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COMMUNICATION OF THE COMMISSION WITH REGARD TO THE INTERPRETATIVE DOCUMENTS OF COUNCIL DIRECTIVE 89/106/EEC

(94/C 62/01)

CONTENTS

General introduction to the 6 Interpretative Documents

1. The Construction Products Directive 89/106/EEC [1] sets out in Articles 3 and 12 that Interpretative Documents give concrete form to the Essential Requirements referred to in Annex I of the same Directive interpreted in accordance with the preamble to that Annex.

   Article 12 (3) lays down that the Interpretative Documents, after the opinion of the Standing Committee for Construction has been solicited, shall be published in the *Official Journal of the European Communities*, series C.

2. The principal objective of the Interpretative Documents (IDs) is to establish the link between the Essential Requirements and the mandates which the Commission gives to European standardization bodies to establish harmonized standards and to the European Organisation for Technical Approvals to establish Guidelines for European Technical Approvals. In order that this can be achieved the following aspects have to be taken into account:

   — harmonization of terminology and the basic technical concepts or identification of the need for such harmonization

   — indication of classes or levels for each Essential Requirement, in so far as is necessary and possible

   — indication of the methods of correlation between classes or levels and the technical specifications [2]

   — use as a reference for the establishment of harmonized standards and guidelines for European Technical Approvals.

[1] OJ No L 40, 11. 2. 1989, p. 12.

[2] For the purposes of the CPD the term 'technical specifications' means standards and technical approvals.

3. Even if the Construction Products Directive (CPD) lays down in an exhaustive way the Essential Requirements applicable to the works, it does not require Member States to impose them in the works; in other words the Member States remain free to regulate or not the construction works.

   Nevertheless, if they regulate those works, and regulations have an impact on the construction products, Member States must comply with the provisions of the Directive and, in consequence, adapt their national regulations; therefore they cannot impose Essential Requirements applicable to the works other than those laid down in the Directive and they can permit the placing on the market of construction products intended by the manufacturer to be incorporated in the works only if they are fit for use.

   A construction product is fit for the intended use when it permits the works in which it is incorporated to satisfy the applicable Essential Requirements; a construction product is presumed to be fit for its intended use if it bears the CE marking which attests the conformity of the construction product to technical specifications (harmonized standards, European Technical Approvals, national technical specifications recognized through Community procedures — Article 4 (2) (c)).

   Harmonized standards for construction products and Guidelines for European Technical Approvals are established on the basis of mandates given to the standards organizations and EOTA; these mandates are established by reference to the Interpretative Documents in which the relevance to the Essential Requirements applicable to the works, in relation to products, has been taken into account.

4. The case of the recognition of national technical specifications, in so far as a harmonized standard does not exist (Articles 4 (2) (c) and 4 (3) of the CPD), is not explicitly dealt with in the structure and terminology of this first edition of the IDs. Nevertheless, if the case arises, the arrangements contained in the IDs would apply to the recognition of national technical specifications under Article 12 (2) (c) of the CPD, as far as their application is relevant, taking into account the Essential Requirements, the type of construction product in question and its intended use.

5. Within the framework of the implementation of the CPD, the IDs also represent a reference for the assessment of a construction product in the two following cases:

   — Article 4 (4) of the Directive (assessment of the fitness for use by an approved laboratory, in the case where a manufacturer has not applied, or has applied only in part, the existing technical specifications)

   — Article 9 (2) of the Directive (assessment of the fitness for use given in a European Technical Approval, carried out by approval bodies acting jointly within EOTA when Guidelines for European Technical Approvals do not, or not yet, exist).

6. The Interpretative Documents are of an evolutive nature and they are therefore capable of further development. In fact, they are based on a combination of:

   — the Essential Requirements as they are developed in Annex I to the Directive

   — the knowledge of existing national regulations applicable to the works, including in the field of public procurement, taking into account possible differences in geographical or climatic conditions or in ways of life as well as possible different levels of protection (Article 3 (2)) which could render necessary the establishment of classes or levels of requirement and/or of performance

   — the state of the art concerning construction products existing at the time of their establishment

   — the intended use of construction products. These different elements may evolve.

   As the Essential Requirements are expressed in terms of objectives, the understanding given in the Interpretative Documents at a certain moment could evolve due mainly to technological development and the state of the art. These evolutive elements may, therefore, justify the adaptation of Interpretative Documents and affect the understanding of the Essential Requirements.

   A Member State may request the revision of one or more Interpretative Documents in order to accommodate proposed additional regulatory requirements for the performance of construction works within the scope of the Essential Requirements. Such requests will be dealt with as a matter of high priority by the Commission and the Standing Committee without prejudice to the process of formal notification under Directive 83/189/EEC [1].

[1] OJ No L 109, 26. 4. 1983, p. 8.

7. In the present Interpretative Documents classes or levels of performances have been established in the Interpretative Document No 2 (Safety in case of fire).

   The Directive lays down that classes or levels of requirements and/or of performance, when necessary, can also be determined outside of the Interpretative Documents.

   As far as the presence of dangerous substances in construction products is concerned, classes and/or levels of performance which technical specifications will refer to, shall allow the levels of protection needed by the works to be guaranteed, taking into account the purpose of the works.

8. As the purpose of the Directive is to eliminate obstacles to trade coming from existing legal, regulatory or administrative provisions, the technical specifications deriving from the Directive should take fully into account the justifiable technical traditions in Member States. This means that technical specifications should not hinder or prevent the use of construction products which enable works to conform to the Essential Requirements and which are in use in the Member States.

INTERPRETATIVE DOCUMENT

Essential Requirement No 1

'MECHANICAL RESISTANCE AND STABILITY'

CONTENTS

ESSENTIAL REQUIREMENT: MECHANICAL RESISTANCE AND STABILITY

1. GENERAL

1.1. **Purpose and scope**

(1) This Interpretative Document relates to Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products, hereinafter referred to as 'the Directive'.

(2) Article 3 of the Directive stipulates that the purpose of the Interpretative Documents is to give concrete form to the Essential Requirements for the creation of the necessary links between the Essential Requirements set out in Annex I to the Directive and the mandates for the preparation of harmonized standards and guidelines for European technical approvals or the recognition of other technical specifications within the meaning of Articles 4 and 5 of the Directive.

Where considered necessary, the provisions of this Interpretative Document will be further specified in each particular mandate. In drafting the mandates, account will be taken, if necessary, of the other Essential Requirements of the Directive, as well as of other relevant Directives concerning construction products.

(3) This Interpretative Document deals with the aspects of the works where 'Mechanical resistance and stability' may be concerned. It identifies products or product families and characteristics relating to their satisfactory performance.

For each intended use of the product, the mandates will indicate in further detail which of those characteristics shall be dealt with in the harmonized specifications, using a step-by-step procedure with CEN/Cenelec/EOTA, which will allow the product characteristics to be modified or complemented, if necessary.

Annex I to the Directive gives the following definition of the Essential Requirement which is applicable when and where the works are subject to regulations containing such a requirement:

'The construction works must be designed and built in such a way that the loadings that are liable to act on it during its construction and use will not lead to any of the following:

(a) collapse of the whole or part of the works;

(b) major deformations to an inadmissible degree;

(c) damage to other parts of the works or to fittings or installed equipment as a result of major deformation of the load-bearing construction;

(d) damage by an event to an extent disproportionate to the original cause.'

(4) In accordance with the Council Resolution of 7 May 1985 (New Approach) and the preamble of the Directive, this interpretation of the Essential Requirement is intended not to reduce the existing and justified levels of protection for works in the Member States.

1.2. **Levels or classes for Essential Requirements and for related product performances**

1.2.1. Where differences specified in Article 3 (2) of the Directive are identified and justified in conformity with Community law, classes for Essential Requirements and for related product performances may be necessary. The purpose of such classes is to achieve the free circulation and free use of construction products.

In this case such classes shall be determined either in the Interpretative Document or according to the procedure provided for in Article 20 (2) (a) of the Directive. Where through this procedure a classification of product performance is identified as the means of expressing the range of requirement levels of the works, the Commission will within the mandate request CEN, Cenelec or EOTA to make the appropriate proposal.

The range of requirement levels covered by the classes depends on the existing and justified levels encountered in Member States.

In cases where a Member State determines in conformity to Article 6 (3) of the Directive among the classes only one or some classes to be observed in its territory (or part of it), it shall do so only on the basis of the differences specified in Article 3 (2) of the Directive.

1.2.2. Where justified differences specified in Article 3 (2) of the Directive are not identified, classes (or levels) of product performances may also be used by the standardizers as a means of convenience for specifiers, manufacturers and purchasers. For certain products, classes (or levels) make it easier to use the standard to relate product performance to its intended use.

Such performance classes (or levels) for products may with reference to Article 4 (1) of the Directive therefore be established by the standardizers who will keep the Commission and the Standing Committee informed of the ongoing work on this matter in the framework of the execution of mandates.

1.2.3. Each time classes are defined for works or for products, it is necessary to set up a class called 'no performance determined' when and where at least one Member State has no legal requirement at all in that field.

1.3. **Meaning of general terms used in the Interpretative Documents**

1.3.1. *Construction works*

'Construction works' means everything that is constructed or results from construction operations and is fixed to the ground. This term covers both *buildings* and *civil engineering* works. In the Interpretative Documents 'construction works' are also referred to as the 'works'. Construction works include for example: dwellings; industrial, commercial, office, health, educational, recreational and agricultural buildings; bridges; roads and highways; railways; pipe networks; stadiums; swimming pools; wharfs; platforms; docks; locks; channels; dams; towers; tanks; tunnels; etc.

1.3.2. *Construction products*

(1) This term refers to products which are produced for incorporation in a permanent manner in the works and placed as such on the market. The terms 'construction products' or 'products', where used in the Interpretative Documents, include materials, elements and components (single or in a kit) of prefabricated systems or installations which enable the works to meet the Essential Requirements.

(2) Incorporation of a product in a permanent manner in the works means:

— that its removal reduces the performance capabilities of the works; and

— that the dismantling or the replacement of the product are operations which involve construction activities.

1.3.3. *Normal maintenance*

(1) Maintenance is a set of preventive and other measures which are applied to the works in order to enable the works to fulfil all its functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc.

(2) Normal maintenance generally includes inspections and occurs at a time when the costs of the intervention which has to be made are not disproportionate to the value of the part of the works concerned, consequential costs being taken into account.

1.3.4. *Intended use*

The intended use of a product refers to the role(s) that the product is intended to play in the fulfilment of the Essential Requirements.

1.3.5. *Economically reasonable working life*

(1) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

(2) An economically reasonable working life presumes that all relevant aspects are taken into account, such as:

— costs of design, construction and use;

— costs arising from hindrance of use;

— risks and consequences of failure of the works during its working life and costs of insurance covering these risks;

— planned partial renewal;

— costs of inspections, maintenance, care and repair;

— costs of operation and administration;

— disposal;

— environmental aspects.

1.3.6. *Actions*

Actions which may affect the compliance of the works with the Essential Requirements are brought about by agents acting on the works or parts of the works. Such agents include mechanical, chemical, biological, thermal and electro-magnetic agents.

1.3.7. *Performance*

Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product, for an action to which it is subject or which it generates under the intended service conditions (for the works or parts of works) or intended use conditions (for products).

2. EXPLANATION OF THE ESSENTIAL REQUIREMENT 'MECHANICAL RESISTANCE AND STABILITY'

2.1. Meanings of terms used in the text of the Essential Requirement 'Mechanical Resistance and Stability' (1):

2.1.1. *Load-bearing construction*

Organized assembly of connected parts designed to provide mechanical resistance and stability to the works. In this Interpretative Document, 'load-bearing construction' is referred to as *'the structure'*.

2.1.2. *Loadings that are liable to act on the works*

Actions and other influences which may cause stress, deformations or degradation in the works during their construction and use. In this Interpretative Document, 'actions and other influences' are referred to as *'actions'*.

(1) For the meaning of these terms given in the following, account was taken of the International Standard ISO 8930 dated 15. 12. 1987.

2.1.3. *Collapse*

Various forms of failure of the structure as described in section 3.4.1.

2.1.4. *Inadmissible deformation*

Deformation or cracking of the works or part of the works which invalidates the assumptions made for the determination of the stability, the mechanical resistance or the serviceability of the works or parts of it, or causes significant reduction in the durability of the works.

2.1.5. *Damage by an event to an extent disproportionate to the original cause*

This means large damage of the works relative to the original cause (by events like explosions, impact, overload or consequence of human errors) which could have been avoided or limited without unacceptable difficulties or costs.

2.2. **Other specific terms**

Other specific terms are defined or explained where they occur in the text. See in particular Chapter 3.

3. BASIS FOR VERIFICATION OF THE SATISFACTION OF THE ESSENTIAL REQUIREMENT 'MECHANICAL RESISTANCE AND STABILITY'

3.1. **General**

(1) This chapter identifies basic principles prevailing in Member States for the verification of the satisfaction of the Essential Requirement 'Mechanical resistance and stability'. These principles are currently complied with when and where the works are subject to regulations containing this Essential Requirement. Chapter 4 provides guidance on how to meet this Essential Requirement by compliance with the technical specifications referred to in Article 4 of the Directive.

(2) The Essential Requirement, as far as applicable, is satisfied with acceptable probability during an economically reasonable working life of the works.

(3) The satisfaction of the Essential Requirement is assured by a number of interrelated measures concerned in particular with:

— the planning and design of the works, the execution of the works and necessary maintenance;

— the properties, performances and use of the construction products.

(4) It is up to the Member States, when and where they feel it necessary, to take measures concerning the supervision of planning, design and execution of the works, and concerning the qualifications of parties and persons involved. Where this supervision and this control of qualifications are directly connected with the characteristics of products, the relevant provisions shall be laid down in the context of the mandate for the preparation of the standards and guidelines for European technical approval related to the products concerned.

3.2. **Actions**

(1) See section 2.1.2

(2) When considering the satisfaction of the Essential Requirement, a distinction may be made between the following types of actions:

— Permanent actions: permanent actions due to gravity; actions of soil and water pressure; deformations imposed during construction, etc.

— Variable actions: imposed loads on floors, roofs or other parts of the works (excluding wind and snow); snow and ice loads; wind loads (static and dynamic); water and wave loads; thermal actions, frost; loads in silos and tanks; traffic loads on bridges and pavements; actions induced by cranes; dynamic actions from machinery; construction loads; etc.

— Accidental actions: impact; explosions; seismic actions; actions due to fire; etc.

3.3. **Verification of the satisfaction of the Essential Requirement**

(1) Verifications prevailing in Member States are based on the limit state concept described in section 3.4, using appropriate design models (supplemented, if necessary, by tests) involving all relevant variables. This implies that models are sufficiently precise to predict the behaviour of the structure and normally take into account the minimum standard of workmanship likely to be achieved, and the reliability of the information on which the design is based, and the assumptions made concerning maintenance.

(2) Testing is also used where calculation methods are not applicable or appropriate. In such cases testing complies with the basic principles given in this Chapter.

(3) Special measures are required for some actions, e.g. seismic actions or the effect of fire or impact.

(4) Potential damage of the works by an event to an extent disproportionate to the original cause may be limited or avoided by an appropriate choice of one or more of the following measures:

— avoiding, eliminating or reducing the hazards to which the structure may be exposed;

— selecting a structural form which has low sensitivity to the hazards considered;

— providing adequate ductility of the structure for energy absorption.

3.4. **Methods for verifying mechanical resistance and stability of works**

(1) Limit states are states beyond which the performance requirements are no longer satisfied. Limit states may relate to persistent situations during the working life of the works or to transient situations during the execution of the works (stage of construction and/or assembling or repair), or to unintended uses or accidents. In general, distinction is made between ultimate limit states and serviceability limit states.

(2) Ultimate limit states are those associated with the various forms of structural failure or states close to structural failure, which for practical purposes are also considered as ultimate limit states.

(3) Ultimate limit states which may require consideration include:

— loss of equilibrium of the structure or any part of it, considered as a rigid body;

— failure by excessive deformation or settlement, transformation into a mechanism, rupture, or loss of stability of the structure or any part of it, including supports and foundations.

(4) Serviceability limit states correspond to states beyond which specified criteria for the structure related to its use or function are no longer met.

(5) Serviceability limit states which may require consideration are for example:

— deformations or deflections which cause anxiety or hinder the effective use of the works or cause unacceptable damage to finishes or non-structural elements;

— vibrations which cause discomfort to people or damage to the works or its contents, or which limit its functional effectiveness;

— detrimental cracking.

4. TECHNICAL SPECIFICATIONS AND GUIDELINES FOR EUROPEAN TECHNICAL APPROVAL

4.1. General

(1) 'Technical specifications' means those referred to in Article 4 of the Directive. 'Guidelines for European Technical Approval' of a product or family of products means those referred to in Article 11 of the Directive.

(2) A general distinction is made between:

— *Category A:* These are standards, which concern the design and execution of buildings and civil engineering works and their parts, or particular aspects thereof, with a view to the fulfilment of the Essential Requirements as set out in the Directive. Category A standards should be taken into consideration within the scope of the Directive as far as the differences in laws, regulations and administrative provisions of Member States prevent the development of harmonized product standards.

— *Category B:* These are technical specifications and guidelines for European technical approval which exclusively concern construction products subject to an attestation of conformity and marking according to Articles 13, 14 and 15 of the Directive. They concern requirements with regard to performance and/or other properties, including durability, of those characteristics that may influence the fulfilment of the Essential Requirements, testing and compliance criteria of a product.

Category B standards that concern a family of products, or several families of products, are of a different character and are called horizontal (Category Bh) standards.

(3) This distinction between Categories A and B is not intended to lay down different priorities for the work on the respective documents but to reflect the difference in the responsibilities of the authorities of Member States and in those of the bodies for European Standardisation and Technical Approval in implementing the Directive.

(4) In order to ensure the quality of these documents with a view to the fulfilment of the Essential Requirement, the provisions of this Interpretative Document will result in specific conditions which will be included in the mandates for the preparation of the respective European standards and guidelines for the European technical approval.

(5) The assumptions made in Category A standards on the one hand and those made in Category B specifications on the other shall be compatible with each other.

(6) Category B technical specifications and guidelines for European technical approval shall indicate the intended use(s) of the respective products.

4.2. Provisions concerning works or parts of them

4.2.1. *Basis for verification*

In order to satisfy the Essential Requirement on mechanical resistance and stability, works in Member States are currently verified on the basis of procedures:

(a) complying with the provisions of Chapter 3 of this Interpretative Document including the relevant limit states to be considered;

(b) making provisions with respect to the serviceability limit states; the owner of the works may lay down special or additional serviceability requirements depending on the function of the works.

4.2.2. *Actions*

(1) The ranges of values for actions and other influences which need to be considered for the design, execution and use of the works are currently given in the national regulations. These also provide the representative values of actions and influences and specify the types of actions and values or classes to be considered for particular types of works.

(2) As far as fatigue design is concerned, national regulations or Category A standards referred to in 4.1 (2) may consider rules for different working lives and rules for return periods.

4.2.3. *Partial safety factor format*

Design rules in technical specifications and in guidelines for European technical approval may be based on the partial safety factor format using representative values for actions and the properties of materials. In such a case account is taken of the fact that levels of safety and serviceability depend on the quality assurance system. The desired levels of safety and serviceability may be established by using probabilistic reliability methods.

4.2.4. *Simplified rules*

Technical specifications and guidelines for European technical approval may include simplified design rules based on the limit state concept, such as:

Case 1 — Verification by calculations:

(a) by simplifying the calculation for ultimate limit states and/or serviceability limit states, or

(b) by considering only serviceability limit states, where the ultimate limit states need not be considered explicitly;

Case 2 — Verification without calculations:

(a) by specifying particular detailing rules, or

(b) for simple works, by specifying particular provisions based on substantial experience.

4.3. **Provisions concerning products**

4.3.1. *Products and related characteristics which may be relevant to the Essential Requirement*

(1) For the purpose of preparing mandates for Category B standards and guidelines for European technical approval, the list given in the appendix indicates products or families of products which may be placed on the market and which contribute to the ability of the works as a whole, or certain parts of the works, to satisfy the Essential Requirement. This list of products is not exhaustive.

(2) In this list, the characteristics relevant to the Essential Requirement, which need to be taken into account in the preparation of the mandates for European standards and guidelines for European

technical approval, are shown against each product or family of products. They are also indicative of the characteristics to be considered in the mandates for those products that are not included in the list.

(3) For the characteristics listed in the appendix the following applies:

i) where mentioned, tolerances on sizes are to be considered in the specifications with reference to the overall design or execution need;

ii) where relevant (e.g. plastics), the range of temperature in which characteristics must be valid has to be expressed;

iii) even in cases where this is not specifically mentioned, a conventional age as well as rate of testing may be specified;

iv) durability (referred to the values of characteristics) is intended to mean the extent to which the values of the characteristics are maintained during the working life under the natural process of change of the characteristics, by excluding the effect of aggressive external actions.

v) the Interpretative Document applies to products where their performance affects the structural integrity of works (as a whole and in their separate parts).

4.3.2. *Performances of products*

(1) As far as practicable the characteristics of products should be described in performance terms in the technical specifications and guidelines for European technical approval. Methods of calculation, measurement, and testing (where possible), together with compliance criteria, shall be given either in the relevant technical specifications or in references called up in such specifications.

(2) The expression of the product performances should be compatible with the basis for the verification of the Essential Requirement as currently in use in Member States and referred to in Chapter 3 and as provided in the European Category A standards referred to in 4.1 (2), taking into account the actual implementation of these documents.

4.3.3. *Attestation of conformity of products*

(1) 'Attestation of conformity' of products means that the provisions and procedures laid down in Articles 13, 14 and 15 of Annex III to the Directive are followed. These provisions aim to ensure that, with acceptable probability, the performance of a product will be achieved as specified in the relevant technical specification.

(2) The mandates will include indications concerning the conformity attestation procedures within the framework of Annex III to the Directive and related provisions to be indicated in the technical specifications and guidelines for European technical approval.

5. WORKING LIFE, DURABILITY

5.1. Treatment of working life of construction works in relation to the Essential Requirement

(1) It is up to the Member States, when and where they feel it necessary, to take measures concerning the working life which can be considered reasonable for each type of works, or for some of them, or for parts of the works, in relation to the satisfaction of the Essential Requirements.

(2) Where provisions concerning the durability of works in relation to the Essential Requirement are connected with the characteristics of products, the mandates for the preparation of the European standards and guidelines for European technical approvals, related to these products, will also cover durability aspects.

5.2. **Treatment of working life of construction products in relation to the Essential Requirement**

(1) Category B specifications and guidelines for European technical approval should include indications concerning the working life of the products in relation to the intended uses and the methods for its assessment.

