.25-28)

8. Technique first used at this station:
Year: .... Month: .... Date: .... (7.29-34)

9. Technique discontinued at this station:
Year: .... Month: .... Date: .... (7.35-40)

10. Distance from intake to road/street: .... metres (7.41-43)

11. Height of intake above ground/street level: .... metres (7.44-48)

Noise

Noise legislation

Council Directive 70/157/EEC of 6 February 1970 on the approximation of laws in the Member States relating to the permissible sound level and the exhaust system of motor vehicles
(OJ L 42, 23.2.70, p. 16)

- Commission Directive 73/350/EEC of 7 November 1973 adapting to technical progress the Council Directive of 6 February 1970 on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles
  (OJ L 321, 22.11.73, p. 33)

- Council Directive 77/212/EEC of 8 March 1977 amending Directive 70/157/EEC relating to the permissible sound level and the exhaust system of motor vehicles
  (OJ L 66, 12.3.77, p. 33)

- Commission Directive 81/334/EEC of 13 April 1981 adapting to technical progress Council Directive 70/157/EEC on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles
  (OJ, L 131, 18.5.81, p. 6)

- Commission Directive 84/372/EEC of 3 July 1984 adapting to technical progress Council Directive 70/157/EEC on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles
  (OJ, L 196, 26.7.84, p. 47)

- Commission Directive 84/424/EEC of 1984 adapting to technical progress Council Directive 70/157/EEC on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles
  (OJ L 238, 6.9.84, p. 31)

Council Directive 77/311/EEC of 29 March 1977 on the approximation of the laws of the Member States relating to the driver-perceived noise level of wheeled agricultural or forestry tractors
(OJ L 105, 28.4.77, p. 1)

Council Directive 78/1015/EEC of 23 November 1978 on the approximation of the laws of the Member States relating to the permissible sound level and exhaust system of motorcycles
(OJ L 349, 13.12.78, p. 21)

- Council Directive 87/56/EEC of 18 December 1986 amending Directive 78/1015/EEC on the approximation of the laws of the Member States relating to the permissible sound level and exhaust system of motorcycles
  (OJ L 24, 27.1.87, p. 42)

Council Directive 79/113/EEC of 19 December 1978 on the approximation of the laws of the Member States relating to the determination of the noise emission of contruction plant and equipment
(OJ L 33, 8.2.79, p. 15)

- Act of Accession of Greece of 28 May 1979
  Annex I, Chapter X, point 1
  (OJ L 291, 29.10.79, p. 17)

- Council Directive 81/1051/EEC of 7 December 1981 amending Directive 79/113/EEC on the approximation of the laws of the Member States relating to the determination of the noise emission of construction plant and equipment
  (OJ L 376, 30.12.81, p. 49)

- Act of Accession of Spain and Portugal of 12 June 1985,
  Annex I, Chapter IX, point 1j
  (OJ L 302, 15.11.85, p. 9)

- Commission Directive 85/405/EEC of 11 July 1985 adapting to technical progress Council Directive 79/113/EEC on the approximation of the laws of the Member States relating to the determination of the noise emission of construction plant and equipment
  (OJ L 233, 30.8.85, p. 9)

Council Directive 80/51/EEC of 20 December 1979 on the limitation of noise emissions from subsonic aircraft
(OJ L 18, 24.1.80, p. 26)

- Council Directive 83/206/EEC of 21 April 1983 amending Directive 80/51/EEC on the limitation of noise emissions from subsonic aircraft
  (OJ L 117, 4.5.83, p. 15)

Council Directive 84/533/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of compressors
(OJ L 300, 19.11.84, p. 123)

- Commission Directive 85/406/EEC of 11 July 1985 adapting to technical progress Council Directive 84/533/EEC on the approximation of the laws of the Member States relating to the permissible sound power level of compressors
  (OJ L 233, 30.8.85, p. 11)

Council Directive 84/534/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of tower cranes
(OJ L 300, 19.11.84, p. 130)

Council Directive 84/535/EEC of 17 September 1984 on the approximation of the laws of the Member States relaing to the permissible sound power level of welding generators
(OJ L 300, 19.11.84, p. 142)

- Commission Directive 85/407/EEC of 11 July 1985 adapting to technical progress Council Directive 84/535/EEC on the approximation of the laws of the Member States relating to the permissible sound power level of welding generators
  (OJ L 233, 30.8.85, p. 16)

Council Directive 84/536/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of power generators
(OJ L 300, 19.11.84, p. 149)

- Commission Directive 85/408/EEC of 11 July 1985 adapting to technical progress Council Directive 84/536/EEC on the approximation of the laws of the Member States relating to the permissible sound power level of power generators
  (OJ L 233, 30.8.85, p. 18)

Council Directive 84/537/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of powered hand-held concrete breakers and picks
(OJ L 300, 19.11.84, p. 156)

- Commission Directive 85/409/EEC of 11 July 1985 adapting to technical progress Council Directive 84/537/EEC on the approximation of the laws of the Member States relating to the permissible sound power level of powered hand-held concrete-breakers and picks
  (OJ L 233, 3.8.85, p. 20)

Council Directive 84/538/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound level of lawnmowers
(OJ L 300, 19.11.84, p. 22)

Council Directive 86/594/EEC of 1 December 1986 on airborne noise emitted by household appliances
(OJ L 344, 1.12.86, p. 24)

Council Directive 86/662/EEC of 22 December 1986 on the noise emitted by hydraulic excavators, rope-operated excavators, dozers, loaders and excavator dozers
(OJ L 384, 31.12.86, p. 1)