(2) The indications given on the working life of a product cannot be interpreted as a guarantee given by the producer, but are regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

APPENDIX

PRODUCTS RELEVANT TO THE ESSENTIAL REQUIREMENT 'MECHANICAL RESISTANCE AND STABILITY'

1. PRODUCTS FOR MASONRY

PRODUCTS	RELEVANT CHARACTERISTICS
Masonry units	
made of different materials e.g.:	
clay	Tolerances on sizes (1) *(only for labelling purposes)*
calcium silicate	Shape/size/position of voids in hollow masonry units
concrete *(normal and lightweight)*	Density
autoclaved aerated concrete	Water suction properties
stone	Dimensional stability: moisture
	Compressive strength
	Tensile strength *(only for special justified cases)*
	Impact resistance of external shells
Note: Masonry units may have different geometries e.g.: solid, perforated, hollow, frogged	Durability *(with respect to the values of the above characteristics and under the following actions):* freezing and thawing
Premixed and prebatched mortars based on e.g.:	
cement	After set and hardening:
lime	Density
resin	Dimensional stability: moisture
	Tensile and compressive strength
	Bond strength on relevant masonry units
	Durability *(with respect to the values of the above characteristics and under the following actions):* freezing and thawing; chlorides; sulphates
Mortar constituents	
	— For lime, characteristics affecting the above mortar characteristics are to be considered
	— For other constituents see section 3 of this list
Bed joint reinforcement	
The reinforcement may be placed in the mortar bed joints or in special grooves and may e.g. be in the form of bars, wires or meshwork (expanded metal plate, welded wire, woven wire, wire ladder)	Bond strength in relevant mortar
	Tensile strength
	Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents

PRODUCTS	RELEVANT CHARACTERISTICS
Ties	
Ties may e.g. be ordinary wall ties, slip ties or shear ties *(symmetrical or asymmetrical)* and be made of e.g. plastics, or metals (steel, stainless steel, phosphate bronze, copper, aluminium)	Compressive strength Tensile strength Bending stiffness also *(except wall ties)* — Shear resistance — Shear stiffness Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
Ancillary components	
e.g. straps, joist hangers, support angles and brackets	Strength and stiffness under relevant actions Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents

2. TIMBER PRODUCTS FOR STRUCTURAL USE

Solid structural timber	
Timber may be round or sawn, planed or otherwise processed and endjointed (glue). Timber may be untreated or impregnated to increase durability or fire resistance	Strength and modulus of elasticity in: bending, compression, tension, shear — parallel and perpendicular to grain Durability *(with respect to the values of the above characteristics and under the following actions):* biological attack from wood-destroying fungi, insects and marine borers
Glued laminated timber	
Horizontally or vertically laminated, straight and curved, etc.	As for solid structural timber, and additionally bond integrity — glue-line shear strength — delamination resistance
Other glued timber products	
	Bond integrity as above
Timber poles for transmission lines	
	Strength and stiffness under prescribed actions Durability *(with respect to the values of the above characteristics and under the following actions):* biological attack from wood-destroying fungi and insects

PRODUCTS	RELEVANT CHARACTERISTICS
Wood-based boards	
e.g. plywood, particle board, fibreboard, oriented strand board, cement-bonded board	Dimensional stability under varying moisture conditions Strength and stiffness under different moisture conditions in: bending, compression, tension, shear — in different directions; in plane and perpendicular to the plane of the panel Durability *(with respect to the values of the above characteristics and under the following actions):* biological attack from wood-destroying fungi and insects moisture Bond integrity — glue-line shear strength — delamination resistance
Adhesives *(for in-situ use)* e.g. phenolic, aminoplastic and casein	Bond integrity: — delamination resistance — effect of shrinkage — interaction with wood (acid damage) Durability *(with respect to the values of the above characteristics)*
Mechanical and dowel-type fasteners	
e.g. nails, staples, dowels, bolts and screws	Tensile strength Bending strength Bending stiffness Joint strength in shear Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
Connector and punched metal plate fasteners	
e.g. nail plates, toothed plate connectors, split ring, shear plates	Joint strength in shear Stiffness in shear Behaviour under cyclic actions Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents

3. CONCRETE AND PRODUCTS FOR CONCRETE (PLAIN-REINFORCED-PRESTRESSED) PRODUCTS

Concrete constituents	
CEMENT *(for in-situ use)* including ordinary Portland, Portland-composite, blast furnace, pozzolanic, composite, low heat of hydration, rapid hardening, sulphate resisting, etc.	Those directly affecting the characteristics of hardened concrete listed below and those of mortars — reactiveness with sulphate — alkali content

PRODUCTS	RELEVANT CHARACTERISTICS
AGGREGATES *(for in-situ use)* e.g. gravel, sand, crushed rock, blastfurnace slag, lightweight aggregates, recycled aggregates	Those affecting the characteristics of hardened concrete *(see below)* and mortars *(see Mortar constituents)* — alkali/aggregate reaction — grading — cleanliness
Concrete	*For fresh concrete* workability *For hardened concrete* characteristics of hardened concrete at conventional ages and rate of testing: — density — compressive strength — tensile strength — modulus of elasticity — maximum compressive strain — shrinkage coefficient — final creep coefficient Durability *(with respect to the values of the above characteristics and under the following actions):* freeze-thaw abrasion sulphate *For high strength concrete additionally* — energy absorbing properties (with regard to brittleness) — fracture energy — behaviour under cyclic loading
Other concrete constituents e.g.:	
ADDITIONS *(for in-situ use)* e.g. microsilica, fly ash, blastfurnace slag	Those affecting the characteristics of hardened concrete e.g.: fineness silica content sulphates chlorides carbon content
ADMIXTURES *(for in-situ use)*	As above and absence of deleterious interactions with other components

PRODUCTS	RELEVANT CHARACTERISTICS
Reinforcing steel e.g.: ordinary steel stainless steel galvanized steel epoxy coated rebar bars — ribbed, plane, smooth coiled rods welded fabric	Tolerances on size (1) *(only for labelling purposes)* Weldability Tensile ultimate strength Tensile yield strength Fatigue strength — low cycle fatigue Ductility Modulus of elasticity Elongation at maximum load Bond strength (with concrete) Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
ANCILLARY COMPONENTS e.g. fasteners, couplers	Strength and stiffness under relevant actions
Prestressing steel wires bars strands	As for 'reinforcing steel' and, additionally, relaxation losses Durability *(with respect to the values of the above characteristics and under the following actions):* stress corrosion corrosion agents
PRESTRESSING DEVICES *for post-tensioning* Anchorages Couplers	Failure strength Elongation at failure and at service load Fatigue strength Load transfer to concrete Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
DUCTS AND SHEATHS	Factor of flexural behaviour Lateral load resistance Tensile load resistance Watertightness Durability *(with respect to the values of the above characteristics)*
GROUTS	Fluidity and cohesion Resistance to water penetration Bond strength Compression strength Shrinkage deformation on hardening Durability *(with respect to the values of the above characteristics and under the following actions):* frost Absence of deleterious interactions with other components

4. PRODUCTS FOR METAL CONSTRUCTIONS

PRODUCTS	RELEVANT CHARACTERISTICS
Steel and aluminium alloys sections	
Hot-rolled, cold-formed or otherwise produced sections with different shape — plate, bar, T, L, H, channels angle, hollow — of different materials — ordinary steel, corrosion resistant steel, aluminium — unprotected or protected against corrosion by coating with paint, zinc, epoxy, anodizing Also included are piles and sheet piling	Tolerances on geometry Yield strength Ultimate tensile strength Fatigue resistance — low cycle fatigue Fracture toughness (related to lowest service temperature) Modulus of elasticity Ductility Ultimate strain Weldability Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
Structural connectors	
e.g. rivets, bolts (nuts and washers), studs, screws, etc.	Tolerances on geometry Yield strength Ultimate strength Fatigue resistance Weldability Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
Welding materials *(for in-situ uses)*	Strength and stiffness of relevant welded joints

5. OTHER PRODUCTS

A) **Products for general geotechnical use**	
SOIL REINFORCEMENT	
e.g. geotextiles, geogrids and filaments	Tensile strength Stiffness Durability *(with respect to the values of the above characteristics and under the following actions):* various agents active in soils ultraviolet light
SOIL STABILIZATION	
Various products, e.g. for pressure grouting	Fluidity and cohesion Compatibility with soil components Durability *(with respect to the values of the above characteristics)*

PRODUCTS	RELEVANT CHARACTERISTICS
GROUND ANCHORS	
e.g. rock bolts, soil pins	Tensile strength Shear strength Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion agents
B) Prefabricated products	
SYSTEMS FOR WATER AND GAS SUPPLY AND SEWERS	
e.g. tubes, pipes and fittings, gutters and shafts made of concrete (reinforced or unreinforced), plastics, steel, cast iron	Tolerances on geometry (1) *(only for labelling uses)* Internal pressure strength External pressure strength Longitudinal bending strength Crushing resistance Durability *(with respect to the values of the above characteristics and under the following actions):* various agents in soil or in the transported agents
PREFABRICATED LOAD-BEARING COMPONENTS OR PANELS	
e.g. floor units, roof units, columns, wall units, diaphragm walls, ground beams, piles, culverts, lintels (including those in composite action with masonry), retaining walls, railway sleepers	*As appropriate:* Bending strength Tension strength Compression strength Shear strength Torsion strength Punching shear strength Bending stiffness Compression stiffness Impact resistance *(for special uses for walls and floors)* Durability *(with respect to the values of the above characteristics as appropriate to use and materials)*
PREFABRICATED CONCRETE MEMBER CONNECTORS	
	As above and additionally friction coefficient
METAL COMPONENTS	
e.g. stairs, galleries and walkways, fixed ladders, façades	Tolerances on geometry (1) *(only for labelling purposes)* Strength, stiffness as appropriate to use Durability *(with respect to the values of the above characteristics and under the following actions):* corrosion
STRUCTURAL BEARINGS	
	Compressive strength Shear strength Combined compression/shear strength Compressive stiffness Shear stiffness Durability *(with respect to the values of the above characteristics and under the following actions)* oxidation temperature fatigue

PRODUCTS	RELEVANT CHARACTERISTICS
VIBRATION ISOLATORS AND DAMPERS	
e.g. rubber bearings, energy absorbing systems, friction couplers	As for structural bearings and especially: energy absorbing properties (e.g. hysteresis loop shape and stability)
C) **Products for road construction**	
AGGREGATES FOR ROAD USES	
	Grading Cleanliness Resistance to fragmentation Durability *(with respect to the values of the above characteristics and with regard to):* resistance to attrition
BITUMEN	
	Density Softening point Hardness Resistance to oxidation at high temperature Durability *(with respect to the values of the above characteristics and under the following agents):* climate conditions chemicals
HYDRAULIC BINDERS	
e.g. fly ash, blastfurnace slag	Grading Chemical composition Mechanical properties *after set and hardening* (compressive strength, modulus of elasticity) Durability *(with respect to the values of the above characteristics)*
BITUMINOUS MIXTURES	
	Bituminous binder content Aggregates grading Adhesion of binder to aggregates *After compacting and hardening* Compaction Bending stiffness Resistance to rutting Bond strength binder to aggregates Durability *(with respect to the values of the above characteristics and under the following actions):* fatigue water chemicals (for special uses)

(1) The labelling of tolerances on geometry is considered to fit into the scope of this Interpretative Document when justified and relevant to the listed structural characteristics.

INTERPRETATIVE DOCUMENT

Essential Requirement No 2

'SAFETY IN CASE OF FIRE'

CONTENTS

ESSENTIAL REQUIREMENT: SAFETY IN CASE OF FIRE

1. GENERAL

1.1. Purpose and scope

(1) This Interpretative Document relates to Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products, hereinafter referred to as 'the Directive'.

(2) Article 3 of the Directive stipulates that the purpose of the Interpretative Documents is to give concrete form to the Essential Requirements for the creation of the necessary links between the Essential Requirements set out in Annex I to the Directive and the mandates for the preparation of harmonized standards and guidelines for European technical approvals or the recognition of other technical specifications within the meaning of Articles 4 and 5 of the Directive.

Where considered necessary, the provisions of this Interpretative Document will be further specified in each particular mandate. In drafting the mandates, account will be taken, if necessary, of the other Essential Requirements of the Directive, as well as of other relevant Directives concerning construction products.

(3) This Interpretative Document deals with the aspects of the works where 'Safety in case of fire' may be concerned. It identifies products or product families and characteristics relating to their satisfactory performance.

For each intended use of the product, the mandates will indicate in further detail which of those characteristics shall be dealt with in the harmonized specifications, using a step-by-step procedure with CEN/Cenelec/EOTA, which will allow the product characteristics to be modified or complemented, if necessary.

Annex I to the Directive gives the following definition of the Essential Requirement which is applicable when and where the works are subject to regulations containing such a requirement:

'The construction works must be designed and built in such a way that in the event of an outbreak of fire:

— the load-bearing capacity of the construction can be assumed for a specific period of time,

— the generation and spread of fire and smoke within the works are limited,

— the spread of fire to neighbouring construction works is limited,

— occupants can leave the works or be rescued by other means,

— the safety of rescue teams is taken into consideration.'

(4) In accordance with the Council Resolution of 7 May 1985 (New Approach) and the preamble to the Directive, this interpretation of the Essential Requirement is intended not to reduce the existing and justified levels of protection for works in the Member States.

1.2. Levels or classes for Essential Requirements and for related product performances

1.2.1. Where differences specified in Article 3 (2) of the Directive are identified and justified in conformity with Community law, classes for Essential Requirements and for related product performances may be necessary. The purpose of such classes is to achieve the free circulation and free use of construction products.

In this case such classes shall be determined either in the Interpretative Document or according to the procedure provided for in Article 20 (2) (a) of the Directive. Where through this procedure a classification of product performance is identified as the means of expressing the range of requirement levels of the work, the Commission will within the mandate request CEN, Cenelec or EOTA to make the appropriate proposal.

The range of requirement levels covered by the classes depends on the existing and justified levels encountered in Member States.

In cases where a Member State determines, in conformity to Article 6 (3) of the Directive, within the classes only one or some classes to be observed in its territory (or part of it), it shall do so only on the basis of the differences specified in Article 3 (2) of the Directive.

1.2.2. Where justified differences specified in Article 3 (2) of the Directive are not identified, classes (or levels) of product performances may also be used by the standardizers as a means of convenience for specifiers, manufacturers and purchasers. For certain products, classes (or levels) make it easier to use the standard to relate product performance to its intended use.

Such performance classes (or levels) for products may with reference to Article 4 (1) of the Directive therefore be established by the standardizers who will keep the Commission and the Standing Committee informed of the ongoing work on this matter in the framework of the execution of mandates.

1.2.3. Each time classes are defined for works or for products, it is necessary to set up a class called 'no performance determined' when and where at least one Member State has no legal requirement at all in that field.

1.3. **Meaning of general terms used in the Interpretative Documents**

1.3.1. *Construction works*

'Construction works' means everything that is constructed or results from construction operations and is fixed to the ground. This term covers both *buildings* and *civil engineering* works. In the Interpretative Documents 'construction works' are also referred to as the 'works'. Construction works include for example: dwellings; industrial, commercial, office, health, educational, recreational and agricultural buildings; bridges; roads and highways; railways; pipe networks; stadiums; swimming pools; wharfs; platforms; docks; locks; channels; dams; towers; tanks; tunnels; etc.

1.3.2. *Construction products*

(1) This term refers to products which are produced for incorporation in a permanent manner in the works and placed as such on the market. The terms 'construction products' or 'products', where used in the Interpretative Documents, include materials, elements and components (single or in a kit) of prefabricated systems or installations which enable the works to meet the Essential Requirements.

(2) Incorporation of a product in a permanent manner in the works means:

— that its removal reduces the performance capabilities of the works; and

— that the dismantling or the replacement of the product are operations which involve construction activities.

1.3.3. *Normal maintenance*

(1) Maintenance is a set of preventive and other measures which are applied to the works in order to enable the works to fulfil all its functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc.

(2) Normal maintenance generally includes inspections and occurs at a time when the costs of the intervention which has to be made are not disproportionate to the value of the part of the works concerned, consequential costs being taken into account.

1.3.4. *Intended use*

The intended use of a product refers to the role(s) that the product is intended to play in the fulfilment of the Essential Requirements.

1.3.5. *Economically reasonable working life*

(1) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

(2) An economically reasonable working life presumes that all relevant aspects are taken into account, such as:

— costs of design, construction and use;

— costs arising from hindrance of use;

— risks and consequences of failure of the works during its working life and costs of insurance covering these risks;

— planned partial renewal;

— costs of inspections, maintenance, care and repair;

— costs of operation and administration;

— disposal;

— environmental aspects.

1.3.6. *Actions*

Actions which may affect the compliance of the works with the Essential Requirements are brought about by agents acting on the works or parts of the works. Such agents include mechanical, chemical, biological, thermal and electro-magnetic agents.

1.3.7. *Performance*

Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product, for an action to which it is subject or which it generates under the intended service conditions (for the works or parts of works) or intended use conditions (for products).

2. EXPLANATION OF THE ESSENTIAL REQUIREMENT 'SAFETY IN CASE OF FIRE'

2.1. Introduction to Fire Requirements

For definitions and terms relating to this document, see Annex 1

Fire safety requirements constitute a vital part of the regulations for works in the EEC countries. Fire safety in construction works includes requirements on the layout of buildings and on the performance of structures, building products, services and installations, and fire safety installations under fire conditions.

Such requirements are normally formulated for a number of occupancies, such as dwellings, hotels, assembly rooms, offices, industrial premises, etc., taking into account the specific occupant risk and the specific fire risk.

2.2. Fire Safety Strategy

Fire safety objectives deal with the items given in the definition of the Essential Requirement — *see 1.1 (3).*

An important part of the strategy is to minimize the occurrence of fires (fire prevention) but the scope of this document cannot cover all the relevant factors, such as, for example, fire safety management.

The development and growth of fire depends upon a number of factors including the nature and distribution of the contents (fire load), the air supply, the thermal properties of the enclosure of the construction works, the fire and smoke control systems, and the fire protection system efficacy. Building contents, however, are not a matter for this Directive. The reaction-to-fire performance of the internal lining of a room (its wall and ceiling surfaces, and its floor coverings) can influence the rate at which fire and smoke develop and therefore is often controlled.

In addition fire safety of the occupants can be improved by early detection of a fire, which may be provided by an automatic fire detection and alarm system and/or by suppression of fire by an appropriate fire protection system.

A fire compartment is surrounded by a boundary which constitutes a barrier to fire (compartmentation) and smoke (a smoke barrier). In order to prevent fire growing to an unacceptable size leading to a dangerous spread of smoke within the construction works, the boundaries of such room(s) would normally be constructed to resist fire for a given period of time. While the construction surrounding the compartment concerned has to be fire-resisting, consideration also needs to be given to means of communication between adjoining compartments. Thus the use of doors, stairs and escalators, etc., should not breach the integrity of compartments (and the barriers to fire and smoke).

A prerequisite for the integrity of the compartmentation is the overall stability of the main structure.

The restriction or prevention of the spread of fire between neighbouring (separate) buildings is the next important step in the fire safety strategy.

The intervention of the fire brigade/rescue teams plays an important role in providing fire safety in construction works. The above described provisions for, and the means of, fire protection are seen in close relationship with the intervention, fire-fighting and rescue operation by the fire brigade.

Even if the effect of the fire brigade action may not be expressed directly, the necessary provisions for fire safety of the construction works are influenced and may be taken into account in different ways in the Member States.

The above strategy is consistent with the objective of the Essential Requirement 'Safety in case of fire' and the five headings, see *1.1 (3)*. The five headings are not independent. In this document the construction products concerned are identified and listed under the appropriate heading and their characteristics are given in Chapter *4.3*.

2.3. Engineering approach in the field of Fire Safety

Fire safety engineering is the approach by the application of engineering principles to evaluating the required level of fire safety and to designing and calculating the necessary safety measures.

Regarding fire safety of construction works, the tools of fire safety engineering can be used in several ways:

(a) for determining basic information on how fire and fire effluents are developing and spreading in works, e.g.

— the calculation of fire development in rooms

— the calculation of fire spread inside or outside buildings beyond the room of fire origin

— the assessment of movement of fire effluents in buildings and similar works

(b) for the assessment of actions, e.g.

— the exposure to heat and fire effluents of persons and works

— the mechanical action on building structures and/or works

(c) for evaluating the performance of construction products when exposed to fire, e.g.

— in developing fires, characteristics like ignitability, flame spread, rate of heat release, production of smoke and toxic gases

— resistance of structures affected by fire in terms of load-bearing capacity and separating function

(d) for the evaluation of detection, activation, suppression, e.g.

— the activation times of control systems, suppression systems, fire brigade, occupants

— the effect of fire and smoke control systems (including extinguishing agents)

— the assessment of detection times depending on the nature and location of fire/smoke detectors

— the interaction of suppression and other safety devices

(e) for the evaluation and design of evacuation and rescue provisions

At present only some aspects of fire engineering have been developed and a significant research effort is needed in order to develop a global, coherent approach.

An engineering approach requires that relevant characteristics of products are provided, and calculation and design procedures are validated on an agreed and harmonized basis.

3. BASIS FOR THE VERIFICATION OF THE SATISFACTION OF THE ESSENTIAL REQUIREMENT 'SAFETY IN CASE OF FIRE'

3.1. General

(1) This chapter identifies basic principles prevailing in Member States for the verification of the satisfaction of the Essential Requirement 'Safety in case of fire'. These principles are currently complied with, when and where the works are subject to regulations containing this Essential Requirement. Chapter 4 provides guidance on how to meet this Essential Requirement by compliance with the technical specifications referred to in Article 4 of the Directive.

(2) The Essential Requirement, as far as applicable, is satisfied with acceptable probability during an economically reasonable working life of the works.

(3) The satisfaction of the Essential Requirement is assured by a number of interrelated measures concerned in particular with:

— the planning and design of the works, the execution of the works and necessary maintenance;

— the properties, performances and use of the construction products.

(4) It is up to the Member States, when and where they feel it necessary, to take measures concerning the supervision of planning, design and execution of the works, and concerning the qualifications of parties and persons involved. Where this supervision and this control of qualifications are directly connected with the characteristics of products, the relevant provisions shall be laid down in the context of the mandate for the preparation of the standards and guidelines for European technical approval related to the products concerned.

3.2. **Actions**

(1) The performance of products is related to the specified action.

In this INTERPRETATIVE DOCUMENT, the term ACTION is considered to be a mechanical action (e.g. loads, forces resulting from constrained thermal expansion, and impacts), a thermal action, an action caused by environmental conditions (e.g. weathering, humidity) or a combination of these.

A thermal action consists of radiation, convection and conduction. The level of thermal action versus time is defined by the stage of development of fire, which could be simulated by calculation or test in the evaluation of product performance in end use conditions.

For thermal actions the following levels of exposure are identified:

— small ignition source (e.g. match type)

— single burning items (e.g. burning furniture, stored materials in industrial premises)

— fully developed fire (e.g. natural fire exposure, standard temperature/time curve).

(2) For evaluating the reaction-to-fire performance of products, radiation, convection and a combination of these exposures are used. Thermal actions depend upon the kind, intensity and duration of exposure and may be characterized by:

— size of flame,

— level of radiation,

— level of convective heat transfer (combustion gas temperature and velocity),

with or without local flame impingement.

(3) For evaluation of the response of fire detection installations, smoke control and fire extinguishing installations, fires simulating a single item or a localized group of items burning, are used.

The actions depend upon the kind, intensity and duration of exposure and may be characterized by:

— rate of heat release,

— flame height and amount of smoke generated,

— fire area (surface burning area),

— level of temperature.

(4) For the evaluation of fire resistance of structures the following possibilities are prevailing in Member States:

(a) *consideration of natural fire scenarios*

(defined by parameters listed below)

A calculation of the thermal action caused by fire in a construction works (e.g. room, group of rooms, part of a construction works) should consider:

— the fire load (type, amount and burning rate)

— air supply to the fire

— geometry and size of enclosure (defined by the fire compartment)

— thermal properties of the enclosure

and depending on the particular fire safety strategy or engineering approach, consideration can also include:

— influence of fire suppression installation (e.g. sprinkler installation)

— fire brigade/rescue team action (which may be initiated by a fire detection installation).

(b) *consideration of conventional fire scenarios*

The Essential Requirement requires that fire spread is limited and that the load-bearing capacity of the construction is adequate for a specific period of time. These requirements can be satisfied by proving fire resistance of load-bearing and/or separating elements. Internationally it is agreed to use the 'standard temperature/time curve' (see ISO 834 Part 1) as a model for a fully developed fire. It follows the relationship:

$$T = 345 \log_{10} (8 t + 1) + 20$$

where T = is the furnace gas temperature, °C

t = is the duration of the thermal exposure during the fire test, in minutes.

The 'standard temperature/time curve' is a conventional model used for evaluating the performance of products exposed to a fully developed fire. The adoption of this temperature/time curve is a simplification to represent thermal action.

For specific fire situations determined in Chapter 4, products shall be exposed to the standard temperature/time curve up to 300, 600 and 820 °C, staying at these levels for the remainder test time.

The severity of thermal attack associated with a natural fire can be higher or lower than that associated with the 'standard temperature/time curve'. For a more severe attack (especially a higher rate of temperature rise) a harmonized hydrocarbon curve is used for proving fire resistance, which follows the relationship

$$T = 1080 [1 - 0{,}325 \exp (- 0{,}167 t) - 0{,}675 \exp (- 2{,}5 t)] + 20$$

(t = time in minutes).

A test having a rate of temperature increase slower than that of the 'standard temperature/time curve' (that is a smouldering curve) should be required in circumstances mentioned e.g. in *4.3.1.3.4 (b)* but only if it is expected that the performance of the product exposed to a slowly growing natural fire would be substantially less than the performance achieved when that product is exposed to the heating conditions of the 'standard temperature/time curve'. The smouldering curve follows the relationship

$$T = 154 (t)^{0,25} + 20$$

(t = time in minutes).

The condition of heat transfer to the test specimen is included in the test specification.

For special extreme fire scenario (e.g. traffic tunnels, nuclear plants, etc.), more severe conventional curves may be specified.

(c) *Basis for calculations of fire resistance*

When making a calculation of fire resistance it is necessary to consider load-bearing capacity, integrity and insulation. This presupposes a calculation of, or experimental data on, the thermal response of the element which, in the case of a calculation, requires information on heat transfer from the fire to the element.

When a conventional temperature/time curve is used (i.e. the ISO 834 temperature/time relation given above) appropriate convective and radiative heat transfer coefficients should be used which correspond to the conditions occurring in the harmonized test. For other design fire exposures (e.g. hydrocarbon and smouldering fires) an appropriate heat transfer coefficient should be used.

Assessment of integrity is sometimes difficult as it requires information, for example on the likelihood of cracks and holes developing in the element which often can only be determined by undertaking a fire resistance test.

Note: Fire load density may be determined from design values depending on the building type (in accordance with the general philosophy for determining actions on structures) or by measurement of the actual fire load.

3.3. Verification of the satisfaction of the Essential Requirement

There might be various methods for verifying that the Essential Requirement or specified level of the Essential Requirement is satisfied on the basis of the harmonized characteristics of the construction products. None of them shall create barriers to the use of a product which would comply with the relevant technical specifications.

The requirement's expression in the national regulations can be made in accordance with three different approaches, or a combination of these:

— statement of a minimum performance requirement, in numerical or general terms, of the works. Where this is done in general terms then a link is required between the requirement for works and the product characteristics,

— statement of minimum fire performance of the products e.g. fire resistance, reaction-to-fire, performance of fire safety installations. In this case, the statement shall be made by reference to the technical specifications,

— statement of the critical fire environment levels people in or near the works may be exposed to. The harmonized terminology shall be used.

Section 4 states the principles relevant to the methods for assessing fire performance and the methods for verifying compliance with the requirements.

4. TECHNICAL SPECIFICATIONS AND GUIDELINES FOR EUROPEAN TECHNICAL APPROVAL

4.1. General

(1) 'Technical specifications' means those referred to in Article 4 of the Directive. 'Guidelines for European Technical Approval' of a product or family of products means those referred to in Article 11 of the Directive.

(2) A general distinction is made between:

— *Category A:* These are standards which concern the design and execution of buildings and civil engineering works and their parts, or particular aspects thereof, with a view to the fulfilment of the Essential Requirements as set out in the Directive.

Category A standards should be taken into consideration within the scope of the Directive as far as the differences in laws, regulations and administrative provisions of Member States prevent the development of harmonized product standards.

— *Category B:* These are technical specifications and guidelines for European technical approval which exclusively concern construction products subject to an attestation of conformity and marking according to Articles 13, 14 and 15 of the Directive. They concern requirements with regard to performance and/or other properties, including durability, of those characteristics that may influence the fulfilment of the Essential Requirements, testing and compliance criteria of a product.

Category B standards that concern a family of products, or several families of products, are of a different character and are called horizontal (Category Bh) standards.

(3) This distinction between Categories A and B is not intended to lay down different priorities for the work on the respective documents but to reflect the difference in the responsibilities of the authorities of Member States and in those of the bodies for European Standardisation and Technical Approval in implementing the Directive.

(4) In order to ensure the quality of these documents with a view to the fulfilment of the Essential Requirement, the provisions of this Interpretative Document will result in specific conditions which will be included in the mandates for the preparation of the respective European standards and guidelines for the European technical approval.

(5) The assumptions made in Category A standards on the one hand and those made in Category B specifications on the other shall be compatible with each other.

(6) Category B technical specifications and guidelines for European technical approval shall indicate the intended use(s) of the respective product.

4.2. Provisions concerning works or parts of them

4.2.1. *General*

Verification of performances of construction works concerning the Essential Requirement 'Safety in Case of Fire' may include:

— Methods for assessing, for example, fire development (including generation of smoke and hazardous fire effluents) in a room, spread of fire and smoke in the construction works, and spread of fire and smoke to neighbouring construction works and to the environment.

— Methods for assessment of performance and design of parts of works (e.g. structures and installations) e.g. structural fire performance, smoke venting installations, pressurization installations, sprinkler installations, fire detection and alarm installations.

— Methods for evaluating the interaction between fire, occupants, fire protection measures and fire-fighting and rescue activities.

The levels of the Essential Requirement may be a function of:

— the type, use and location of the construction works

— its layout

— the availability of the emergency facilities

4.2.2. *Load-bearing capacity of the construction*

4.2.2.1. Statement of principles

The stability of the main structure of a construction works in case of fire is necessary:

— to provide for the safety of the occupants during the time they are assumed to remain in the building,

— to increase the safety of rescue teams and fire-fighters,

— to guard against collapse of a building, causing injury to people,

— to allow the construction products involved in fire safety to carry out their functions for the necessary time.

The required period of stability, usually expressed in terms of conventional fire resistance times, depends on the goals of regulators.

The following are examples of the goals of some regulators:

— No specified fire resistance requirements for buildings with limited fire load density or where the consequences of collapse of structures are acceptable.

— Fire resistance for a specified but limited period of time, where the time requirements can be specified to allow for safe evacuation of occupants and intervention of rescue teams.

— Fire resistance of the main structure to ensure it can survive a full burn out of all combustible materials in the building, or a specified part of it, without taking into account the intervention of the fire brigade/rescue teams.

The stability of buildings has to be ensured through sufficient fire resistance of the main structure. The fire resistance of the main structure is currently assumed to be satisfied if the fire resistance of the individual elements is demonstrated to be at least the same and the connections do not reduce the fire resistance of the main structure.

Attention is drawn to indirect actions caused by the consequences of thermal dilatation, deflection and/or failure of structural elements.

4.2.2.2. Parts of works concerned:

(a) *Load-bearing parts with and without fire-separating function*

Walls (internal, external)

Floors

Roofs

Columns and tension members

Beams

Stairs

(b) *Parts which contribute to fire resistance*

passive: — Suspended ceilings/ceiling membrane

— Vertical protective membrane

— Fire protective claddings and coatings

— Water-filled structures

active: — Waterspray installation.

The purpose of a waterspray system, in this case, is to cool structural elements.

4.2.3. *Limitation of generation and spread of fire and smoke within the construction works*

4.2.3.1. Statement of principle

The objectives are:

— to retard the speed of fire development and spread of fire and smoke in the works so as to enable occupants near and/or remote from the origin of fire to have sufficient time to escape

— to enable the fire brigade/rescue teams to control the fire before it has grown too large.

These may be achieved by:

— prevention of initial ignition

— limitation of the generation and spread of fire and smoke within the room of origin

— limitation of spread of fire and smoke beyond the room of origin.

4.2.3.2. Prevention of initial ignition

4.2.3.2.1. General

Prevention of initial ignition depends on a set of conditions ranging from user instruction to requirements regarding the detailing of appliances and equipment as well as installation of the latter in the construction works.

4.2.3.2.2. Works or parts of them concerned

Provisions prevailing in Member States are described below:

(a) *Electrical Installations*

Electrical installations are designed and installed in such a way so as to ensure that

— they do not initiate fire;

— they do not actively contribute to a fire;

— the spread of fire is limited;

— in the event of fire, effective fire extinguishing measures can be taken and rescue is possible.

(b) *Heating Installations*

Heating installations and their parts have to be designed and installed in such a way as to ensure that

— they do not initiate fire;

— they do not actively contribute to a fire;

— the spread of fire is limited;

— the risk to adjacent elements (walls, floors) or objects (furniture) is limited;

— large component surfaces and exposed appliance surfaces cannot heat up to an unacceptable extent;

— in the event of fire, effective fire extinguishing measures can be taken and rescue is possible.

(c) *Gas Installations*

This item is satisfactorily covered by Council Directive 90/396/EEC on the approximation of the laws of the Member States relating to appliances burning gaseous fuels.

(d) *Lightning Protection Installations*

The objective of a lightning protection installation is to protect the construction works and their occupants from lightning or other manifestations of atmospheric electricity. To achieve this objective the installation should:

— provide an adequate air termination network at which atmospheric electric charge may safely enter the protection system without damage to the construction works;

— provide one or more routes of adequately low impedance by which the electric charge can be conducted to earth without risk to the construction works or other installations within the construction works;

— provide an earth termination network such that the charge can be lost to earth without excessive rise in the installation's electrical potential;

— provide adequate bonding to other metallic parts of the construction works;

— if required, monitor and/or record the number and/or strength of individual lightning strikes.

Exposure/action: Design electrical discharge.

Performance criteria: Ability to protect the works against lightning and safely transfer any current to the ground.

(e) *Flammable Gas Detection Installations*

The objectives of a flammable gas detection installation are to detect the presence of flammable gas before the concentration becomes ignitable or explosive, to give any necessary warnings, and to initiate any necessary protective measures (such as switching on ventilation or shutting off gas flows).

To achieve these objectives, the installation should:

— provide throughout the area to be protected suitable detectors to enable the presence of flammable gas to be detected at a sufficiently early stage;

— provide a reliable means of communication between the detectors and a central receiving point;

— provide at the receiving point a means of interpreting the signals from detectors, identifying the position from which any warning has been raised, attracting attention to fire or fault warnings, and initiating such other actions as may be required;

— be able to resist the environmental conditions of construction works in which it is mounted so that it retains the ability to carry out its functions during an acceptable working life.

(f) *Explosion Suppression Installations*

The objective of an explosion suppression installation is to prevent the creation of an unacceptably high pressure (explosion pressure), resulting from ignition of gas or dust, within an enclosure that is not designed to withstand the maximum explosion pressure. This requires the immediate sensing of pressure rise and the injection of a uniformly dispersed extinguishing medium into the protected enclosure within the shortest possible time.

Exposure/action: Ambient climate, specified test condition for activation, and relevant pressure tests to ensure performance in case of an explosion.

Performance criteria: Ability to be activated to design parameters and release and establish a calculated concentration of extinguishing medium within an enclosure within a specified time.

(g) *Ventilation systems*

The hazard of fire and smoke spread from one fire compartment to another through a ventilation system should be avoided.

Examples of situations using fire-resisting ducts and/or fire dampers are as follows:

1. Each compartment has a separate air supply and air exhaust ducts, which have no openings where passing through other compartments. To avoid fire spread fire-resisting ducts are used.

2. The different compartments have a common duct. The following protection devices may be used:

   (a) The ducts are not fire-resisting. A fire damper is installed at each penetration of a fire-resisting compartment wall/floor. In some cases the fire dampers are installed remotely from the wall/floor, and the duct between fire damper and wall/floor is then fire-resisting.

   (b) The ducts are fire-resisting. At each opening a fire damper is installed. Instead of fire-resisting ducts the use of non fire-resisting ductwork inside fire-resisting shafts is also possible. In this case the fire dampers are installed at the openings of the shafts.

   (c) The ducts are fire-resisting. The air supply/exhaust fan runs permanently. The entry of fire into supply ducts and the exit of fire from exhaust ducts is prevented by airflow/pressure conditions.

3. The air distribution is established using overflow openings, each equipped with a fire damper.

4.2.3.3. Limitation of the generation and spread of fire and smoke within the room of origin

4.2.3.3.1. General

Provisions prevailing in Member States aim at limiting the rapid participation of construction products in the early stage of a fire and limiting the contribution of construction products to the full development of a fire in the room of origin. Thus the relevant products must have certain reaction-to-fire performances in their end use conditions. These performances are evaluated over a range of thermal exposures from exposure to a small flame (match type exposure), the heating condition simulating a fire in the contents (single burning item, e.g. furniture), to the thermal action similar to that of a further developed fire.

Note: In the early stage of a fire, critical conditions for the occupants might not be reached in the room of origin, and survival is still possible within the premises concerned. Unfavourable contribution of heat and smoke (opacity — toxicity) from the exposed surfaces can reduce the time until critical conditions for the occupants are reached.

Increased thermal action is usually associated with a further development of fire. In a large room, however, severe thermal action from a localized fire in the contents may expose nearby construction products to heating conditions normally associated with a further developed fire.

Fire detection and alarm systems can be installed in order to ensure early detection of a fire and to activate alarms, warning and fire suppression/extinguishing systems.

4.2.3.3.2. Parts of works concerned:

(a) Walls/ceilings

(b) Floors

(c) Pipes and ducts — including externally applied insulation — *(relevant products: see 4.3.1.1)*

(d) Installations

Provisions concerned with works or parts of them are described below.

1) *First Aid Hose Installations*

A first aid hose installation is a manual and fixed installation installed in the works in order to make it possible for the occupants to control and extinguish a small fire from nearby.

Exposure/action: Ambient indoor and outdoor climate

Force to draw out the hose

Water pressure.

Performance criteria: Ability to deliver a design flow of water (l/s) at a design pressure, through a length of hose, with a jet of water of sufficient length to enable the occupants to initiate first intervention without delay.

2) *Sprinkler Installations*

The purpose of a sprinkler installation is to ensure early response to a fire and discharge a specified amount of water ($l/m^2 \times min$) over a design area for a relevant time in order to control/extinguish the fire. The sprinkler system might also activate various emergency functions such as alarm to occupants and call of fire brigade.

Exposure/action: Ambient indoor climate (e.g. temperature and humidity)

Fire exposure simulated in a medium (e.g. hot air or hot liquid) to assess the rate of response

Mechanical impact on distribution pipework etc.

Performance criteria: Ability to be activated automatically and release an evenly distributed and specified amount of water over a given area for a specified time.

Characteristics: — ($l/m^2 \times min$), maximum area of operation, number of sprinkler heads operating simultaneously.

— Response time for the installation.

3) *Waterspray Installations*

The purpose of a waterspray system is one or more of the following:

— To ensure early response to a fire by releasing a predetermined pattern and amount of water over a predetermined area for the purpose of control and/or extinguishment of that fire.

— To provide cooling to an installation which, if affected by heat (usually but not exclusively radiated heat) would aggravate the situation by explosion, collapse, release of fuels or otherwise.

— To provide a barrier of spray to inhibit the spread of fire.

4) *CO_2 Extinguishing Installations*

The purpose of a fixed CO_2 installation is to dilute the oxygen content at the site of a fire, by displacing part of it with CO_2 gas so that the fire is extinguished, simultaneously or previously giving an alarm so that appropriate emergency action (evacuation of personnel, call of fire-fighting services, etc.) may be taken.

The objective may be achieved by total flooding of a compartment to the design concentration of CO_2 gas or by local application (achieving an extinguishing concentration in the immediate vicinity only of a fire).

Exposure/action: Ambient indoor climate.

Performance criteria: Ability to be activated manually or automatically and release the extinguishing media, evenly distributed within the enclosure or over a specified area, in order to establish and maintain a design concentration (Vol. %) within a specified time.

Characteristics: Concentration of CO_2 and filling time of enclosure/release rate of CO_2.

Note: For total flooding systems, since an extinguishing concentration of CO_2 gas depletes the oxygen content below that required to support human life, it is necessary to ensure complete evacuation from the compartment in which the CO_2 gas is to be discharged before that happens. Whilst for local application systems, complete evacuation may not be necessary, it is essential that special design criteria and special precautions (training of personnel etc.) be rigidly adhered to.

5) *Halon (or Halon like replacements) Extinguishing Installations*

The purpose of a fixed extinguishing system using halon or an extinguishing medium having a similar effect is to release a calculated quantity of the halon in a gaseous form sufficient to inhibit the chemical reaction of the burning substance (fuel) and oxygen, thus extinguishing the fire, simultaneously (or previously) giving an alarm so that appropriate action (evacuation of personnel, call to fire-fighters/rescue teams, etc.) may be taken.

The objective may be achieved by the total flooding of a compartment to the design concentration of halon gas or by local application (achieving an extinguishing concentration in the vicinity only of the fire).

Exposure/action: Ambient indoor climate.

Performance criteria: Ability to be activated manually or automatically and release the extinguishing media, evenly distributed within the enclosure or over a specified area, in order to establish and maintain a design concentration (Vol. %) within a specified time.

Characteristics: Concentration of halon and filling time of enclosure.

6) *Foam Extinguishing Installations*

A fixed foam extinguishing installation is a manual or automatic system installed in order to extinguish fires particularly, but not exclusively, those involving flammable liquids.

A fixed foam extinguishing system is one in which a solution of foam concentrate and water is applied to the surface of a fire to provide a barrier between the vapours burning in the surface and oxygen in the surrounding atmosphere. A secondary function is to cool the fuel so that combustion is no longer sustainable.

Whilst many of these systems may be automatic in operation, most of them require manual intervention.

Exposure/action: Ambient indoor climate.

Performance criteria: Ability to be activated manually or automatically and release a calculated amount of aerated or underaerated foam/water solution of a given density (kg/m^3) over a specified area within a specified time.

Characteristics: Expansion rate and filling time of enclosure.

7) *Powder Extinguishing Installations*

The purpose of a fixed extinguishing powder system is to provide for the discharge of the medium on to the fire at an early stage after ignition.

Powder, stored in container(s), is discharged by gas pressure through nozzle(s). It may be conveyed from container to nozzle by rigid or flexible pipework (hose reel) or the nozzle may be directly attached to the container. The system may be manually or automatically operated.

Exposure/action: Ambient indoor climate.

Performance criteria: Ability to be activated manually or automatically and release a calculated amount (kg/m^2) of the extinguishing media over a specified area (m^2) or item.

8) *Manual Fire Alarm Installations*

A manual fire alarm installation in a works makes it possible for the occupant to initiate (and hence transfer) a fire alarm signal to a central control and indicating unit so as to make it possible to initiate different actions e.g. evacuation of the occupants.

Exposure/action: Ambient climate appropriate to intended use (indoor/outdoor applications).

Performance criteria: Ability to be activated manually and, where relevant, transfer a signal to a central indication and control unit.

9) *Automatic Fire Detection and Alarm Installations*

The aim of an automatic fire detection and alarm installation is to detect fire at the earliest possible reliable moment and to transfer a signal to a control and indication unit so that an alarm and appropriate action can be taken (e.g. evacuation of occupants, call fire-fighters/rescue teams, automatic release of extinguishing agent). The alarm indication enables an emergency signal to be given.

The purpose of the installation is to detect any phenomenon occurring from fire, i.e. gas, smoke, flame and heat, and to convert this detection into a signal understood by the control unit.

Detection part

Exposure/action: Ambient climate.

Specified test fires ('single burning item'-type).

Performance criteria: Ability to detect smoke, flames and/or heat automatically (related to specified sizes of design fire or simulation thereof) and transfer a signal to a central indication and control unit.

Alarm part

Exposure/action: Ambient climate.

Performance criteria: Ability to be activated automatically or manually and provide an audible and/or visual emergency/fire signal.

10) *Smoke and Heat Exhaust Ventilation Installations*

The purpose of the installation is to remove smoke and heat from a fire in a construction works using natural or powered vents or a combination thereof (as long as they are not used in the same smoke compartment) with manual or automatic operation, together with smoke curtains to limit the lateral spread of smoke and create a smoke-free area beneath a buoyant smoke layer.

The installation may contribute to any of the following objectives:

— keeping the escape routes and access routes free from smoke,

— facilitating fire-fighting operations by creating a smoke-free layer,

— delaying or preventing flash-over, thus preventing full development of the fire,

— reducing damage caused by smoke and heat,

— reducing the stresses to which structural members are exposed in case of fire.

4.2.3.4. Limitation of spread of fire and smoke beyond the room of origin

4.2.3.4.1. General

Limitation of fire and smoke spread can be achieved by one or a combination of the following:

— installation of fire-separating elements (walls, floors, etc.) adapted to the use of the construction (i.e. adapted to the expected thermal action in the construction works),

— closure of openings in fire-separating elements,

— an appropriate design of the façades, hindering spread to adjacent parts of the same works,

— fire suppression/fire extinguishing installation,

— removal of hot gases by natural or mechanical means,

— installation of smoke barriers (e.g. smoke control doors),

— the provision of fire-resisting ventilation ducting and/or the installation of fire dampers and actuating devices,

— creating differences of air pressure between zones within the construction works to control the passage of smoke between them.

Note: Critical life-threatening conditions for the occupants should not be reached in the escape routes. The propagation of heat and smoke (opacity — toxicity) beyond the room of origin can reduce the time until critical conditions are reached.

For practical reasons the smoke compartmentation boundaries, often, but not always, coincide with the fire compartmentation and both functions are then able to be fulfilled by the same separating elements.

Usually, fire-resisting separating elements without openings or gaps are implicitly expected to constitute sufficient barriers to smoke spread without the necessity of formulating detailed requirements. For other separating elements, e.g. doors, penetration seals for pipes and electrical cables, etc. this may not be so and the explicit formulation of smoke barrier requirements may be necessary if a smoke-stop function is expected to be fulfilled.

Special consideration needs to be given to the risk of smoke propagation represented by the presence of ventilation ducts and service ducts and shafts including their maintenance openings.

4.2.3.4.2. Parts of works concerned:

(a) *Exposed surfaces*

Exposed surfaces used as façades

(b) *Parts (with fire-separating function)*

— Walls (internal/external)

— Floors

— Roofs

— Partitions and non-load-bearing external walls

As far as external walls are concerned, fire spread from one fire compartment to another can occur due to:

— failure of fire separation elements between fire compartments

— failure of joints between walls/floors and the façades

— fire spread in cavities inside the façades

— fire spread along the outside surface of the façade

Performance criteria: — Reaction-to-fire performance

— Fire resistance against: fire from the inside

fire from the outside

— Ceiling membranes

— Closures for conveyors and trackbound transportation systems

— Raised floors

— Construction joints

— Service ducts and shafts *(relevant products: see 4.3.1.3.5)*

(c) *Parts which contribute to fire resistance*

Suspended ceilings

A suspended ceiling is one which is considered only to contribute to the fire resistance of the element (e.g. floor or roof) above, unlike a ceiling membrane *(4.3.1.3.5.3)* which in itself possesses fire resistance independent of any element above.

The effect of lighting, ventilation and maintenance openings, service installations and combustible materials in the floor or roof void, suspension devices, etc. on the fire resistance has to be considered. *(relevant products: see 4.3.1.3.4 (a))*

(d) *Installations*

Ventilation systems (ducts and dampers) *(see 4.2.3.2.2 (g))*

Automatic fire detection and alarm installations *(see 4.2.3.3.2 (d) 9))*

Smoke and heat exhaust ventilation installations *(see 4.2.3.3.2 (d) 10))*

Pressurization installations

The purpose of a pressurization installation for smoke control is to protect certain escape routes and other areas against the ingress of smoke by maintaining the air within them at pressures higher than those in adjacent parts of the works. These smoke free zones enable:

— occupants of the work to evacuate to a safe place, and/or

— fire-fighters and rescue teams to move around the building from a safe place.

Exposure/action: Ambient indoor and outdoor climate.

Performance criteria: Ability to activate and establish a design overpressure in a specified enclosure or a design velocity of flow through openings in the walls of the specified enclosure. The installation shall be able to maintain its function in case of failure of the primary power supply.

4.2.4. *Limitation of spread of fire to neighbouring construction works*

4.2.4.1. Statement of principle

The limitation of spread of fire to neighbouring construction works is necessary:

— to ensure safety of occupants in other construction works nearby and remote from the burning construction works

— to avoid conflagration and the consequences thereof, e.g. loss of vital services such as hospitals, communication installations, loss of resources and widescale destruction of homes and housing facilities

— to enable the fire brigade to control the fire (radiation from large fires may prevent approach of fire brigade/rescue teams).

The following two situations are currently covered:

— Fire spread between construction works which are entirely separate, as in buildings facing each other across a street for example.

— Fire spread between different construction works joined together, but with a fire-separating wall between them.

Limitation of fire spread to neighbouring construction works may be achieved by

— Limitation of radiation by controlling:

  — distance between construction works

  — size of unprotected areas such as windows

  — reaction-to-fire performance of products for façades

  — fire resistance of the unglazed or glazed parts of the façades

  — active protection measures such as waterspray installations.

— Controlling the ignition and fire spread over the external roof surface, including roof lights,

— Controlling the penetration of the fire to the inside of the building,

— Controlling the ignition of the surface of the roof covering from a fire below,

— Ensuring the fire-separating function of a roof or part of a roof exposed to a fully developed fire from below,

— The use of fire-separating walls with or without performance requirements such as impact resistance in addition to fire resistance.

4.2.4.2. Parts of works concerned:

(a) Fire-separating parts

— Fire-separating walls

— External walls and façades *(see 4.2.3.4.2 (b))*

— Roof coverings including roof lights

(b) Automatic waterspray installations *(see 4.2.2.2 (b))*

4.2.5. Evacuation of occupants

4.2.5.1. Statement of principle

Provision of means of escape for occupants in a construction works and provision of access for rescue teams is necessary:

— to allow occupants anywhere within the construction works to be able to evacuate to a place of safety,

— to allow rescue teams to have access to, search, and get out of the construction works.

In case of fire the safety of occupants during evacuation may be ensured by four types of measures:

— design and layout of escape routes in order to ensure safe evacuation of occupants to a place of safety

— separation of escape routes from the surroundings by means of fire and smoke-separating elements

— smoke control measures

— limitation of fire and smoke generation from wall and ceiling linings and floor coverings in escape routes.

In addition to the measures given in sections *4.2.2* and *4.2.3* the following measures can be considered, having regard to the construction works, its occupancy and use:

— fire detection and alarm installations including fire warning installations

— design, layout and number of escape routes and exits appropriate to the number of occupants and their mobility.

— provisions in escape routes which may include:

— emergency lighting installations

— emergency exit sign installations

— emergency power supply installations serving fire safety installations

— safety devices on doors (panic bars etc.)

— emergency guidance systems.

— provision of pressurization installations and other smoke control measures.

— provision of safe rescue places inside and/or outside the construction works.

— provision for access of rescue teams:

— access to the construction works

— accessibility for emergency and fire brigade vehicles

— fire-fighting lift installations.

— emergency communication systems within the construction works

— emergency alarm installations/fire warning installation

— emergency communication installations (also for the fire brigade).

— Emergency facilities used either by the occupants, or by the fire brigade (for intervention and fire-fighting at the start of the fire)

— first aid hose installations.

4.2.5.2. Parts of works concerned:

(a) *Exposed surfaces*

Walls/ceilings

Floors

Fire protective systems for electrical cables (including cables with intrinsic fire resistance)

(b) *Parts of works (with fire-separating functions)*

Walls and partitions

Ceilings (including suspended ceilings)

Floors

(c) *Installations*

1) Manual fire alarm installation *(see 4.2.3.3.2 (d) 8))*

2) Automatic fire detection and alarm installations *(see 4.2.3.3.2 (d) 9))*

3) Smoke and heat exhaust ventilation installations *(see 4.2.3.3.2 (d) 10))*

4) Pressurization installations *(see 4.2.3.4.2 (d))*

5) Flammable gas detection installations *(see 4.2.3.2.2 (e))*

6) Fire warning installations

A fire warning system is installed in a works in order to make possible the activation of an audible and/or a visual signal to warn the occupants or the staff that an emergency situation exists and evacuation may need to be initiated.

Exposure/action: Ambient climate.

Performance criteria: Ability to activate manually or automatically visible or audible warnings to the occupants. The installations should be able to maintain its function for a minimum design time (hours) in case of failure of the primary power supply.

7) Fire call installations

The purpose of the installation is to provide facilities within the works for the automatic transmission of a fire alarm from the works to the fire-fighters/rescue teams or to a control (fire command) station.

8) Emergency lighting installations

The purpose of the installation is to ensure that lighting is provided promptly, automatically and for a suitable time in a specified area when the normal power supply to the normal lighting fails. The purpose of the installation is to ensure:

— that the means of escape can be safely and effectively used;

— that activities in particularly hazardous workplaces can be safely terminated;

— emergency actions can be effectively carried out at appropriate locations in the work.

Exposure/action: Ambient climate.

Performance criteria: Ability to provide sufficient light in case of failure of the primary power supply in order to allow safe evacuation of the occupants or for other purposes.

9) Emergency exit signs installations

Emergency exit signs are installed in a works in order to show the occupants the location of exits to be used for evacuation in case of an emergency (fire) and the planned way of egress from each point in the works to the exits (e.g. by direction marking) (including 'not to be used in case of fire').

Exposure/action: Ambient climate, resistance against impact.

Performance criteria: Ability to provide clear, easy to identify and visible instructions concerning escape routes and exits for occupants.

10) First aid hose installations *(see 4.2.3.3.2 (d) 1))*

11) Emergency power supply of installations serving fire safety installations

The purpose of this installation is to provide, promptly, automatically and for a suitable time — power supply to the fire safety installations when the normal supply fails or in the event of damage or accident to elements of the system intended to supply, distribute or control power for this installation. Fire safety installations sometimes include their own emergency power supply.

12) Water supply installations serving fire safety installations

The purpose of the installation is to provide a suitable and reliable water supply (sometimes including a suitable water source) for the fire brigade and for the effective operation of fixed firefighting installations.

Exposure/action: Ambient climate appropriate to intended use.

Performance criteria: — Required flow of water (m^3/h)

— Pressure (bar)

— Continuity of supply (h).

4.2.6. *Safety of rescue teams*

4.2.6.1. Statement of principles

In addition to load-bearing capacity *(see 4.2.2)*, limitation of spread of fire and smoke *(see 4.2.3 and 4.2.4)*, and evacuation of occupants *(see 4.2.5)*, provisions aim at:

— ensuring possibility for rescue operations to be carried out

— allowing fire-fighting to be carried out effectively inside and around the works

— enabling rescue teams and fire-fighters to operate with a reasonable level of safety and leave the works with safety.

Such provisions may include:

— access/space for fire-fighting appliances outside/inside the building

— water supply installations serving fire safety installations

— fire hydrant installations

— rising and/or falling fire mains in the building with branch outlets, and where appropriate foam inlets, dedicated to fire suppression

— floor-plan layouts

— fire-fighting shafts

— fire-fighting or safety staircases

— fire-fighting lift installations

— fire-fighting lobbies

— smoke and heat exhaust ventilation installations

— pressurization installations

— emergency power supply installations serving fire safety installations

— emergency lighting installations

— control of utilities (gas, electricity, water, etc.) and active fire safety systems

— switches/valves for shutting down utilities

— emergency communications installations

— fire protective systems for electrical cables (including cables with intrinsic fire resistance)

— marking of dangerous substances

— signs to assist fire-fighters.

4.2.6.2. Parts of works concerned:

(a) Fire protective systems for electrical cables

(b) Emergency power supply of installation serving fire safety installations *(see 4.2.5.2 (c) 11))*

(c) Water supply installations serving fire safety installations *(see 4.2.5.2 (c) 12))*

(d) Smoke and heat exhaust ventilation installations *(see 4.2.3.3.2 (d) 10))*

(e) Pressurization installations *(see 4.2.3.4.2 (d))*

(f) Fire call installations *(see 4.2.5.2 (c) 7))*

(g) Emergency lighting installations *(see 4.2.5.2 (c) 8))*

(h) Fire hydrant installations

The purpose of the installation is to provide a connection (i.e. hydrant) to the water main to which the fire brigade can connect fire-fighting equipment (e.g. hose) in order to fill reservoirs and/or supply hoses and monitors.

(i) fire-fighting lift installations

A fire-fighting lift (often called a fire lift) is installed in a works to enable fire-fighters and their equipment to travel rapidly and with a reasonable measure of safety to upper and lower floors so that they have sufficient energy left for the difficult and lengthy task of fire-fighting/rescue.

The lift can also be used by the occupants of the works in normal conditions, but in a fire emergency the control of the lift is transferred to the fire-fighters using a fire-fighting lift switch usually positioned near the lift at fire service access level. The lift may be positioned in a protected lobby to minimize the possibility of smoke and fire entering the lift car and/or lift well. The speed of the lift should enable any floor to be reached within a very short time (1 minute for instance).

Another objective of a fire-fighting lift may be to evacuate disabled persons when a fire emergency arises.

A fire lift should preferably be sited next to a protected stairway so that if failure of the lift occurs fire-fighters can use the stairs without having to pass through a life-threatening zone. To achieve this it is considered good practice to have the lift and stairs within a protected shaft with a lobby separating the lift/stairs from the accommodation (fire/smoke area) at each storey level.

Exposure/action: Increased temperature.

Specified load.

Water damage to electrical components (from fire suppression/fire-fighting).

Performance criteria: Provision of a safe and reliable means of transportation of fire-fighters and rescue teams by lift in a works in case of fire.

Ability to maintain its function in case of failure of the primary power supply.

(j) Emergency communication installations

An emergency communication system may be installed in a construction works in order to provide facilities within the works for transmission of information within the works, to the fire brigade, to the building staff or to trained tenants, performing duties in the event of a fire emergency.

4.3. Provisions concerning products

4.3.1. *Products and related characteristics which may be relevant to the Essential Requirement*

(1) For the purpose of preparing mandates for Category B standards and guidelines for European technical approval, the following list indicates products or families of products which may be placed on the market and which contribute to the ability of the works as a whole, or certain parts of the works, to satisfy the Essential Requirement. This list of products is not exhaustive.

(2) Characteristics, relevant to the Essential Requirement, which need to be taken into account in the preparation of the mandates for European standards and guidelines for European technical approval, are given for these products or family of products. They are also indicative of the characteristics to be considered in the mandates for those products that are not included in the list.

(3) Due to the interdependence of the aspects of the Essential Requirement defined in *1.1 (3)*, the same product may appear under more than one of these aspects. This can influence the required level of performance of a product in a given construction works because of the different fire scenarios associated with the headings. The interrelationship of different characteristics may also need to be considered.

4.3.1.1. Products subject to reaction-to-fire requirements

To enable reaction-to-fire performance of products to be evaluated a harmonized solution will be developed which may utilize full or bench scale tests that are correlated to relevant real fire scenarios.

Products will be considered in their end use conditions.

The relevant performance criteria are considered to be ignitability, rate of heat release, rate of spread of flame, rate of smoke production, toxic gases, flaming droplets/particles and/or a combination of these.

Products may be single (homogeneous) materials, composites or assemblies e.g.

— products for walls, ceilings and floors including their surface coverings

— building elements

— products incorporated within building elements

— pipes and ducts components (including externally applied insulation)

— products for façades/external walls (including insulation layers etc.).

4.3.1.2. Products for roofs subject to fire requirements

4.3.1.2.1. Roofs exposed to an internal fire

(a) For roofs which require fire resistance under the conditions of a fully developed fire from below, *see 4.3.1.3.3.*

(b) For the performance of roofs exposed to a single burning item below the roof *(see 3.2)*, the following should be considered:

— collapse of the roof

— fire penetration through the roof and ignition of the surface of the roof covering

— fire spread below and inside the roof

— flaming droplets/particles in areas remote from the ignition source.

4.3.1.2.2. Roofs exposed to an external fire

To enable the fire performance of roof coverings (including insulation layers, vapour barriers, substrates, etc.) and roof lights to be demonstrated, it will be necessary to provide tests which will:

— determine the effects of a simulated flying brand on the roof (without wind)

— determine the effects of wind on the roof covering and roof light which have caught fire by a burning brand (with irradiance).

The performance criteria should contain limitations on:

— fire penetration through the roof or roof light into the building

— fire spread over the external surface or within the composition of the roof covering

— the production of flaming droplets/particles.

4.3.1.3. Products subject to resistance-to-fire requirements

4.3.1.3.1. General

To date, the ISO standard fire is the design fire commonly used in Europe and elsewhere, to enable fire resistance to be demonstrated. It is considered reasonable to relate it to postflashover, fully developed building fires. In the Member States the requirements for fire resistance using the standard fire reflect the safety levels thought to be appropriate. However, the standard fire resistance test is not intended to reflect the temperatures and stresses that would be experienced in natural fires. It provides a measure of the relative performance of structures and materials within the capabilities and dimensions of standard furnaces. In general, uncertainties about structural behaviour in natural fires are taken into account by making conservative fire resistance requirements.

A natural fire scenario may be used as an alternative to the standard fire and it is particularly useful where flashover will not be attained, or where significantly different rates of heat transfer may be assumed or where elements are subjected to non-uniform heating.

The basic criteria used to characterize the fire resistance of a product are:

— load-bearing capacity

— integrity

— insulation

expressed in minutes.

The symbols

R for load-bearing capacity

E for integrity

I for insulation

suffixed by the recorded performance time in minutes, are used when the characterization is made according to the standard temperature/time curve.

The classes shall be expressed as follows:

For load-bearing elements:

REI — time: Minimum time during which all criteria (load-bearing capacity, integrity and insulation) are satisfied.

RE — time: Minimum time during which the two criteria load-bearing capacity and integrity are satisfied.

R — time: Minimum time during which the criterion of load-bearing capacity is satisfied.

For non-load-bearing elements:

EI — time: Minimum time during which the two criteria of integrity and insulation are satisfied.

E — time: Minimum time during which the criterion of integrity is satisfied.

The performance time is expressed in one of the following figures:

15, 20, 30, 45, 60, 90, 120, 180, 240, 360.

Thus the following relevant classes may be defined:

REI 15, REI 30, REI 45, . . . RE 15, RE 30, . . . R 15, R 30, . . .

So a building element with a load-bearing capacity of 155 minutes, an integrity of 80 minutes and a thermal insulation of 42 minutes is classified as R 120/ RE 60/ REI 30, or a building element with a load-bearing capacity of 70 minutes and an integrity of 35 minutes is classified as R 60/ RE 30.

Where summation methods are applicable, the measured times for each product, rounded down to one minute, may be combined to determine the appropriate classification.

The classification can be expanded by:

— W when the insulation is controlled on the basis of the radiation emitted,

— M when particular mechanical actions are considered,

— C for doors equipped with a self-closing device,

— S for elements with particular limitations smoke leakage.

For unsymmetrical fire-separating elements the fire resistance classification is based on fire exposure from the side assessed as giving the lowest fire resistance, except if the direction of the fire exposure is known.

Member States may have a requirement for reaction-to-fire properties (expressed in harmonized specifications) in addition to fire resistance.

4.3.1.3.2. Load-bearing elements without separating function (e.g. beams, columns):

— *Evaluated against standard temperature/time curve*

Exposure/action: Standard temperature/time curve.

Performance criteria: Load-bearing capacity (R)

Classification (1): R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240

— *Evaluated against natural fire*

Exposure/action: Natural fire.

Performance criteria: Survival of the element against a given time or fire load.

Classification: Pass/fail.

4.3.1.3.3. Load-bearing elements with fire-separating function (e.g. for walls, floors, roofs including those which incorporate glazing)

Exposure/action: (a) or (a) and (b) apply

(a) Standard temperature/time curve.

(b) Impact, representing structural failure of other components in case of fire (for certain walls only; established by test or calculation).

Performance criteria: (approved combinations classification)

(a) Load-bearing capacity (2) integrity and insulation (REI)

(b) Load-bearing capacity (2) and integrity (RE)

(c) Load-bearing capacity (2) (R)

(d) Load-bearing capacity (2) integrity and insulation also in case of impact (REI-M) (M = mechanical)

(e) For glazed parts, the radiation criterion can also be used (W)

(1) In exceptional circumstances, generally for civil engineering works, the upper limit (R 240) can be extended.

(2) Permits a higher classification for (R) e.g. R 120/E 60/I 60

Classification:	RE		20	30		60	90	120	180	240
	REI	15	20	30	45	60	90	120	180	240
	REI-M			30		60	90	120	180	240

4.3.1.3.4. Products and systems for protecting elements or parts of the works

This section specifies particular requirements for assessing the contribution made by fire protection coatings and systems to the fire resistance of structural and non-structural parts of the works e.g. walls, floors, roofs, beams, columns.

(a) *Suspended ceilings*

Exposure/action: (a) Standard temperature/time curve (from below the suspended ceiling).

(b) Exposure from a single burning item *(see 3.2)* (this exposure from the underside is used only in special circumstances and is not intended to be mandatory for all suspended ceilings).

Performance criteria: (a) For the whole element: — load-bearing capacity

— integrity

— insulation

(b) Stability of the components of the suspended ceiling (for exposure/action (b)).

Classification: Only valid for the combination of the element of construction and the suspended ceiling.

(b) *Fire protective coatings, claddings and screens*

These products and systems are used for the fire protection of load-bearing elements and structures so as to increase the duration of their load-bearing capacity in case of fire. Fire protective coatings can be characterized in terms of material properties (thermal conductivity, diffusivity, integrity, stickability, etc.) over a range of high temperatures for the determination of the load-bearing capacity of the protected elements (by calculation and/or extrapolation or interpolation of test results).

Exposure/action: Standard temperature/time curve *(see also 3.2 (4) (b))* for products activated only by the heat flux of the fire).

Performance criteria: As for unprotected load-bearing elements given in *4.3.1.3.2* and *4.3.1.3.3.*

Classification: Ditto.

4.3.1.3.5. Products for non-load-bearing elements or parts of works

4.3.1.3.5.1. Partitions (including those incorporating glazing)

Exposure/action: (a) or (a) and (b) apply

(a) Standard temperature/time curve

(b) Impact, representing structural failure of other components in case of fire (for certain walls only; established by test or calculation).

Performance criteria: (combinations of classification)

(a) Integrity (E)

(b) Integrity and insulation (EI)

(c) Integrity and insulation also in case of impact (EI-M)

(d) For glazed parts, additionally the criterion radiation can be used (W)

Classification:	E		20	30		60	90	120		
	EI	15	20	30	45	60	90	120	180	240
	EI-M			30		60	90	120		

4.3.1.3.5.2 Façades, external walls (including glazed elements)

Two aspects have to be considered:

(a) Fire resistance aspects

— fire from inside the room *(see 4.3.1.3.5.1)*

— fire from outside

Exposure/action: Specified temperature/time curve which follows the standard temperature/time curve at least up to 600 °C staying at this level for the remainder test time.

Performance criteria: (a) Integrity (E)

(b) Integrity + insulation (EI)

Classification:	E	15	30	60	90
	EI	15	30	60	90

(b) Fire propagation aspects to upper levels inside walls or along exterior façades *(see 4.2.3.4.2 (b))*

4.3.1.3.5.3. Ceiling membranes

A ceiling membrane is a ceiling which in itself possesses fire resistance independent of any element above (unlike a suspended ceiling).

Exposure/action: (a) Standard temperature/time curve (exposure from below the ceiling).

(b) Fire exposure from within the void above the ceiling membrane.

Performance criteria: Integrity and insulation (EI)

Classification:	EI	15	30	45	60	90	120	180	240

4.3.1.3.5.4. Raised floors

This section refers to raised floors used in conjunction with a structural floor below.

Exposure/action: Fire exposure (to be decided in the mandate) from below the raised floor (i.e. within the void).

Performance criteria: Load-bearing capacity, integrity and insulation.

Classification: (to be decided in the mandate).

4.3.1.3.5.5. Fire doors and shutters and their closing devices (including those that incorporate glazing and hardware)

This section covers the particular fire resistance requirements for doors, including those which incorporate glazing.

Exposure/action: Standard temperature/time curve.

Performance criteria: (a) Integrity (E)

(b) Integrity and insulation (insulation requirements near edge gap may be reduced to the level that ignition of any combustible surface finishing on the unexposed side is avoided) (EI)

(c) Self-closing (C)

(d) Integrity and radiation (only on elements without sufficient I) (EW)

Classification:										
EI	15	20	30	45	60	90	120	180	240	
EW		20	30		60					
E	15		30	45	60	90	120	180	240	

Closing devices

This section is also intended to ensure that doors and shutters which form part of a fire-separating element are self-closing in case of fire and/or smoke.

Doors and shutters are closed by closing equipment either after each opening or only when fire occurs. Installations with closing mechanisms only effective when fire occurs are either hold open systems or free swing door closers. They have to ensure closure reliability even when the power supply fails. Installations might additionally be equipped with an opening device.

A hold open system may comprise a fire detector (e.g. heat and/or smoke detector), a release device, a hold open mechanism and a power supply. Response of the release device in case of fire or by any other causes of release (e.g. manual), should ensure the leaves are closed by their closing mechanism. The functioning of the hold open system is dependent on the reliability of its detection and release systems and the compatibility of the components.

A free swing door closer allows the door to swing freely in normal use but in case of fire a closing device operates to close the door.

The working life of a closing device has to be considered *(see Chapter 5).*

Exposure/action: Ambient climate.

Performance criteria: Ability to release 'hold open' installations for doors and shutters and to ensure reliable closing of doors and shutters in case of fire or failure of the power supply.

Working life (durability) should be considered.

Ability to close a door from any angle and overcome resistance e.g. latch.

4.3.1.3.5.6. Lift landing doors (including those that incorporate glazing)

Exposure/action: Standard temperature/time curve.

Performance criteria: (a) Integrity (E)

(b) Integrity and insulation (insulation requirements near edge gap may be reduced to the level that ignition of any combustible surface finishing on the unexposed side is avoided) (EI)

(c) Integrity and radiation (only on elements without sufficient I) (EW)

Classification:							
EI	15	20	30	45	60	90	
EW		20	30		60		
E	15		30	45	60	90	

4.3.1.3.5.7. Closures for conveyors and trackbound transportation systems

This section specifies closures which, in case of fire, close openings in fire-separating elements, such as walls and floors, penetrated by conveyor systems. Special devices are needed to ensure that moving items on the conveyor do not damage the closure or prevent the closure from being fully effective in closing the opening, especially in the event of power failure.

The safe and effective closing of such openings can only be achieved if the mechanical and electrical operations of the closure of the conveyor system and the components are carefully coordinated.

Exposure/action: Standard temperature/time curve.

Performance criteria: (a) Integrity (E)

(b) Integrity and insulation (insulation requirements near edge gap may be reduced to the level that ignition of any combustible surface finishing on the unexposed side is avoided) (EI)

(c) Self-closing (C)

Classification:									
EI	15	20	30	45	60	90	120	180	240
E	15		30	45	60	90	120	180	240

Working life of closures has to be considered.

4.3.1.3.5.8. Penetration seals for cables and pipes

Assessment should be made of:

— the effect of such penetrations on the integrity and insulation performance of the fire-separating element,

— the integrity and insulation performance of the penetration sealing system; and

— the insulation performance of the penetrating service or services, and, where necessary, the integrity of a service.

Exposure/action: (a) Standard temperature/time curve.

(b) Flame impingement (as far as necessary — see note below).

Performance criteria (a) Integrity (E)

(b) Integrity and insulation (EI)

Note: In deciding the criteria for performance it is necessary to consider the ways in which fire (including a small flame) may be transmitted through such elements. These ways may include:

— fire penetration through a space formed between a service and the seals, or between the seal and the element it penetrates, or through an opening formed within the service itself, or in the fire seal material;

— fire action which produces an unacceptable temperature rise on the unexposed surface of the element near the penetration;

— fire action which produces an unacceptable rise in the surface temperature of that part of the service that is in the non-fire affected compartment or on the unexposed surface of the penetration sealing system.

Classification:	EI	15	20	30	45	60	90	120	180	240
	E	15		30	45	60	90	120	180	240

4.3.1.3.5.9. Service ducts and shafts

This section covers the fire resistance of service ducts and shafts including their maintenance openings. These are building components which are separate from the rest of the structure and serve to accommodate all kinds of services and installations. The fire resistance relates to the fire spread from one fire compartment to another. The test arrangement has to reflect the installations which occur in practice.

Exposure/action: Standard temperature/time curve.

Performance criteria: Integrity and insulation (EI)

Classification:	EI	15	20	30	45	60	90	120	180	240

4.3.1.3.5.10. Chimneys and flues

The objective of the installation is to transport combustion products (smoke, fumes and particles) from the heat producing appliance or fireplace to the outside air so that the safety of the occupants of the works and people nearby is not affected.

To achieve this objective, the components of the installation should prevent excessive heat transfer through the walls of the installation so that fire is not initiated in adjacent parts of the works.

Exposure/action: (a) Normal heating conditions (gas temperature of 350 and 500 °C).

(b) Burn-out conditions (for a specified time) simulating combustion of deposits on the inner lining of the flue or chimney (1 000 °C).

Performance criteria: (a) Insulation (different criteria for the two exposures).

(b) Leakage.

Classification: According to the type of heating appliance.

Note: The prevention of fire penetration from one floor to another should be evaluated in accordance with *4.3.1.3.5.8.*

4.3.1.3.6. Ventilation systems

4.3.1.3.6.1. Ventilation ducts

The requirements for components of ventilation ducts relate to their use in vertical and horizontal ducts including branches, joints, air supply and exhaust openings, suspension devices, etc.

Exposure/action: (a) Standard temperature/time curve fire from inside.

(b) Fire from outside.

(c) Pressure difference.

Performance criteria: (a) Integrity (E)

(b) Integrity and insulation (EI)

(c) Leakage (S)

Classification:										
EI	15	20	30	45	60	90	120	180	240
E			30		60				

Classification should indicate if performance criteria are satisfied by fire from inside or fire from outside or both.

If leakage is restricted: S is added to the classification.

4.3.1.3.6.2. Dampers

The requirements for fire dampers relate to both vertical and horizontal installations. Test conditions have to be chosen according to the operating conditions, i.e. dampers with or without connected ducts *(see 4.2.3.2.2 (g))*.

Exposure/action: (a) Standard temperature/time curve.

(b) Closing procedure.

(c) Pressure difference.

Performance criteria: (a) Integrity (E)

(b) Integrity and insulation (EI)

(c) Leakage (S)

Classification:										
EI	15	20	30	45	60	90	120	180	240
E			30		60	90	120		

If leakage is restricted: S is added to the classification.

Durability, sensitivity and reliability of closing device of fire dampers have to be considered *(see 5.2)*.

4.3.1.4. Products within services

4.3.1.4.1. Electrical Installations *(see 4.2.3.2.2 (a))*

The construction products (e.g. meters, transformers, circuit breakers, cables, etc.) used may have to meet requirements concerning their fire resistance and reaction-to-fire.

4.3.1.4.2. Heating Installations *(see 4.2.3.2.2 (b))*

The construction products used may have to meet requirements concerning their fire resistance and reaction-to-fire.

4.3.1.4.3. Gas Installations *(see 4.2.3.2.2 (c))*

The construction products used may have to meet requirements concerning their fire resistance and reaction-to-fire.

4.3.1.4.4. Lightning Protection Installations *(see 4.2.3.2.2 (d))*

The installation consists of air terminations, down conductors, junction elements and joint strips, test joints or links, supports, fasteners and clamps, earth conductors and electrodes, and corrosion-protective anodes.

The construction products used may have to meet requirements concerning reaction-to-fire.

4.3.1.4.5. Emergency Power Supply of Installations serving Fire Safety Installations *(see 4.2.5.2 (c) 11))*

The installation may consist of: a supply separated from the main supplying the primary power; or a central power supply source (generator or rechargeable secondary batteries provided with suitable chargers); devices for starting, changing over (load transfer) and switching off the source; and electric circuits with protection and control devices, connecting the power source to the relevant components of the powered installations.

4.3.1.4.6. Fire Protective Systems for Electrical Cables

The purpose is to provide a reliable power supply from the power source to the safety installation(s).

For that reason, either electrical circuits are protected from fire, or electrical circuits with intrinsic resistance to fire are used.

(a) Exposure/action: Specified temperature/time curve which follows the standard temperature/time curve at least for the first 30 minutes, staying at this level for the remainder test time.

Performance criteria: Continuity of supply.

Classification: PH 15, PH 30, PH 60, PH 90.

(b) Exposure/action: Standard temperature/time curve.

Performance criteria: Continuity of supply.

Classification: P 15, P 30, P 60, P 90.

Note: It is intended to use exposure (a) for cable having conductors up to and including 2.5 mm² which are suitable for alarm, emergency lighting and communications.

4.3.1.4.7. Water Supply Installations serving Fire Safety Installations *(see 4.2.5.2 (c) 12))*

Water supply facilities or specific installations consist of natural or artificial water sources (when public mains do not cover the requirements), pumping and control devices, and a network of pipes for distributing water to the required points or installations.

4.3.1.5. Components of Fire Detection and Alarm Installations

4.3.1.5.1. Manual Fire Alarm Installations *(see 4.2.3.3.2 (d) 8))*

The installation consists of manual call points connected to a control and indication unit (with emergency power supply). The control unit, which may be shared with an automatic detection system, may activate various emergency and fire protection measures (such as warning to occupants, alarm to the fire brigade, operation of extinguishing systems, closing devices, etc.) and record any of this information.

4.3.1.5.2. Automatic Fire Detection and Alarm Installations *(see 4.2.3.3.2 (d) 9))*

The detection part of the installation consists of detectors connected to a control unit and one or more indication units with emergency power supplies (i.e. electrical supply from mains and standby batteries).

The alarm part of the installation consists of audible or visible signal units connected to the control unit.

The control part of the installation provides electrical control outputs in order to activate other fire safety installations automatically.

4.3.1.5.3. Flammable Gas Detection Installations *(see 4.2.3.2.2 (e))*

A flammable gas detection installation consists of: flammable gas detectors; communication links (normally electrical, but which could use optical, radio, pneumatic or any other suitable means) which may include data-handling and isolating components; control equipment; indicating equipment; audible or visual means of attracting attention, such as sounders or flashing lights; a primary power supply; and an emergency power supply in case of failure of the primary supply.

4.3.1.5.4. Fire Warning Installations (Fire alarm systems, Sound systems for emergency purposes) *(see 4.2.5.2 (c) 6))*

The installation consists of a central unit with an emergency power supply, connected by electrical wires (or other means) to audible and/or visual signal units. The installation may be activated manually or by means of an automatic fire detection system or a fire control/extinguishing system.

4.3.1.5.5. Fire Call Installations *(see 4.2.5.2 (c) 7))*

4.3.1.6. Components of fire suppression installations

4.3.1.6.1. Sprinkler Installations *(see 4.2.3.3.2 (d) 2))*

The sprinkler installation may include products such as sprinkler heads, pipes, fittings and hangers, installation control valves, alarm bells, flow indicators, water pumps, emergency power supply, etc.

Characteristics for sprinkler heads:

— distribution of water droplet size and area of coverage for each sprinkler head ($l/m^2 \times min$)

— temperature of activation

— response time

— mechanical impact

4.3.1.6.2. Waterspray Installations *(see 4.2.2.2 (b))*

The waterspray installation may include products such as multi-jet control valves, waterspray nozzles specifically designed for one or more of the above three objectives *(see 4.2.3.3.2 (d) 3))*, water pipes, fittings and hangers, installation control valves, alarm signal, flow indicators, water pumps, emergency power supplies, etc.

Exposure/action: Ambient climate (indoor/outdoor as appropriate).

Performance criteria: Ability to be activated manually or automatically and release a calculated quantity of water over an area or a surface.

4.3.1.6.3. CO_2 Extinguishing Installations *(see 4.2.3.3.2 (d) 4))*

The CO_2 installation may include containers for the CO_2 (in liquid form), valves (including safety devices), pipework (rigid or flexible), fittings and hangers, alarm system, discharge nozzles designed so that the CO_2 is converted from the liquid form to the gaseous form before reaching the fire.

4.3.1.6.4. Halon Extinguishing Installations *(see 4.2.3.3.2 (d) 5))*

The halon installation may include containers for the halon (in liquid form), valves, controls and pipework, fittings and hangers, alarm systems, and discharge nozzles such that the halon is applied to the fire in the gaseous form.

4.3.1.6.5. Foam Extinguishing Installations *(see 4.2.3.3.2 (d) 6))*

4.3.1.6.6. Explosion Suppression Installation *(see 4.2.3.2.2 (f))*

The installation consists of a sensor system and an extinguishing system. The sensor system consists of suitable detectors (thermo-electrical, optical or pressure sensors, or a combination thereof) connected to a control unit or a valve.

The suppression system consists of pressurized containers filled with the extinguishing media fitted with rapid action valves activated by a signal from the sensor system and designed to eject the extinguishing media within the shortest possible time.

4.3.1.6.7. Powder Extinguishing Installations *(see 4.2.3.3.2 (d) 7))*

4.3.1.7. Products and components of smoke control installations

4.3.1.7.1. Smoke Control Doors

This section specifies the particular requirements of the smoke tightness of doors including those which incorporate glazing.

Exposure/action: (a) Pressure difference.

(b) Temperature (ambient, medium, high temperature).

Performance criteria: (a) Leakage (S)

(b) Self-closing (C)

Classification: This depends on the level of leakage and the test temperature.

For closing devices see *4.3.1.3.5.5;* durability has also to be considered.

4.3.1.7.2. Smoke and Heat Exhaust Ventilation Installations *(see 4.2.3.3.2 (d) 10))*

A natural smoke and heat exhaust ventilation installation consists of smoke and heat extract ventilators, air inlet vents and where appropriate includes smoke curtains, smoke or heat detectors connected to a central unit for activation of the smoke and heat ventilators, mechanical devices to open the vents (manual operation) and/or the necessary power supply to operate the ventilators. The installation shall be so designed that automatic operation can be overridden by manual operation.

A powered smoke and heat exhaust ventilation installation consists of powered ventilators, smoke curtains, natural and/or powered air inlets at low level, and may include ducts, smoke and heat exhaust dampers, a fire detection system for activation of smoke and heat exhaust ventilators, fire protected wiring and power supply, e.g. emergency power supply.

(a) *Duct elements:*

Exposure/action: Standard temperature/time curve.

Internal fire (at the inlet of the duct).

Performance criteria: (a) Mechanical stability.

(b) Maintenance of cross-section under fire conditions.

(c) Integrity.

(d) Insulation.

(e) Leakage.

Classification: E 30 60 90 120

EI 30 60 90 120

(b) *Smoke and heat exhaust dampers:*

Exposure/action: Standard temperature/time curve.

Internal or external fire.

Performance criteria: (a) Mechanical stability.

(b) Maintenance of cross-section under fire conditions.

(c) Integrity.

(d) Insulation.

(e) Leakage.

(f) Reliability of dampers.

Classification: E 30 60 90 120

EI 30 60 90 120

(c) *Smoke curtains:*

Exposure/action: Specified temperature/time curve which follows the standard temperature/time curve over at least the first 600 °C.

Performance criteria: Mechanical stability/deformation.

Classification: Mechanical stability duration.

(d) *Powered smoke and heat ventilators (fans):*

Exposure/action: Exposure to hot gases (1).

Performance criteria: (a) Capacity to maintain the flow under defined exposure.

(b) Reliability of the activation system.

Classification: Pass/fail with indication of the duration.

(e) *Natural smoke and heat ventilators:*

Exposure/action: Exposure to hot gases (1).

Performance criteria: (a) Ability to open and work at given temperature and/or smoke density when activated in defined conditions.

(b) Absence of deformations liable to reduce aerodynamic free area.

(c) aerodynamic free area.

Classification: Pass/fail.

(1) Specification of the temperature gradient and maximum value will be considered when the mandate is given.

4.3.1.7.3. Pressurization Installations *(see 4.2.3.4.2 (d))*

The installation will usually comprise: fans (including back-up fans) to inject air into the pressurized zone; air ducts to provide a passageway for the transmission of air; ventilation openings to provide leakage of air; an emergency power supply; automatic sensors (e.g. smoke detectors) or manual switches for initiating the emergency state of the system; fire/smoke dampers in branches from the ductwork where the ductwork is situated outside the protected enclosure; grilles and diffusers.

4.3.1.8. Products and components of installations for means of escape

4.3.1.8.1. Emergency Lighting Installations (panic lighting, escape lighting) *(see 4.2.5.2 (c) 8))*

An emergency lighting installation consists of:

(a) luminaires (specifically for connection to a central emergency power supply or provided with self-contained power sources including charging devices), electrical connections with elements for protection, control and change-over (transfer and switch-off), or

(b) a number of luminescent signs (Exit Door Signs and Route Markers) which in the event of failure of the normal lighting (e.g. caused by power failure), provide sufficient light for the purpose.

4.3.1.8.2. Emergency Exit Sign Installations *(see 4.2.5.2 (c) 9))*

The installation may consist of literal or symbolic signs. These may be illuminated either by emergency lighting luminaires (internal or external) built into the signs, or by self-luminous materials.

Performance criteria: The signs shall also be visible in case of failure of the power supply.

4.3.1.8.3. Safety Devices on Doors

— *Locked doors in escape routes*

Safety devices have to ensure that doors in escape routes (e.g. exit doors), which might be locked in normal use, can be used and passed through by occupants in an evacuation without the use of keys or any other type of tools and without delaying the evacuation of the area.

The locking mechanism (e.g. panic bars etc.) may be released automatically and manually, but in the case of a power failure it must be automatic. Automatic release may be combined with the activation of an automatic fire detection or automatic sprinkler installation and, in the case of manual release, from a central position and/or near to the door itself.

— *Doors which open and close automatically*

Safety devices have to ensure that doors which open and close automatically in normal use can be easily opened manually in the event of a power failure, so that occupants can leave the works safely. In normal use these doors are activated by signals such as light beams, pressure mats, etc. In case of failure of power supply for the opening operation or the activation signal, doors must open automatically or must be easy to open manually so that occupants can leave the works with safety.

Exposure/action: Ambient indoor climate.

Force to release the door closing system.

Performance criteria: Ability to enable blocked and locked doors in escape routes to be opened manually by occupants or automatically without the use of keys or any other type of tools etc.

Automatic release of locked doors in case of failure of the primary power supply.

4.3.1.9. Components for fire-fighting installations

4.3.1.9.1. First Aid Hose Installations *(see 4.2.3.3.2 (d) 1))*

The installation consists of fixed units mounted on walls or in cabinets permanently connected to a water supply installation. The fixed units are composed of a coupling, valve with a pressure indicator, a semi-rigid water-filled hose reel or a layflat hose with its support, and a nozzle.

4.3.1.9.2. Fire Riser (fire mains) Devices

The purpose of the installation is to facilitate fire-fighting in works by making it possible to connect fire hoses at strategic points in the works to assure that a reliable and sufficient water supply exists. The riser may be permanently filled with water (wet riser) or may be empty (dry riser) until filled by the fire brigade on intervention.

(a) *Dry risers/mains*

The device consists of pipes with outlets and connectors at designated points in the works and an inlet at ground level for connection to a pumping system provided by the fire brigade.

(b) *Wet risers/mains*

The device consists of the same components as given in (a) above. The device is permanently connected to a reliable and sufficient water supply including a pumping set.

Exposure/action: Ambient climate.

Water pressure.

Performance criteria: Ability to provide a reliable and sufficient water supply for fire-fighting at designated points in the works with facilities for the connection of hoses.

4.3.1.9.3. Fire Hydrant Installations *(see 4.2.6.2 (h))*

The installation consists of hydrants (pillar or buried) connected to main water supply pipes and located at appropriate positions. Pillar hydrants may be dry or wet.

Dry pillar hydrants consist of a hollow pillar (head) mounted above ground level and provided with connection outlets, a valve body to be connected with flanges to the main water supply pipe, and when necessary, a barrel that joins the head with the valve body which operates the valve. Wet pillar hydrants are permanently filled with water and consist of a pillar provided with connection outlets with an operating valve and a connection flange.

Buried hydrants consist of valve/s and connection outlet/s in an underground chamber with a surface manhole cover.

4.3.1.9.4. Fire-fighting Lift Installations *(see 4.2.6.2 (i))*

The fire-fighting lift installation will usually comprise: a lift car; fire-resisting lift landing doors; a smoke control system; a primary source of power (electrical or hydraulic power); a secondary power supply, for use when the primary supply fails, capable of operating the lift for a specified period; motor; suspension

cables or rams; guide rails; a control system; an emergency communication system; safety gear to prevent the lift car falling out of control; electrical cables/hydraulic piping; and buffers.

4.3.1.9.5. Emergency Communication Installations *(see 4.2.6.2 (j))*

The emergency communication installation consists of a central (fire command) station provided with an emergency power supply which is connected to a network of loudspeakers, two-way telephones, voice-call boxes or other appropriate devices.

Exposure/action: Standard temperature/time curve (for the enclosure and the electrical and communication installation).

Performance criteria: Ability to maintain communication between selected places in a works.

The ability of the installation to maintain its functions in case of failure of the primary power supply.

4.3.2. *Performances of products*

(1) As far as practicable the characteristics of products should be described in performance terms in the technical specifications and guidelines for European technical approval. Methods of calculation, measurement, and testing (where possible), together with compliance criteria, shall be given either in the relevant technical specifications or in references called up in such specifications.

(2) The expression of the product performances should be compatible with the basis for the verification of the Essential Requirement as currently in use in Member States and referred to in Chapter 3 and as provided in the European Category A standards referred to in 4.1 (2), taking into account the actual implementation of these documents.

4.3.3. *Attestation of conformity of products*

(1) 'Attestation of conformity' of products means that the provisions and procedures laid down in Articles 13, 14 and 15 of and Annex III to the Directive are followed. These provisions aim to ensure that, with acceptable probability, the performance of a product is achieved as specified in the relevant technical specification.

(2) The mandates will include indications concerning the conformity attestation procedures within the framework of Annex III of the Directive and related provisions to be indicated in the technical specifications and guidelines for European technical approval.

5. WORKING LIFE, DURABILITY

5.1. Treatment of working life of construction works in relation to the Essential Requirement

(1) It is up to the Member States, when and where they feel it necessary, to take measures concerning the working life which can be considered reasonable for each type of works, or for some of them, or for parts of the works, in relation to the satisfaction of the Essential Requirements.

(2) Where provisions concerning the durability of works in relation to the Essential Requirement are connected with the characteristics of products, the mandates for the preparation of the European standards and guidelines for European technical approvals, related to these products, will also cover durability aspects.

5.2. **Treatment of working life of construction products in relation to the Essential Requirement**

(1) Category B specifications and guidelines for European technical approval should include indications concerning the working life of the products in relation to the intended uses and the methods for its assessment.

(2) Sometimes products are qualified for normal use but this does not include automatically the durability of fire safety performance.

Examples are:

— products sensitive to environmental influences (weathering, chemical effects, etc.) e.g. fire retardant treated products, intumescent materials

— movable closures (if they do not close under normal use there may be no risk for life safety but there might be one in case of fire) e.g. self-closing doors, shutters and dampers.

Methods for assessing working life are e.g.:

— tests involving washing and cleaning procedures

— long- and short-term weathering tests

— mechanical tests (closing tests, vibration, impact tests)

— corrosion tests.

(3) The indications given on the working life of a product cannot be interpreted as a guarantee given by the producer, but are regarded only as a mean for choosing the right products in relation to the expected economically reasonable working life of the works.

ANNEX

DEFINITIONS AND TERMS

Active fire protection measures

Systems and equipment installed to reduce danger to persons and property by either detecting fire, extinguishing fire, removing smoke and hot gases, or any combination of these functions.

Adjoining works

Construction works with common or connecting building elements (Opposite: separated works).

Alarm

Sudden attention or action for protection of persons or property (ISO 8201, 1987).

Building contents

The whole contents of a building excluding all construction products such as facings of the walls, partitions, floors and ceilings.

Ceiling membrane

a ceiling which is suspended or otherwise supported but which in itself possesses fire resistance independent of any element above (see also suspended ceiling).

Combustible (*)

Capable of burning.

Combustion (*)

Exothermic reaction of a substance with an oxidizer, generally accompanied by flames and/or glowing and/or emission of smoke.

Critical conditions for occupants

Limit values for temperature increase, oxygen depletion and concentration of toxic combustion gases that seriously endanger life safety in a certain time.

Design fire exposure

Thermal actions and other parameters used in fire design.

Emergency

Imminent risk or serious threat to persons or property (ISO 8201, 1987).

Emergency lighting

Provision of lighting for use during escape when normal lighting fails (ISO 8421-6, 6.29).

Emergency power supply

System installed in order to provide promptly, automatically and for a suitable time, power supply to fire safety installations, when normal supply fails or in the event of an accident to elements of a system intended to supply, distribute or control power for this installation (emergency lighting and signalling, fire detection, fire warning, fire-fighting lifts, pumps, communication system, etc.) (NFPA 70, 700-1).

Essential Requirement

See Construction Products Directive (Annex 1).

Evacuation, escape

Orderly movement of persons to a place of safety (in case of fire or other emergency) (ISO 8421-6, 6.6).

Escape route

Route forming part of the means of escape from any point in a building to a final exit (ISO 9421-6, 6.11).

Evacuation time

Time taken for all occupants of a building or part of a building, on emission of an evacuation signal, to reach a final exit (ISO 8421-6, 6.18).

Exit (fire, emergency)

Exit on an escape route (ISO 8421-6, 6.22).

Exit signs

Signs which clearly indicate exits (ISO 8421-6, 6.23).

Exposed surface

Surface of a product which is exposed to the action of the fire.

Façade cladding/external cladding

External surface lining material applied on façade. The façade cladding may include the insulating material applied in the space between external and internal façade linings.

Façade/external wall

Vertical building element separating the inside of a building from the outside. The façade includes transparent and non-transparent parts and their fixings to the building structure.

Fire (*)

1) A process of combustion characterized by emission of heat accompanied by smoke and/or flame.

2) Rapid combustion spreading uncontrolled in time and space.

Fire alarm, alarm of fire

Warning of fire originated by a person or by an automatic device (ISO/DIS 8421-3).

Fire alarm installation

Combination of components for giving an audible and/or visible and/or other perceptible alarm of fire. The system may also initiate other ancillary actions (ISO/DIS 8421-3).

Fire brigade

Public or private organization with the aim of safeguarding life and fighting fires.

Fire compartment (*)

An enclosed space in a building that is separated from other parts of the same building by enclosing construction having a specified period of fire resistance, within which a fire can be contained (or from which a fire can be excluded), without spreading to (or from) another part of the building.

Fire detector

Device which gives a signal in response to certain physical and/or chemical changes accompanying a fire (ISO/DIS 8421-3).

Fire door

A door or shutter, which, together with its frame and furniture as installed in a building, when closed is capable of meeting specified performance criteria.

Fire exposure

Thermal actions affecting the product.

Fire hazard (*)

The potential for loss of life (or injury) and/or damage to property by fire.

Fire load (*)

The sum of the calorific energies which could be released by the combustion of all the combustible materials in a space, including the facings of the walls, partitionings, floors and ceilings.

Fire load density (J/m^2) (*)

The fire load per unit floor area.

Fire mains, dry (rising/falling)

Fixed and rigid pipe installed permanently in a building and intended for connection of fire brigade hoses, in order to be charged at the moment of use (ISO/DIS 8421-4, 4.4.5).

Fire mains, wet (rising/falling)

Fixed and rigid pipe installed permanently in a building and which is permanently charged by its connection to a water supply and fitted with valves/outlets at specific points.

Fire resistance (*)

The ability of an element of a building construction to fulfil for a stated period of time the required load-bearing function, integrity and/or thermal insulation specified in the standard fire resistance test.

Fire resistance class

Conventionally defined classes, used for the classification of building elements on the basis of their proven fire resistance time.

Fire risk (*)

Probability of a fire causing a loss of life (or injury) and/or damage to property.

Fire retardant (*)

A substance added, or a treatment applied to a material in order to suppress, significantly reduce or delay the combustion of the material.

Fire safety installations

Those installations concerned with services, alarm and detection, installations for means of escape, suppression and fire-fighting equipment, etc.

Fire safety management

All measures taken during the lifetime of a works to minimize fire risk and fire hazard by proper maintenance and improvement of a works.

Fire safety objectives

Qualitatively or quantitatively expressed objectives in terms of fire risk and/or fire hazard.

Fire-separating wall

A wall which separates two adjoining fire compartments.

Fire severity

Level of thermal attack (heat flux) to building elements, caused by a fire.

Fire spread

Extension of a fire, both within the room of origin and from room to room.

Fire survival cable

An electric cable intended for the transmission of power or signals during a fire, and which is able to fulfil its design function for a stated period of time during a standard fire resistance test.

Fire test

A procedure designed to measure or assess the response of a material, product, structure or system to one or more aspects of fire (BS 6336: 1982).

Flame retardant (*)

A substance added, or a treatment applied to a material in order to suppress, significantly reduce or delay the propagation of flame.

Flame spread (*)

Propagation of a flame front.

Flashover (*)

The rapid transition to a state of total surface involvement in a fire of combustible materials within an enclosure.

Fully developed fire (*)

The state of full involvement of combustible materials in a fire.

Generation of smoke

See smoke release.

Hardware (doors)

Equipment applied to both door leafs and/or door frames to enable them to function as a door: e.g. latches, locks, closing devices, hinges, etc.

Hazard analysis

Analysis carried out in order to evaluate the potential for loss of life or injury and/or damage to property.

Heat release

A measure of the heat released from a burning material.

Ignition (*)

Initiation of combustion.

Ignition source (*)

An applied source of heat which is used to ignite combustible materials or products. Initial spark or flame or hot object causing ignition.

Interpretative Document (ID)

See: Construction Products Directive.

Load-bearing construction

Assembly of elements designed to provide mechanical resistance and stability to the works.

Main structure

All the elements necessary to ensure stability of a building.

Natural fire

a fire not governed by standardized temperature/time curves.

Natural fire curve

The time related variation of temperature

(a) of a test fire without control of ventilation;

(b) predicted by a calculation model, taking into account fire load, ventilation, etc.

Performance

Behaviour (of a product) related to use (ISO 6241/1984).

Performance requirement

User requirement, expressed in terms of the performance of the product.

Pressurization

The establishment of a positive or negative pressure difference across a barrier to protect a stairway, lobby, escape route or room of a building from smoke penetration (ISO 8421-5/1988 (E/F)).

Rate of heat release (*)

The calorific energy released per unit time by a material during combustion under specified test conditions.

Rate of spread of flame

For gas: The rate of spread of flame front in the gas.

For a solid: The rate of spread of flame on the surface of a solid (ISO 3261/1975 (E/F)).

Reaction-to-fire (*)

The response of a material under specified test conditions in contributing by its own decomposition to a fire to which it is exposed.

Roof coverings

Materials used for covering a roof to exclude weather, including insulation layers and vapour barriers but not the roof deck.

Room of origin

Room in which a fire starts.

Separated works

Construction works separated by a clear space between them (Opposite: adjoining works).

Separating function

The ability of a member to prevent the spread of fire and/or smoke by passage of flames or hot gases (cf. integrity) or ignition beyond the exposed surface (cf. thermal insulation) during the relevant fire exposure.

Smoke (*)

A visible suspension of solid and/or liquid particles in gases resulting from combustion or pyrolysis.

Smoke and heat venting installation

System incorporated in a building in order to improve the evacuation of the combustion gases and the heat produced by a fire. A smoke and heat extraction system can be based on powered extraction as well as natural convection.

Smoke control

Measures to control the spread or movement of smoke and combustion gases during a fire within a building (ISO 8421-5/1988 (E/F)).

Smoke control door

Door set designed to reduce the rate of spread or movement of smoke during a fire (ISO 8421-5/1988 (E/F)).

Smoke release

The release by a material of smoke and/or gas when heated by a fire and/or an ignition source (BS 6336/1982).

Smoke curtains, roof (or ceiling) screens

Vertical subdivision fitted internally to the roof (or ceiling) to create an obstacle to lateral flow of smoke and combustion gases (ISO 8421-5, 1988 (E/F).

Smoke vents, roof vents

Openings in the enclosing walls or roof of a building, intended to release heat and smoke in the event of fire, automatically and/or manually opened (ISO 8421-5, 1988 (E/F)).

Sprinkler installation (automatic)

An assembly of pipework, graded in size, erected throughout the construction works in which sprinkler heads are installed at prescribed intervals. The pipework is connected to a set of installation control valves incorporating an alarm and fed by an approved water supply.

Standard fire duration

Duration of a fire in a compartment in accordance with the standard temperature/time curve, without fire brigade intervention. This duration is determined by the fire load.

Standard temperature/time curve (*)

The time-related variation of temperature measured in a specified way during the standard fire resistance test as given in ISO 834.

Suspended ceiling

A ceiling which is suspended or otherwise supported and which is considered only to contribute to the fire resistance of the element (e.g. floor or roof) above it (See also ceiling membrane).

Thermal action

Heat exposure of a product during a fire (natural or experimental).

Temperature time curve

The time-related variation of temperature during a fire.

Type of occupancy

Subdivision of occupancies as a function of the age, awareness and mobility of the occupants, the type of fire load, and kind of activity in occupancy.

Water-spray installation

An assembly of pipework, graded in size, installed to apply water to an element of construction to cool it in case of fire, or to protect some predetermined item(s) within the construction works.

(*) Indicates that the definition has been taken from ISO Guide 52.

INTERPRETATIVE DOCUMENT

Essential Requirement No 3

'HYGIENE, HEALTH AND THE ENVIRONMENT'

CONTENTS

ESSENTIAL REQUIREMENT: HYGIENE, HEALTH AND THE ENVIRONMENT

1. GENERAL

1.1. Purpose and scope

(1) This Interpretative Document relates to Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products, hereinafter referred to as 'the Directive'.

(2) Article 3 of the Directive stipulates that the purpose of the Interpretative Documents is to give concrete form to the Essential Requirements for the creation of the necessary links between the Essential Requirements set out in Annex I to the Directive and the mandates for the preparation of harmonized standards and guidelines for European technical approvals or the recognition of other technical specifications within the meaning of Articles 4 and 5 of the Directive.

Where considered necessary, the provisions of this Interpretative Document will be further specified in each particular mandate. In drafting the mandates, account will be taken, if necessary, of the other Essential Requirements of the Directive, as well as of other relevant Directives concerning construction products.

(3) This Interpretative Document deals with the aspects of the works where 'Hygiene, Health and the Environment' may be concerned. It identifies products or product families and characteristics relating to their satisfactory performance.

For each intended use of the product, the mandates will indicate in further detail which of those characteristics shall be dealt with in the harmonized specifications, using a step-by-step procedure with CEN/Cenelec/EOTA, which will allow the product characteristics to be modified or complemented, if necessary.

Annex I to the Directive gives the following definition of the Essential Requirement which is applicable when and where the works are subject to regulations containing such a requirement:

'The construction work must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants or neighbours, in particular as a result of any of the following:

— the giving-off of toxic gas,

— the presence of dangerous particles or gases in the air,

— the emission of dangerous radiation,

— pollution or poisoning of the water or soil,

— faulty elimination of waste water, smoke, solid or liquid wastes,

— the presence of damp in parts of the works or on surfaces within the works.'

(4) In accordance with the Council Resolution of 7 May 1985 (New Approach) and the preamble to the Directive, this interpretation of the Essential Requirement is intended not to reduce the existing and justified levels of protection for works in the Member States.

1.2 Levels or classes for Essential Requirements and for related product performances

1.2.1. Where differences specified in Article 3 (2) of the Directive are identified and justified in conformity to Community law, classes for Essential Requirements and for related product performances may be necessary. The purpose of such classes is to achieve the free circulation and free use of construction products.

In this case such classes shall be determined either in the Interpretative Document or according to the procedure provided for by Article 20 (2) (a) of the Directive. Where through this procedure a classification of product performance is identified as the means of expressing the range of requirement levels of the work, the Commission will within the mandate request CEN, Cenelec or EOTA to make the appropriate proposal.

The range of requirement levels covered by the classes depends on the existing and justified levels encountered in Member States.

In cases where a Member State determines in conformity to Article 6 (3) of the Directive among the classes only one or some classes to be observed in its territory (or part of it), it shall do so only on the basis of the differences specified in Article 3 (2) of the Directive.

1.2.2. Where justified differences specified in Article 3 (2) of the Directive are not identified, classes (or levels) of product performances may also be used by the standardizers as a means of convenience for specifiers, manufacturers and purchasers. For certain products, classes (or levels) make it easier to use the standard to relate product performance to its intended use.

Such performance classes (or levels) for products may with reference to Article 4 (1) of the Directive therefore be established by the standardizers who will keep the Commission and the Standing Committee informed of the ongoing work on this matter in the framework of the execution of mandates.

1.2.3. Each time classes are defined for works or for products, it is necessary to set up a class called 'no performance determined' when and where at least one Member State has no legal requirement at all in that field.

1.3. **Meaning of general terms used in the Interpretative Documents**

1.3.1. ***Construction works***

'Construction works' means everything that is constructed or results from construction operations and is fixed to the ground. This term covers both ***buildings*** and civil ***engineering works.*** In the Interpretative Documents 'construction works' are also referred to as the 'works'. Construction works include for example: dwellings; industrial, commercial, office, health, educational, recreational and agricultural buildings; bridges; roads and highways; railways; pipe networks; stadiums; swimming pools; wharfs; platforms; docks; locks; channels; dams; towers; tanks; tunnels; etc.

1.3.2. ***Construction products***

(1) This term refers to products which are produced for incorporation in a permanent manner in the works and placed as such on the market. The terms 'construction products' or 'products', where used in the Interpretative Documents, include materials, elements and components (single or in a kit) of prefabricated systems or installations which enable the works to meet the Essential Requirements.

(2) Incorporation of a product in a permanent manner in the works means:

— that its removal reduces the performance capabilities of the works; and

— that the dismantling or the replacement of the product are operations which involve construction activities.

1.3.3. ***Normal maintenance***

(1) Maintenance is a set of preventive and other measures which are applied to the works in order to enable the works to fulfil all its functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc.

(2) Normal maintenance generally includes inspections and occurs at a time when the costs of the intervention which has to be made are not disproportionate to the value of the part of the works concerned, consequential costs being taken into account.

1.3.4. *Intended use*

The intended use of a product refers to the role(s) that the product is intended to play in the fulfilment of the Essential Requirements.

1.3.5. *Economically reasonable working life*

(1) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

(2) An economically reasonable working life presumes that all relevant aspects are taken into account, such as:

— costs of design, construction and use;

— costs arising from hindrance of use;

— risks and consequences of failure of the works during its working life and costs of insurance covering these risks;

— planned partial renewal;

— costs of inspections, maintenance, care and repair;

— costs of operation and administration;

— disposal;

— environmental aspects.

1.3.6. *Actions*

Actions which may affect the compliance of the works with the Essential Requirements are brought about by agents acting on the works or parts of the works. Such agents include mechanical, chemical, biological, thermal and electro-magnetic agents.

1.3.7. *Performance*

Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product, for an action to which it is subject or which it generates under the intended service conditions (for the works or parts of works) or intended use conditions (for products).

2. EXPLANATION OF THE ESSENTIAL REQUIREMENT 'HYGIENE, HEALTH AND THE ENVIRONMENT'

This Interpretative Document identifies aspects of works where hygiene, health and the environment may be concerned, and identifies products and product families, and characteristics relating to their satisfactory performance where harmonized standards are required.

For the purpose of establishing the suitability of products, Annex I to the Directive gives the following definition of the Essential Requirement which is applicable where the works are subject to regulations containing such a requirement:

'Hygiene, Health and the Environment'

The construction work must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants or neighbours, in particular as a result of any of the following:

— the giving-off of toxic gas

— the presence of dangerous particles or gases in the air

— the emission of dangerous radiation

— pollution or poisoning of the water or soil

— faulty elimination of waste water, smoke, solid or liquid wastes

— the presence of damp in parts of the works or on surfaces within the works.

Other Directives relevant to hygiene, health or the environment, for example, the protection of workers, must also be taken into account when elaborating technical specifications, harmonized standards, etc. In the present document, the requirement is developed according to five specific aspects:

Indoor environment

Water supply

Waste water disposal

Solid waste disposal

Outdoor environment.

Noise protection is dealt with in another Interpretative Document.

The Directive applies to all works, including buildings and civil engineering works, where such works are subject to regulations. The Essential Requirement on Hygiene, Health and the Environment concerns all such works where the hygiene or health of the occupants, the users or neighbours is concerned.

The nature of such threats can vary considerably according to the type of the works. The present document mainly develops the aspects linked with buildings intended for occupation, with no limitation on the period of occupation. However, for some aspects of the Essential Requirement, specific provisions for works other than buildings and corresponding products are stated in the relevant sub-chapters. Nevertheless, for works and products which are not mentioned in this Interpretative Document, specific provisions should be added when elaborating mandates, on condition that the basic statements of this Interpretative Document are satisfied.

The forms of pollution and the pollutants that are considered in this document may be the cause of several undesirable health effects, ranging from discomfort and sensorial annoyance to severe health injuries. For some of them, information on the health effects is incomplete or inconclusive. As improved knowledge becomes available, relevant requirements may be revised.

3. BASIS FOR THE VERIFICATION OF THE SATISFACTION OF THE ESSENTIAL REQUIREMENT 'HYGIENE, HEALTH AND THE ENVIRONMENT'

3.1. General

(1) This chapter identifies basic principles prevailing in Member States for the verification of the satisfaction of the Essential Requirement 'Hygiene, Health and the Environment'. These principles are currently complied with when and where the works are subject to regulations containing this Essential Requirement. Chapter 4 provides guidance on how to meet this Essential Requirement by compliance with the technical specifications referred to in Article 4 of the Directive.

(2) The Essential Requirement, as far as applicable, is satisfied with acceptable probability during an economically reasonable working life of the works.

(3) The satisfaction of the Essential Requirement is assured by a number of interrelated measures concerned in particular with:

— the planning and design of the works, the execution of the works and necessary maintenance;

— the properties, performances and use of the construction products.

(4) It is up to the Member States, when and where they feel it necessary, to take measures concerning the supervision of planning, design and execution of the works, and concerning the qualifications of parties and persons involved. Where this supervision and this control of qualifications are directly connected with the characteristics of products, the relevant provisions shall be laid down in the context of the mandate for the preparation of the standards and guidelines for European technical approval related to the products concerned.

3.2. Actions

The various actions which are taken into account for assessing the satisfaction of the Essential Requirement are indicated in the various sub-chapters of Chapter 3.3 in relation to the specific aspects they apply to.

3.3. Verification of the satisfaction of the Essential Requirement

3.3.0. *Introduction*

This chapter presents the nature and the ways for the control of the various specific aspects of the Essential Requirement, describes the technical specifications for the works when relevant and specifies the characteristics of the products.

All the product characteristics listed in the following may be of importance with respect to Hygiene, Health and the Environment, in general. However, for specific products, only one or more of these characteristics are relevant and therefore others may be left out of consideration.

Additional characteristics (e.g. ease of cleaning) may be asked for in the mandates for reasons of hygiene for special production work (e.g. food storage or food preparation).

3.3.1. *Indoor environment*

3.3.1.0. *Introduction*

The requirement is concerned with providing a healthy indoor environment for occupants and users of works.

The design and execution of construction work should take into account:

— thermal environment

— lighting

— air quality

— dampness

— noise.

Heating, cooling and ventilation are covered by the present Interpretative Document.

Certain aspects of thermal environment and lighting are covered by Interpretative Documents 'Safety in Use' and 'Energy Economy and Heat Retention'.

Other aspects of lighting, e.g. the minimal window area versus the floor area of a room for dwelling and working may be relevant for construction products like prefabricated houses.

Noise protection is covered by the Interpretative Document 'Protection Against Noise'.

3.3.1.1. *Air quality*

3.3.1.1.1. Nature of the requirement

The requirement is concerned with the elimination or control of pollutants in the indoor environment. In the following text, 'pollutant' includes gamma radiation (although strictly it is not an airborne pollutant).

The construction works must provide a healthy indoor environment for occupants and building users, taking account of pollutants including:

— metabolic products, for example: water vapour, carbon dioxide and body odour, etc.

— combustion products, for example: water vapour, carbon monoxide, oxides of nitrogen, carbon dioxide and hydrocarbons, etc.

— tobacco smoke

— volatile organic compounds, for example: formaldehyde, solvents, etc.

— non-viable particulates, for example: respirable and non-respirable suspended particulates and fibres

— viable particulates including micro-organisms, for example: small insects, protozoa, fungi, bacteria and viruses

— radon and radioactive substances emitting gamma radiation

— emission from electric and electronic equipment (ozone, etc.).

These may be the cause of undesirable effects, ranging from discomfort and nuisance to adverse physical effects on health.

Pollutants from all sources need to be taken into account in providing methods for controlling air quality, such as ventilation.

Unhealthy indoor air can be caused by pollutants generated by:

— building materials

— building services, including combustion appliances

— furnishings and fittings

— sources in the outside air

— the soil beneath the building

— processes and activities being undertaken within the building including, for example, cleaning, maintenance, painting, polishing, control of pests, cooking, etc.

— human and animal occupation and plants

— hot water systems.

3.3.1.1.2. Control of pollutants

3.3.1.1.2.1. Pollutants can be controlled by:

Control of sources

Eliminating or limiting the use of materials which may release pollutants, and the use of which results in concentrations greater than acceptable limits.

Eliminating or limiting the release of pollutants into the air by

— Sealing the source, e.g. providing suitable barriers to reduce or eliminate emissions from the source to the inside air.

— Design and adequate maintenance of appliances to reduce release of pollutants.

— Design of products and construction to avoid or reduce sources of pollutants.

— Use of fungicides or other biocides to eliminate the source of viable particulates, when design measures are not applicable.

Control of air by ventilation, filtration or absorption

— Mechanical ventilation

— Passive ventilation

— Filtration of indoor air or incoming air

— Absorption from indoor air or incoming air.

Control of exposure of people by procedural controls, e.g. excluding re-entry for a specified time after repainting.

3.3.1.1.2.2. Requirements are expressed in a number of different ways:

Acceptable average and peak concentrations of specific pollutants in the indoor air.

The prohibition or limitation of use of named substances generally or for specific uses.

Limitations on the rates of release and nature of pollutants from materials or products.

Specification of acceptable methods of sealing or providing barriers.

Specification of ventilation rates or parameters expressing the rate of renewal of indoor air by fresh air, for example air exchange rate or air leakage characteristics, etc.

Specification of suitable area of openings to be provided in the outer envelope provision of mechanical ventilation systems and other descriptions of designs and constructions that have been found to be satisfactory.

Appropriate levels of factors influencing concentrations such as temperature, humidity, etc., e.g. condensation *(see clause 3.3.1.2.2).*

Acceptable measurement and/or calculation methods for determining indoor air quality and the performance of control methods.

3.3.1.1.3. Technical specifications

3.3.1.1.3.1. Construction works (Category A)

Requirements for indoor air quality may be expressed in terms of a calculation procedure defining acceptable concentrations in the indoor air of certain pollutants, or by direct measurement of some pollutants. The performance of methods of control, e.g. ventilation may be determined by calculation methods or by measurement.

Requirements are also expressed in terms of design requirements for building services, e.g. ventilation systems.

Harmonized technical specifications may be needed to support these methods as follows:

Calculation methods

Methods of predicting air exchange rate taking into account the climatic conditions and provisions for ventilation.

Methods for calculating concentrations of indoor pollutants, taking into account the normal loading of the room by the product, release from the products, air exchange rates, air temperature and air humidity.

Methods for assessing the performance of control methods defined in *clause 3.3.1.1.2.*

Measurement methods

Methods for measuring ventilation rates in buildings.

Methods of determining the efficiency of ventilation.

Methods for identifying indoor pollutants and measuring their concentrations.

3.3.1.1.3.2. Construction products (Category B)

The following product families (including building materials) are involved in the control of indoor air quality. The characteristics necessary for satisfactory performance in relation to health, hygiene and the environment are listed below. Harmonized technical specifications are required to measure these characteristics or to calculate performance where technology permits. Where appropriate, on-site tests may be necessary (e.g. for combustion appliances). The corresponding standards should take account of the intended use of the product.

Product characteristics listed for building materials apply to all product families and systems.

a) *Building materials*

Products are those for which emissions of pollutants to the indoor air are possible. Such products include materials used for flooring, partitions, walls and wall linings, ceilings, insulating materials, paints and varnishes, timber preservatives, adhesives, fillers, damp-proof membranes, electric cables and fittings, coatings for floor screeds, masonry, putties, installations, etc. Product characteristics apply to all product families and systems,

— emission of volatile organic compounds and release of other pollutants, taking account of the concentration of pollutants in the product where necessary

— susceptibility to the growth of harmful micro-organisms

— radioactive emissions.

b) *Air-conditioning and ventilation systems*

b.1) Humidifiers and dehumidifiers

Products include plant for controlling humidity in air in, or supplied to, occupied buildings.

— effectiveness in control of water vapour.

b.2) Filtration systems

Products include air cleaning devices for general ventilation in central systems, window air-conditioners, packaged air-conditioners, and room filters.

— airflow rate and pressure difference performance

— effectiveness in removing substances from the air.

b.3) Other air-conditioning and ventilation components and systems

Products include purpose-made ventilation openings, single room extract fans, passive stack ventilation systems, mechanical ventilation systems, air-conditioning systems (as for instance heat exchangers, mixing chambers, volume flow control systems, air ducts and associated components. Also pumps and other equipment for removing pollutants from subsoil).

— airflow, air velocity, and pressure difference performance, including performance of complete systems and their components.

c) *Combustion equipment*

Relevant products are: all combustion equipment used for room heating and water heating and cooking, for example: combustion appliances (with and without connection of flues), air inlets, fail-safe devices and other control equipment, flues and chimneys, etc.

— release of combustion products from appliances during normal use, taking account of ventilation provision in buildings

— dimensioning and integrity of flues

— effectiveness of removing combustion products

— effectiveness of fail-safe mechanisms

— provision of adequate air supply

— integrity of fuel supply pipes.

d) *Barriers and sealants*

d.1) Barriers and surface sealing coatings

Products include membranes and sealing coatings to prevent emissions of particles and fibres and other pollutants from surfaces, and preservatives and fungicides to prevent the growth of micro-organisms and fungi.

— effectiveness in reducing release of specific pollutants.

d.2) Sealants

Products include mastics and other types of material and draughtstrips and materials used to seal gaps and cracks to prevent the passage of gas, liquid and vapour.

— air leakage when installed

— effectiveness in sealing gaps.

e) *Hot water storage and supply (with particular reference to the hazard of Legionnaires' disease)*

Products include tanks, water softeners, taps, shower heads, washers, seals, valves, calorifiers, pumps, heating boilers, cisterns, temperature controls, pipework.

— adequate and accurate temperature control

— design to facilitate cleaning and chemical treatment

— design to minimize the production of aerosols

— design to minimize water stratification (in circumstances which encourage the growth of legionnella)

— minimization of static water

— design to avoid materials which provide nutrients.

3.3.1.2. *Dampness*

3.3.1.2.1. Nature of the requirement

The requirement is concerned with the protection of the health of occupants and users from the effects of excessively low or high dampness.

The construction work must be designed and built in such a way that it will not be a threat to the hygiene, health and the environment of the occupants and users as a result of dampness. Such requirements must, subject to normal maintenance, be satisfied for an economically reasonable working life.

Dampness may affect the health of occupants and building users through:

— the effects of excessively low or high relative humidity in the air

— the indirect effects of dampness inducing mould growth on surfaces and inside products and increased deposit of house dust mites.

3.3.1.2.2. Control of dampness

3.3.1.2.2.1. Humidity in the air in a works may be controlled by:

— increasing or decreasing air temperature (heating, insulation, cooling)

— ventilation of rooms (natural or mechanical)

— humidification and dehumidification of indoor air and incoming air

— removal or reduction of moisture at source or isolation of moisture generating activities.

3.3.1.2.2.2. Dampness on indoor surfaces and/or inside building products may be controlled by:

Moisture proofing from outside damp

— avoiding or preventing infiltration and penetration of rain, snow, etc. into the works

— avoiding or preventing infiltration and penetration of ground water in the work

— walls and roofs: walls should prevent moisture from the ground from entering the building and not carry moisture from the ground to any part which would be damaged by it. External walls and roofs should also resist the penetration of rain and snow to the inside of the building; they should not be damaged by rain and snow and not carry rain and snow to any part which would be damaged by it;

— cladding for external walls and roofs:

cladding materials may be: impervious (lets no water or vapour through),

weather resisting (absorbs water),

moisture resisting (permeable to water vapour),

— floors next to the ground should prevent ground moisture from reaching the upper surfaces of the floor. It should not be damaged by moisture from the ground.

Avoiding condensation on indoor surfaces and inserstitial condensation.

Surface condensation is prevented by ensuring that the relative humidity of the air close to the surface is below acceptable levels. This is achieved by appropriate combination of heating, insulation and ventilation.

Fungicidal surface treatment may, in certain cases, help to prevent mould growth; however, this treatment is usually a temporary measure used when design measures to avoid dampness are not applicable.

Interstitial condensation is prevented by ensuring that the vapour pressure within the elements is below the saturated vapour pressure. This is achieved by the suitable design of products and choice of materials. If deposition cannot be prevented, it should be within acceptable limits, taking account of the sensitivity of materials used, their position within the product and the time required for evaporation.

3.3.1.2.3. Technical specifications

3.3.1.2.3.1. Construction works (Category A)

Harmonized technical specifications may be needed for the:

Control of humidity in the air of the work

Reference methods to calculate the humidity level as a function of the climatic conditions, the damp production rate, the products used and the ventilation rates depending on the type of the works and the use of the works or room.

Moisture proofing from inside dampness

Reference methods to calculate the expected condensation on surfaces and inside products, the calculation of the amount of condensation water and the expected rate of evaporation taking into account, if needed, different levels of climatic conditions and ventilation rates.

3.3.1.2.3.2. Construction Products (Category B)

The following products or product families are involved in dampness control.

The characteristics necessary for satisfactory performance in relation to health and hygiene are listed below.

Harmonized technical specifications are required to measure these characteristics or to calculate performance where technology permits, taking into account the type of works, their use, the intended use of the products and the climatic and ground water conditions.

(a) *Heating equipment (see also Interpretative Document 'Energy Economy and Heat Retention')*

Products include boilers and heating apparatus, radiators, heat emitters, heating control devices

— output and heat transfer characteristics

(b) *Air-conditioning and ventilation equipment*

Products, see list in clause 3.3.1.1.3, excluding humidifiers.

— airflow and pressure difference performance

— rate and control of water vapour production and reduction respectively.

(c) *Insulating materials*

Products are used to insulate elements separating heated rooms from rooms having lower temperature, like walls to the outside or to staircases, windows, roofs and ground floors.

Thermal characteristics and design aspects (see Interpretative Document 'Energy Economy and Heat Retention').

(d) *Fungicides for surface treatment*

— effectiveness.

(e) *Building products*

Products include all building elements exposed to precipitation (rain, snow, hail), ground water and other damp from outside, such as walls, windows, roofs and ground floors as well as their components and materials for lining, insulation, damp-proof membranes, paints and varnishes, sealants, etc.

e.1) Walls, walling materials

— vapour permeability,

— moisture resistance,

— watertightness, water diffusivity,

— thermal characteristics — (see Interpretative Document 'Energy Economy and Heat Retention');

e.2) Curtain walling, cladding materials, cladding systems

— vapour permeability,

— watertightness,

— resistance of joints to penetration of rain and snow;

e.3) Roofs, roofing materials

— vapour permeability,

— capacity of adsorption, -absorption, -desorption,

— moisture resistance,

— watertightness, water diffusivity,

— thermal characteristics (see Interpretative Document on 'Energy Economy and Heat Retention');

e.4) Ground floors (solid, suspended), basement floors

Products include concrete, hardcore material, insulation

— moisture resistance,

— thermal characteristics see Interpretative Document on 'Energy Economy and Heat Retention',

— vapour permeability;

e.5) Damp-proof courses, damp-proof membranes

Products include slates, polythene, pitch polymer, sheet copper, engineering bricks, chemical injection fluid

— vapour permeability,

— moisture resistance,

— watertightness, water diffusivity;

e.6) Vapour-proof membranes

— vapour permeability,

— moisture resistance;

e.7) Insulation material, including cavity insulation

— vapour permeability,

— performance of joints,

— moisture resistance,

— thermal characteristics and design aspects (see Interpretative Document on 'Energy Economy and Heat Retention');

e.8) Copings

— resistance to water,

— performance of joints;

e.9) Damp-proof trays

— imperviousness to water.

3.3.2. ***Water supply***

3.3.2.1. *Nature of the requirement*

The requirement is concerned with the protection of consumers' health related to water and water supply characteristics.

Water supplied for human consumption shall not constitute any identified health risk to the consumers' health when used as follows:

— water for drinking and culinary purposes

— water for domestic use

— water used in a food production intended for human consumption.

Besides national requirements, the characteristics of water at the draw-off tap are also laid down in Council Directive 80/778/EEC of 15 July 1980.

Storage tanks, pipes, fittings and other components in contact with water and additional treatment (e.g. reheating, softening, disinfection, etc.) shall not modify water characteristics in such a way that it may be a risk for consumers' health.

The following points are to be taken into account:

— protection against mixing with waste water or foul air and mixing with any unsuitable external liquid or other contaminants,

— protection against contamination with mineral or organic pollutants, generated by components in contact with water resulting from migration and/or corrosion,

— protection against microbiological contamination,

— protection against contamination with external mineral or organic pollutants resulting from permeability and/or penetration.

3.3.2.2. *Control of water supply*

Mixing with polluted water or foul air may be prevented by controlling back-flow with appropriate preventers.

Mixing with external liquid or other contaminants may be prevented by controlling the watertightness of the products used as components of the supply systems, and avoiding passing systems through hazardous areas.

Contamination with mineral or organic pollutants generated by components in contact with water may be prevented by limiting:

— migration of pollutants from materials

— pollutants resulting from corrosion, ageing and erosion.

Contamination with external mineral or organic pollutants may be prevented by limiting permeability.

Different ways can be used to prevent microbiological contamination, including use of chemicals, design of water systems avoiding dead zones, diminution of organic matter content in water, etc. The use of materials which do not favour excessively microbiological growth on surfaces in contact with water must also be considered.

3.3.2.3.1. *Technical specifications for construction products (Category B)*

Harmonized technical specifications are required to specify the following characteristics of construction products:

a) Material in contact with water

— migration of pollutants,

— criteria for the growth of micro-organisms (geometrical forms);

b) Pipes, fitting and joints

— tightness,

— resistance to corrosion,

— resistance to abrasion,

— permeability to pollutants;

c) Back-flow devices

— effectiveness,

— flow or pressure drop,

— mechanical endurance;

d) Valves and taps

— resistance to corrosion,

— resistance to abrasion,

— mechanical endurance,

— flow rate,

— effectiveness;

e) Cisterns and tanks

— tightness,

— resistance to corrosion,

— water capacity;

f) On-line appliances,

— water capacity,

— water consumption;

g) Other products

For products incorporated in water supply works and not included in the above list, the provisions stated in *clause 3.3.3.2.* 'Control of water supply' must be complied with, when relevant.

3.3.3. ***Waste water disposal***

3.3.3.1. *Nature of the requirement*

The requirement is concerned with the protection of people and the immediate environment against pollutants transported in waste water disposal systems.

The construction works must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants, users or neighbours as a result of faulty disposal.

Waste water includes all substances disposed of through the discharge systems including waste water, rain water and foul air from systems.

The following points are concerned:

— Leakage of fluids into and from the systems,

— Sewage back flow in buildings,

— Giving off of foul air,

— Microbiological contamination.

3.3.3.2. *Control of waste water disposal*

Leakage of fluids from the systems may be prevented by controlling the watertightness of all the components of the systems.

Sewage back-flow in buildings may be prevented by appropriate design of works including if necessary the use of back-flow preventers.

Giving off of foul air may be prevented by controlling the airtightness of the discharge components. Systems must be designed or specific devices must be included to allow the introduction of fresh air into the system and to avoid discharge of foul air into or near inhabited areas. Sewerage components must be designed to avoid any stagnation of sewage.

Microbiological contamination concerns mainly sanitary appliances and may be prevented by controlling cleanability and characteristics of the materials' surfaces.

3.3.3.3. *Technical specifications for construction products (Category B)*

Harmonized technical specifications are required to specify the following characteristics of construction products:

— Pipes, fittings, connections, manholes and joints

  — watertightness,

  — resistance to corrosion,

  — air tightness of discharges (non-release of foul air);

— Back-flow devices

  — effectiveness,

  — mechanical endurance;

— Sanitary appliances

  — cleanability,

  — shape and size to facilitate self-cleaning;

— On-site treatment equipment
  — watertightness,
  — resistance to corrosion,
  — effectiveness of treatment;
— Other products.

For products incorporated in waste water works and not included in the above list, the provisions stated in clause 3.3.3.2 'Control of waste water disposal' must be complied with, when relevant.

3.3.4. ***Solid waste disposal***

3.3.4.1. *Nature of the requirement*

The construction work must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants, users or neighbours as a result of faulty disposal of solid waste. Such requirements must, subject to normal maintenance, be satisfied for an economically reasonable working life.

For the purposes of this document, solid waste means all solid and semi-solid substances or objects that are generally known as household waste or domestic refuse, including small quantities of toxic matters that may be generated in works.

Industrial, toxic, and dangerous solid waste are excluded.

The requirement is concerned with the protection of people inside works and in their vicinity against undesirable matters, objects or living organisms contained in solid wastes.

The hazards may arise from:

— infiltration of pollutants to groundwater,
— production of smokes, presence of disgusting or nauseating smells and liquids during fermentation in contact with air,
— scattering of waste by animals or wind, with possible spread of infection,
— breeding of flies, other insects, and rodents, the role of which may be of great importance in the spread of disease.

Fire caused by inappropriate storage of solid waste, as well as noise from fixed or mobile equipment for storage, collection, and treatment may pose problems.

3.3.4.2. *Control of solid waste disposal*

Production and release of smoke, smells and liquids, as well as scattering and dispersion of waste can be controlled by ensuring tightness of all the components and their covers in operation for the storage and the collection of solid waste.

Fermentation may be abated by conditioning of waste in storage containers and by minimizing the time of retention in the various stages of disposal.

Components shall be properly designed so as to avoid residual waste in use and after evacuation and to facilitate cleaning.

3.3.4.3. *Technical specifications for construction products (Category B)*

Category B harmonized technical specifications are required for the following product families:

— Storage products: containers (fixed elements), complements to containers, chute-feed bulk storage products
  — shape and size to facilitate cleaning,
  — tightness of containers and covers;
— Collection products: chutes, pipeline collection systems
  — tightness.

3.3.5. ***Outdoor environment***

3.3.5.0. *General*

The effect of construction products on the environment is one of the aspects of importance for the harmonization of standards. Construction products should not release pollutants and waste streams which can be dispersed in the environment and cause changes in environmental quality, resulting in risks for the health of human beings, animals and plants and endangering the balance of the ecosystems. The impact on the environment should be considered in every phase of the life cycle of construction materials and include:

— winning, production, building process,

— works in use,

— demolition, waste-deposition, incineration or waste reuse.

In order to prevent future damage to the environment, assessment of construction products throughout their life cycle should be taken into account. To conform with the scope of the Directive this document is restricted to 'works in use'.

For the other phases of the life cycle, as described above, as long as no Community legislation exists it is up to the Member States, with due observance of the Treaty, to take into account the scope of the Directive and when they deem it necessary, to prescribe requirements affecting construction products in order to limit the deterioration of the environment.

3.3.5.1. *Nature of the requirement*

The construction work shall not release pollutants in quantities which may impair the health and hygiene of occupants, users or neighbours.

The requirement is concerned with the protection of people and with the prevention of any impact on the immediate environment by pollution of the air, the soil and the water. These pollutions can be generated by:

— building materials,

— building services, including combustion appliances,

— installations.

3.3.5.2. *Control of the impact of construction works on the outdoor environment*

The impact of construction works on the outdoor environment may be controlled by:

— limitation of dispersion of pollutants,

— limitation of emissions of pollutants,

— limitation of the use of materials, building services or installations which release pollutants.

Requirements for the prevention or limitation of the environmental impact of works on the air, soil and water may be expressed by

— measurement methods or calculation methods, where appropriate, of leaching, dispersion or emissions of pollutants,

— proper design of works.

3.3.5.3. *Technical specifications for construction products (Category B)*

Technical specifications are required to define the following characteristics:

— Building materials used in foundations, piles, external walls, external floors, roofs, granular materials

  — release of pollutants to outdoor air, soil and water, taking account of the concentration of pollutants in the product, where necessary,

  — release reducing factor by sealing;

— Vessels for storage of polluting substances including sealing systems

  — release of pollutants to soil, water and air,

  — tightness,

  — effectiveness of alarm systems;

— Combustion equipment, flues and chimneys

  — release of pollutants to the air;

— Services and systems: air-conditioning and ventilation systems, barriers and sealing systems, pipe systems

  — release of pollutants to soil, water and air.

4. TECHNICAL SPECIFICATIONS AND GUIDELINES FOR EUROPEAN TECHNICAL APPROVAL

4.1. General

(1) 'Technical specifications' means those referred to in Article 4 of the Directive. 'Guidelines for European Technical Approval' of a product or family of products means those referred to in Article 11 of the Directive.

(2) A general distinction is made between:

— *Category A:* These are standards which concern the design and execution of buildings and civil engineering works and their parts, or particular aspects thereof, with a view to the fulfilment of the Essential Requirements as set out in Council Directive 89/106/EEC. Category A standards should be taken into consideration within the scope of the Directive as far as the differences in laws, regulations and administrative provisions of Member States prevent the development of harmonized product standards.

— *Category B:* These are technical specifications and guidelines for European technical approval which exclusively concern construction products subject to an attestation of conformity and marking according to Articles 13, 14 and 15 of Council Directive 89/106/EEC. They concern requirements with regard to performance and/or other properties, including durability, of those characteristics that may influence the fulfilment of the Essential Requirements, testing and compliance criteria of a product. Category B standards that concern a family of products, or several families of products are of a different character and are called horizontal (Category Bh) standards.

(3) This distinction between Categories A and B is not intended to lay down different priorities for the work on the respective documents but to reflect the difference in the responsibilities of the authorities of Member States and in those of the bodies for European Standardisation and Technical Approval in implementing Directive 89/106/EEC.

(4) In order to ensure the quality of these documents with a view to the fulfilment of the Essential Requirement, the provisions of this Interpretative Document will result in specific conditions which will be included in the mandates for the preparation of the respective European standards and guidelines for the European technical approval.

(5) The assumptions made in Category A standards on the one hand and those made in Category B specifications on the other shall be compatible with each other.

(6) Category B technical specifications and guidelines for European technical approval shall indicate the intended use(s) of the respective products.

4.2. **Performances of products**

(1) As far as practicable the characteristics of products should be described in performance terms in the technical specifications and guidelines for European technical approval. Methods of calculation, measurement, and testing (where possible), together with compliance criteria, shall be given either in the relevant technical specifications or in references called up in such specifications.

(2) The expression of the product performances should be compatible with the basis for the verification of the Essential Requirement as currently in use in Member States and referred to in Chapter 3 and as provided in the European Category A standards referred to in 4.1 (2), taking into account the actual implementation of these documents.

4.3. **Attestation of conformity of products**

(1) 'Attestation of conformity' of products means that the provisions and procedures laid down in Articles 13, 14 and 15 of Annex III to the Directive are followed. These provisions aim to ensure that, with acceptable probability, the performance of a product will be achieved as specified in the relevant technical specification.

(2) The mandates will include indications concerning the conformity attestation procedures within the framework of Annex III to the Directive and related provisions to be indicated in the technical specifications and guidelines for European technical approval.

5. WORKING LIFE, DURABILITY

5.1. **Treatment of working life of construction works in relation to the Essential Requirement**

(1) It is up to the Member States, when and where they feel it necessary, to take measures concerning the working life which can be considered reasonable for each type of works, or for some of them, or for parts of the works, in relation to the satisfaction of the Essential Requirements.

(2) Where provisions concerning the durability of works in relation to the Essential Requirement are connected with the characteristics of products, the mandates for the preparation of the European standards and guidelines for European technical approvals, related to these products, will also cover durability aspects.

5.2. **Treatment of working life of construction products in relation to the Essential Requirement**

(1) Category B specifications and guidelines for European technical approval should include indications concerning the working life of the products in relation to the intended uses and the methods for its assessment.

(2) The indications given on the working life of a product cannot be interpreted as a guarantee given by the producer, but are regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

ANNEX

TABLES

ANNEX I A

INDOOR ENVIRONMENT

AIR QUALITY — 1

Field to be controlled	Requirements for works		Characteristics of products	
	Functional Requirements	Performance Requirements	Products or Product family	Characteristics
Pollution from building materials	Limit the use of materials emitting named pollutants to those meeting acceptable performance standards	Limitation of materials emitting named pollutants in defined circumstances and quantities	Building materials and materials used in construction products	Emission of volatile organic compounds and other pollutants Susceptibility to the growth of micro-organisms Radioactive emissions
		Concentration of pollutants in indoor air under defined circumstances		
		Methods of design, construction or installation		
	Provide barriers to limit emissions to the indoor air	Concentration of pollutants in indoor air	Sealing coatings	Effectiveness in reducing emissions
		Methods of design, construction or installation	Sealants	Effectiveness in sealing gaps

AIR QUALITY — 2

Pollution from building materials	Dilute or remove pollutants by ventilation	a) Concentration of pollutants in indoor air b) Air change rate c) Air leakage characteristics of works Methods of design, construction or installation Provision and siting of air inlets and area of opening and provision of mechanical ventilation devices	Air-conditioning and ventilation	Airflow, air velocity and pressure difference performance Ease of cleaning and maintenance

AIR QUALITY — 3

Field to be controlled	Requirements for works		Characteristics of products	
	Functional Requirements	Performance Requirements	Products or Product family	Characteristics
Pollution from subsoil	Seal air passages from subsoil	Concentration of pollutants in indoor air Effectiveness of sealing	Sealants, mastics Membranes	Effectiveness in sealing gaps Effectiveness in reducing flow of pollutants
	Ventilate spaces under floors	Concentration of pollutants in indoor air Air change rate in underfloor spaces	Components of underfloor ventilation systems	Air flow performance Ease of cleaning and maintenance
	Remove pollutants from subsoil in vicinity of building	Concentration of pollutants in indoor air	Components of equipment for removing pollutants	Airflow performance Ease of cleaning and maintenance
	Dilute or remove pollutants by ventilation	see table I A — 2		
Pollutants from people, animals and plants	Dilute or remove pollutants by ventilation	see table I A — 2		

AIR QUALITY — 4

Pollution from water storage and supply	Prevent legionella bacteria and other harmful micro-organisms in aerosols	Levels of legionella in systems	Hot water storage and supply	Temperature control Minimisation of aerosols Stratification minimisation Minimise static water Avoid materials which provide nutrients Design systems to facilitate cleaning
	Design systems to facilitate testing, cleaning and chemical treatment	Freedom from nutrients in systems		
	Design systems to maintain throughout temperatures which are not conducive to the growth of legionella	Cold water temperature Hot water storage temperature Limitation of stratification Materials used in systems		
	Design systems to avoid stagnation	Absence of deadlegs		

AIR QUALITY — 5

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Pollution from combustion equipment	Avoid harmful concentrations of combustion products by provision of adequate flues, chimney liners and air inlets and control of leakage of combustion products and flue gases from combustion equipment	Concentration of pollutants in indoor air Methods of design, construction or installation	Combustion appliances (with and without connection to flues)	Control of emission of pollutants during normal use
			Fail-safe devices and other control equipment	Effectiveness and reliability
			Air inlets	Adequate rating and dimensions
			Flues and liners	Dimensions Thermal and flow properties Effectiveness of removing combustion products

AIR QUALITY — 6

Pollution from: Building services; Ventilation systems; Air-conditioning systems	Prevent growth of harmful organisms and emission of pollutants	Choice of suitable materials Concentration of pollutants in indoor air Methods of design, construction and installations	Filtration systems	Effectiveness in cleaning air Airflow rate and pressure difference performance
	Control of humidity in indoor air	Humidity level in indoor air	Humidifiers Dehumidifiers	Effectiveness in control of water vapour

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Pollution by outdoor air	Clean incoming air	Concentration of pollutants in cleaned indoor air Design and siting of air intake and discharge	Filters	Effectiveness in cleaning air Airflow rate and pressure difference performance
	Seal uncontrolled air passages	Concentration of pollutants in indoor air	Sealants	Effectiveness in sealing gaps

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ANNEX I B

INDOOR ENVIRONMENT

DAMPNESS — 1

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Humidity in the air of rooms	Provide acceptable values for the relative air humidity	Provide appropriate air temperature	Heating equipment	Output
		Provide appropriate air exchange and humidity of incoming or indoor air	Air-conditioning and ventilation equipment, including dehumidifiers	see I A—2
		Remove or reduce moisture at source or isolate moisture-generating activities		
		Provide appropriate controls and instrumentation	Control equipment	Effectiveness, reliability and accuracy

DAMPNESS — 2

Dampness on indoor surfaces and inside products	Avoid mould growth on indoor surfaces or inside products	Provide appropriate air temperature	Heating/cooling equipment	Output (see table I A)
	Limit increased deposit of house dust mites	Provide appropriate air exchange and humidity of incoming or indoor air	Air-conditioning and ventilation equipment including humidifiers, dehumidifiers	see table I A — 2
	Limit condensation on surfaces and interstitial condensation	Provide appropriate insulation and design, avoid cold bridges	Insulating elements, such as walls, windows, roofs and ground floors	Thermal characteristics (see ID No 6) Airtightness
		Prevent life-sustaining basis for mould	Fungicides for treatment of surfaces	Effectiveness

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Dampness on indoor surfaces and inside products	Avoid infiltration and penetration of precipitation (rain, snow) and/or groundwater in the works	Provide appropriate design	Walls, walling materials	Vapour permeability Moisture resistance Capacity of absorption/desorption Water tightness, water diffusivity Thermal characteristics, see Interpretative Document on 'Energy Economy and Heat Retention'
			Curtain walling Cladding materials Cladding systems	Vapour permeability Watertightness Resistance of joints to penetration of rain and snow
			Roofs, roofing materials	Vapour permeability Capacity of absorption/desorption Moisture resistance Watertightness Water diffusivity Thermal characteristics (see ID No 6)

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Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Dampness on indoor surfaces and inside products			Ground floors (solid, suspended)	Moisture resistance Thermal characteristics Vapour permeability
			Damp-proof courses, membranes	Vapour permeability Moisture resistance Watertightness Water diffusivity
			Vapour-proof membranes	Vapour permeability Moisture resistance
			Insulation material	Vapour permeability Performance of joints Moisture resistance Thermal characteristics and design aspects
			Copings	Resistance to water Performance of joints
			Damp-proof trays	Imperviousness to water

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ANNEX II

WATER SUPPY

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Water supply	Appropriate use of products in systems and efficient maintenance	Specify the design and the installation of systems		
	Prevent mixing with polluted water	Avoid backflow	Backflow devices	Effectiveness Flow-pressure drop Mechanical endurance
	Prevent mixing with external contaminants	Not passing through hazardous areas Control tightness	Pipes, fittings, joints	Resistance to corrosion, to abrasion Permeability to pollutants
	Avoid contamination of water by pollutants generated by materials in contact	Limit migration from material	All materials in contact with water	Migration of pollutants Criteria for the growth of micro-organisms (geometrical forms)
		Limit pollutants resulting from corrosion ageing and erosion	All materials in contact with water	Resistance to corrosion, to abrasion
	Avoid excessive micro-biological growth	Appropriate design preventing dead zones	Cisterns, tanks, pipes, fittings and joints	Shape Tightness

ANNEX III

WASTE WATER DISPOSAL

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Waste water disposal	Appropriate use of products in systems and efficient maintenance	Specify the design and the installation of systems		
	Prevent leakage from the system	Control of watertightness	Pipes, fittings, connections, manholes, joints	Watertightness Resistance to corrosion Airtightness of discharges
	Prevent sewage backflow in works	Appropriate design or use of backflow preventers	Backflow devices	Effectiveness Mechanical endurance
	Prevent giving off of foul air	Appropriate design Control airtightness of covers	Covers and other closure devices	Airtightness
	Prevent microbiological contamination	Ensure cleanability	Sanitary appliances	Cleanability Shape to facilitate self-cleaning
			On-site treatment equipment	Watertightness Resistance to corrosion Effectiveness of treatment

ANNEX IV

SOLID WASTE DISPOSAL

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Solid waste disposal	Prevent nuisances from storage and collection of solid waste	Control tightness and cleanliness	Storage products	Shape and size to facilitate cleaning
			Covers Containers Collection products	Tightness

ANNEX V

OUTDOOR ENVIRONMENT

Field to be controlled	Requirements for works		Characteristics of products	
	Functional requirements	Performance requirements	Products or product family	Characteristics
Impact on outdoor environment	Prevention of leaching emission, dispersion of pollutants	Measurement methods or calculation methods of leaching, emission and dispersion of pollutants	Building materials: used in foundation piles, external walls, external floors, roofs, granular materials	— Release of pollutants to outdoor air, soil and water taking account of the concentration of pollutants in the products, if necessary — Release-reducing factor by sealing
			Vessels for storage of polluting substances and included sealing systems	— Release of pollutants to soil, water and air — Tightness — effectiveness of alarm systems
		Provide appropriate design	Combustion equipment flues and chimneys	— Release of pollutants to the air
	Prevention by effective measures of sealing, removal, cleaning operations and maintenance	Method for sealing, removing, cleaning operations and maintenance	Services and systems, air-conditioning and ventilation systems, barriers and sealing systems, pipe systems	— Release of pollutants to soil, water and air

INTERPRETATIVE DOCUMENT

Essential Requirement No. 4

'SAFETY IN USE'

CONTENTS

ESSENTIAL REQUIREMENT: SAFETY IN USE

1. GENERAL

1.1. **Purpose and scope**

(1) This Interpretative Document relates to Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products, hereinafter referred to as 'the Directive'.

(2) Article 3 of the Directive stipulates that the purpose of the Interpretative Documents is to give concrete form to the Essential Requirements for the creation of the necessary links between the Essential Requirements set out in Annex I to the Directive and the mandates for the preparation of harmonized standards and guidelines for European technical approvals or the recognition of other technical specifications within the meaning of Articles 4 and 5 of the Directive.

Where considered necessary, the provisions of this Interpretative Document will be further specified in each particular mandate. In drafting the mandates, account will be taken, if necessary, of the other Essential Requirements of the Directive, as well as of other relevant Directives concerning construction products.

(3) This Interpretative Document deals with the aspects of the works where 'Safety in use' may be concerned. It identifies products or product families and characteristics relating to their satisfactory performance.

For each intended use of the product, the mandates will indicate in further detail which of those characteristics shall be dealt with in the harmonized specifications, using a step-by-step procedure with CEN/Cenelec/EOTA, which will allow the product characteristics to be modified or complemented, if necessary.

Annex 1 to the Directive gives the following definition of the Essential Requirement which is applicable when and where the works are subject to regulations containing such a requirement:

'The construction work must be designed and built in such a way that it does not present unacceptable risks of accidents in service or in operation such as slipping, falling, collision, burns, electrocution, injury from explosion.'

(4) In accordance with the Council Resolution of 7 May 1985 (New Approach) and the preamble of the Directive, this interpretation of the Essential Requirement is intended not to reduce the existing and justified levels of protection for works in the Member States.

1.2. **Levels or classes for Essential Requirements and for related product performances**

1.2.1. Where differences specified in Article 3(2) of the Directive are identified and justified in conformity with Community law, classes for Essential Requirements and for related product performances may be necessary. The purpose of such classes is to achieve the free circulation and free use of construction products.

In this case such classes shall be determined either in the Interpretative Document or according to the procedure provided for in Article 20(2)(a) of the Directive. Where through this procedure a classification of product performance is identified as the means of expressing the range of requirement levels of the work, the Commission will within the mandate request CEN, Cenelec or EOTA to make the appropriate proposal.

The range of requirement levels covered by the classes depends on the existing and justified levels encountered in Member States.

In cases where a Member State determines in conformity to Article 6(3) of the Directive among the classes only one or some classes to be observed in its territory (or part of it), it shall do so only on the basis of the differences specified in Article 3(2) of the Directive.

1.2.2. Where justified differences specified in Article 3(2) of the Directive are not identified, classes (or levels) of product performances may also be used by the standardizers as a means of convenience for specifiers, manufacturers and purchasers. For certain products, classes (or levels) make it easier to use the standard to relate product performance to its intended use.

Such performance classes (or levels) for products may with reference to Article 4(1) of the Directive therefore be established by the standardizers who will keep the Commission and the Standing Committee informed of the ongoing work on this matter in the framework of the execution of mandates.

1.2.3. Each time classes are defined for works or for products, it is necessary to set up a class called 'no performance determined' when and where at least one Member State has no legal requirement at all in that field.

1.3. **Meaning of general terms used in the Interpretative Documents**

1.3.1. *Construction works*

'Construction works' means everything that is constructed or results from construction operations and is fixed to the ground. This term covers both *buildings* and *civil engineering* works. In the Interpretative Documents 'construction works' are also referred to as 'the works'. Construction works include for example: dwellings; industrial, commercial, office, health, educational, recreational and agricultural buildings; bridges; roads and highways; railways; pipe networks; stadiums; swimming pools; wharfs; platforms; docks; locks; channels; dams; towers; tanks; tunnels; etc.

1.3.2. *Construction products*

(1) This term refers to products which are produced for incorporation in a permanent manner in the works and placed as such on the market. The terms 'construction products' or 'products', where used in the Interpretative Documents, include materials, elements and components (single or in a kit) of prefabricated systems or installations which enable the works to meet the Essential Requirements.

(2) Incorporation of a product in a permanent manner in the works means:

— that its removal reduces the performance capabilities of the works; and

— that the dismantling or the replacement of the product are operations which involve construction activities.

1.3.3. *Normal maintenance*

(1) Maintenance is a set of preventive and other measures which are applied to the works in order to enable the works to fulfil all its functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc.

(2) Normal maintenance generally includes inspections and occurs at a time when the costs of the intervention which has to be made are not disproportionate to the value of the part of the works concerned, consequential costs being taken into account.

1.3.4. *Intended use*

The intended use of a product refers to the role(s) that the product is intended to play in the fulfilment of the Essential Requirements.

1.3.5. *Economically reasonable working life*

(1) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

(2) An economically reasonable working life presumes that all relevant aspects are taken into account, such as:

— costs of design, construction and use;

— costs arising from hindrance of use;

— risks and consequences of failure of the works during its working life and costs of insurance covering these risks;

— planned partial renewal;

— costs of inspections, maintenance, care and repair;

— costs of operation and administration;

— disposal;

— environmental aspects.

1.3.6. *Actions*

Actions which may affect the compliance of the works with the Essential Requirements are brought about by agents acting on the works or parts of the works. Such agents include mechanical, chemical, biological, thermal and electro-magnetic agents.

1.3.7. *Performance*

Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product, for an action to which it is subject or which it generates under the intended service conditions (for the works or parts of works) or intended use conditions (for products).

2. EXPLANATION OF THE ESSENTIAL REQUIREMENT 'SAFETY IN USE'

The definition of the Essential Requirement given in Annex 1 to the Directive (see 1.1(3) above) is limited to the risk of violent and immediate bodily injuries arising for persons in or near works, for any reason.

Other risks also affecting user health (illness, poisoning, etc.) are covered by the Essential Requirement 'Hygiene, Health and the Environment'.

The idea of unacceptable risk is to be interpreted in the following way:

Works (including their constituent installations and equipment) presents risks of accidents that are practically and economically impossible to eliminate completely.

This Interpretative Document does not purport to exhaustively list all the risks which can arise for the user of construction works.

The acceptability of a risk is estimated by considering the seriousness of the accident, the probability of its occurrence and the possibility of recourse to technically and economically reasonable preventive measures.

Such assessment must be based upon a 'normal' or 'normally predictable' use of the works. This 'normally predictable use' includes the use by elderly and disabled persons and children, but not a conscious and deliberate risk-taking by the users. It entails reasonable and responsible behaviour by the users or, where the users are children, those responsible for their protection.

As expressed, this requirement refers to three large families of risks:

a) slips, falls, impacts;

b) burns, electrocutions, explosion;

c) accidents resulting from vehicle movement.

The first family essentially concerns injuries following:

— Slips and impacts after falling:

for users of the works, linked to a loss of balance, e.g. falling, stumbling or slipping.

— Direct impacts or contacts resulting from:

— impacts of users against fixed or movable parts of the works;

— impacts of movable parts of the works on users of the works or adjoining works;

— impacts of falling objects, forming part of the works, upon users.

To this last category, we need to add the risks of bodily accidents resulting from contact with or manipulation of the moving parts of a works, i.e. pinching, crushing, cutting, etc.

The second family concerns risk of burns, scalds, electrocution, explosion injuries.

These risks are in general linked to the presence of, contact with, or use of special equipment or building installations.

The following are to be especially considered in this category:

— electrical installations and equipment (electrocution, burns, explosions);

— thermal installations and equipment (burns, explosions);

— water equipment and installations (burns, scalds).

The third family concerns the risk of accidents caused by vehicle movement, resulting in injuries to people within vehicles, pedestrians, and so on.

This includes impacts of vehicles against structures at the edge of the roadway (passive safety devices* [1], road furniture).

It should be clearly understood that, for the purpose of this Interpretative Document, these risks relate to matters arising from the construction of the works and not of other factors such as vehicle safety, driving regulations or the like.

3. BASIS FOR VERIFICATION OF THE SATISFACTION OF THE ESSENTIAL REQUIREMENT 'SAFETY IN USE'

3.1. General

(1) This chapter identifies basic principles prevailing in Member States for the verification of the satisfaction of the Essential Requirement 'Safety in use'. These principles are currently complied with when and where the works are subject to regulations containing this Essential Requirement. Chapter 4 provides guidance on how to meet this Essential Requirement by compliance with the technical specifications referred to in Article 4 of the Directive.

(2) The Essential Requirement, as far as applicable, is satisfied with acceptable probability during an economically reasonable working life of the works.

(3) The satisfaction of the Essential Requirement is assured by a number of interrelated measures concerned in particular with:

— the planning and design of the works, the execution of the works and necessary maintenance;

— the properties, performances and use of the construction products.

[1] For the terms marked with a * in the text an explanation is given in the glossary added as Annex 1 to this ID.

(4) It is up to the Member States, when and where they feel it necessary to take measures concerning the supervision of planning, design and execution of the works, and concerning the qualifications of parties and persons involved. Where this supervision and this control of qualifications are directly connected with the characteristics of products, the relevant provisions shall be laid down in the context of the mandate for the preparation of the standards and guidelines for European technical approval related to the products concerned.

3.2. **Actions**

The various actions which are taken into account for assessing the satisfaction of the Essential Requirements are indicated in the various sub-chapters of Chapter 3.3 in relation to the particular risk they apply to.

3.3. **Verification of the satisfaction of the Essential Requirement**

3.3.0. *Introduction*

In this chapter the analysis of the various risks is accompanied by a description of relevant performance requirements for the works. These descriptions are intended as a background for a better understanding of the essential characteristics of the products.

The Interpretative Document has been developed with particular reference to buildings and roads. The general principles, however, apply to all construction works and in developing harmonized technical specifications the use of products in all types of works should be taken into account.

For special works additional specialized requirements may occur.

In the following sections there are references to other EC Directives which are relevant to particular construction works and products. The standards which support these Directives should also address the safety characteristics identified in this Interpretative Document.

Analysis sheets

For each of the risks an analysis sheet has been drawn up summarizing the causes of the risk, the required performances of the work, the relevant product groups and the characteristics of these products which are essential in Member States' regulations for the fulfilment of the requirement. These analysis sheets are attached to the Interpretative Document at Annex 2.

3.3.1. *Falling*

The risk 'falling' may encompass injuries such as strains which can be caused without impact. Falling may also lead to direct impact and wounding contact consequences, which are dealt with in section 3.3.2.

3.3.1.1. Description of the risk

The risk of falling can be sub-divided into:

falling after slipping;

falling after stumbling or tripping; and

falling due to changes in level.

a) falling after slipping

This risk is related to the coordination skills of the walker, the type of footwear and to the surface condition of the floor or the road pavement. Insofar as construction products are concerned the essential factor is the slipperiness of the floor or the road.

b) falling after stumbling/tripping

This risk concerns injury or death as a result of falling after stumbling and may arise as a result of poor visibility or irregularity in floor surfaces including sudden small changes of the level, variations of their slipperiness and other unexpected obstacles.

c) falling due to changes in level and sudden drops

This risk results from substantial sudden changes in floor level which may result in serious falls when appropriate guardrails are lacking or when inappropriate stairways, fixed ladders or ramps are used.

3.3.1.2. Performance of the works

Falling after slipping

The required performances of the works are a limit upon the slipperiness of the floor or the pavement and a limitation in sudden changes of the slipperiness.

That slipperiness depends on the inherent surface characteristics of the floor as well as on circumstances like the presence of water or grease on the surface.

Falling after stumbling/tripping

To prevent falling after stumbling, the works has to provide smooth floor surfaces in circulation areas without sudden small changes in level, changes in slipperiness or low obstacles.

To prevent falls by stumbling or tripping in poor visibility, minimum standards of illumination are required so that people may move safely within the works, including if they have to escape. In addition, escape routes are required to provide secure and adequate lighting, capable of operating despite failure of the electrical supply.

Falling due to changes in level or sudden drops

Control is exercised on the geometry and dimensions of various means of vertical movement in works. Differing requirements exist among various types of work. Matters such as pitch, step dimensions and stairs' width are regulated, as well as landings and handrails.

The maximum slope of ramps is controlled, with the safety and convenience of disabled users as an important consideration.

In order to protect against falling, protection is required at all substantial sudden changes in floor level. Accessible openings in floor or pavement surfaces should if possible be covered by grids or gratings. The height of guardrails, balustrades, parapets and other such protective measures may be prescribed in relation to the depth of the drop concerned. Openings should be limited in size to safeguard children against falling through or becoming trapped, and features which might facilitate climbing are discouraged. A minimum capability to resist horizontal thrust is required.

Opening windows in upper storeys can present special hazards with users such as children and in window cleaning operations.

3.3.1.3. Essential characteristics of the products

Falling after slipping

In the case where the surface of the floor or pavement is formed by the upper face of a prefabricated product, the slipperiness of the product, taking into account the surface pattern of its installation, characterizes the slipperiness of the works.

Harmonized standards should be established to define the method (as far as possible unique) and conditions of the quantification of the slipperiness taking into account the various parameters:

— for a floor or other relevant surfaces: barefoot, or shod in various manners;

— the conditions of the surface such as dry, wet, iced, greasy, polished.

Classes of slipperiness are needed. This classification should take into account that requirements for slipperiness only exist for some specific applications. Effects of ageing by use, weathering and maintenance should also be considered.

Falling after stumbling/tripping

The relevant products for the provision of suitable lighting are luminaires and emergency lighting units. Their relevant characteristics (light output, capacity and power) are being harmonized in the framework of the Low-Voltage Directive. The requirements of this Directive may be complemented, if necessary, by those of the Construction Products Directive.

Falling due to changes in level or sudden drops

There are many types of stairs with, as most important parameters the pitch, the tread, the height of steps and other dimensions.

The way to determine dimensional characteristics has to be harmonized.

In the case of sudden drops, the relevant characteristics of guardrails, balustrades and parapets are:

— their height above the floor;

— their 'climbability' for children;

— the size of their openings where children may fall through or become trapped;

— and their capability to resist horizontal thrust.

For windows and doors:

— safety catches and hinges.

3.3.2. *Direct impacts*

3.3.2.1. Description of the risk

This risk concerns injury or death as a result of accidental or non-accidental contacts (impacts/collisions) between the work or part(s) (elements) of the work and users in or around the work.

In particular it concerns:

— Impacts/collisions etc. between users and those elements or parts of the work which are normally subject to contact or manipulation (e.g. doors, windows, automatic garage doors, etc.)

— Impacts/collisions etc. between users and parts of the work as a result of accidents (e.g. as in *3.3.1* such as falling through a brittle element) or particular circumstances (e.g. failure of lighting)

— Impacts of falling objects, forming part of the work, upon users.

This risk does not include the risk of accidents resulting from vehicle movement, which is treated separately in 3.3.6.

3.3.2.2. Performance of the works

The characteristics of the work or its elements which affect the level of risk include:

— geometry (e.g. headroom);

— presence of sharp or cutting edges;

— nature of surfaces (hardness, roughness etc.);

— behaviour on impact (e.g. strength, ability to prevent penetration of falling people or objects, shatter properties*, size of shatter fragments etc.);

— forces applied to a body, for example by an automatically operated door.

The level of risk is also affected by the presence of safety devices or precautions taken to limit or prevent access to dangerous elements.

This risk is minimized by adherence to certain design requirements for the works rather than by particular requirements for the constituent products. That is, it is the use of products in the works, rather than the inherent properties of the products, which is important.

The different sub-risks (causes) are summarized in Annex 2, table 2, alongside the requirements for works and consequent requirements for products.

3.3.2.3. Essential characteristics of the products

The columns 4 and 5 of risk 2 in Annex 2 list the products and their characteristics which require harmonized standards of Category B.

In summary, harmonization of the following technical specifications is needed:

— for automatically operated products (like doors):

  — forces applied to a body,

  — safety devices characteristics;

— for doors/balustrades/windows containing glazing/glass

  — definition of geometry of glazing/glass in doors, etc.,

  — visibility of transparent obstacles;

— for stairways/landings/doorways

  — definition/measurement of headroom;

— for spiral stairs

  — definition of geometry;

— for luminaires

  — definition/measurement of power requirements, light output (*see 3.3.1.3* 'Falling after stumbling/ tripping');

— for signs for escape routes

  — definition/measurement of sign geometry,

  — definition/measurement of visibility, legibility;

— for swing doors

  — definition of geometry of transparent elements, measurement of visibility of those elements;

— for products without a structural intended use and presenting risks of accidents in service or in operation

— mechanical resistance and stability.

There are also general requirements for all standards associated with eliminating the risk of cuts from sharp edges of accessible products and for minimizing risks of contacts with potentially dangerous parts of products.

There are overlapping requirements in the case of this risk with other Directives (e.g. Lift Directive, Machinery Directive, Workplace Directive), and with other Essential Requirements of the Construction Products Directive for example, safety in fire and safe exit. For products covered by specific Directives, their requirements will be complemented, if necessary, by those of the Construction Products Directive.

3.3.3. *Burns*

3.3.3.1. Description of the risk

The risk of burns can arise from the following causes:

— contact with hot parts of the work or installations;

— contact by spraying or immersion with hot liquids;

— the thermal effect of radiant sources.

In the above cases the risk of burns is related to the thermal flux received by the user. The severity of the burn received depends on the temperature of the objects or media with which the user comes into contact and on conditions for exchange of heat such as the nature of the objects or media.

However, having regard to the present state of knowledge, the simplest way of expressing safety requirements is the temperature criterion (surface temperature, fluids temperature, radiant temperature). Generally the risk is related also to the degree of accessibility* of the parts of the works involved.

3.3.3.2. Performance of the works

The installations and equipment concerned are mainly those designed for the heating of the spaces in the works, the preparation, storage and distribution of hot water or other fluids. Certain parts of the lighting equipment and of the mechanical or electrical installations which, in normal or abnormal operation, might cause burns to users will also be relevant.

In most cases, the means to limit risk will be either to limit the opportunity for contact, or to limit the surface temperature of accessible parts or the temperatures of the fluids concerned, or to adopt a combination of these measures.

In other cases, the intended use of the installations and the equipment itself may make it impossible to make technically and economically reasonable arrangements, and the prevention of the risk will depend upon educating the users.

These considerations may lead to differentiating the 'active' parts from the 'non-active' parts of certain equipment or products.

For surface temperature a limited set of temperature classes corresponding to different levels of protection should be established.

3.3.3.3. Essential characteristics of the products

Regulations, design codes and codes of practice for works generally refer to certain characteristics of products such as:

— definition of some of the items of equipment used;

— technical characteristics of the apparatus or installations concerned;

— specific safety devices, whether or not integrated with the apparatus as placed on the market.

Harmonized technical specifications of Category B concerning equipment for producing, distributing and recovering heat, for removing smoke and hot gases, as well as the various devices for monitoring, regulating or limiting temperature, have to be established, based upon the following:

1. Apparatus, equipment and systems for producing, distributing and emitting heat:

   — Definitions and terminology linked to apparatus and equipment designed to be incorporated in installations for heating and producing hot water.

   — Expressing performance characteristics of these products.

   — Measurement of temperature levels which may be reached in normal, or normally predictable operation by active and non-active accessible parts.

   — Definition of accessibility of hot parts and test methods for this characteristic.

   — Tightness of concerned parts and joints.

   — Test or measurement methods for checking or establishing these characteristics.

   Gas equipment in this category must be characterized according to the same methods.

2. The abovementioned systems may include control devices such as:

   — thermostats;

   — flow regulation devices;

   — power supply cut-off devices;

   — temperature monitoring devices;

   — pressure relief valves;

   — etc.

   The following harmonization may be needed:

   — harmonized definitions;

   — expression of pertinent performances such as fidelity (hysteresis), sensitivity and temperature constancy;

   — methods for measuring or testing these performances;

   — where appropriate, preparation of performance classes of products (for example, to differentiate failsafe devices* from others).

3. Radiant heaters and heat generating equipment in general: harmonization is needed of definitions, testing methods and/or calculation methods of heat effects at different distances from the apparatus.

   Most of these products are covered by other specific Directives (such as Gas Appliances, Low-Voltage, Machinery, etc.). In these cases, harmonization is going on within the framework of those Directives and will be complemented, if necessary, under the Construction Products Directive.

3.3.4. *Electrocution and electrical shock*

3.3.4.1. Description of the risk

The risk may arise from:

— lightning striking the works or the users of the works;

— the voltage of electrical supply systems reaching parts of the works with which the user may come in contact.

The risk of a works being struck by lightning can be affected by geographical circumstances and the height of the work in relation to its surroundings.

The risk that the voltage of an electrical supply system reaches parts of the works with which the user may come in contact depends on the design of the system itself, the level of the voltage, and on the circumstances of usage (e.g. the presence of moisture).

For supply systems with a higher voltage, the risk also occurs within a certain distance of voltage-bearing parts of the system.

3.3.4.2. Performance of the works

Lightning

To prevent works and users from being struck by lightning, the works may have to be provided with a lightning protection system incorporating adequate interception devices, discharge conductors and earthing.

Electrical supply systems

The requirements for the works are:

— prevention of contact with parts of electrical systems that have a voltage higher than a certain level; or of the possibility of being within a certain distance of parts of the system that have a certain voltage;

— measures to prevent accessible parts of the work (including the electrical supply system) becoming live under specific conditions, e.g. when wet.

Traffic devices

Electrical supply systems for road traffic signal equipment and street lamps necessitate protective measures to prevent contact between road users and those part of the works which are or may become live (e.g. by impact of vehicles).

3.3.4.3. Essential characteristics of the products

Lightning

There are different standards for elements of lightning protective systems in Member States. Harmonization is needed.

Electrical supply systems

In the field of high-voltage and low-voltage systems a considerable degree of harmonization has already been achieved by Cenelec and laid down in harmonization documents.

Electrical supply systems in the construction field include both high and low-voltage systems. Low-voltage systems are treated already in EC Directive 73/23/EEC of 19 February 1973. The requirements of this Directive need to be complemented, if necessary, with those of the Construction Products Directive.

Traffic devices

The risk of electrical shocks from traffic lights, lane signals, variable message devices, traffic detectors, monitoring equipment, transmission equipment and power supplies for road traffic equipment should be minimized.

Essential characteristics which have to be harmonized are:

— insulation levels and automatic cut-outs or

— (harmless) voltages.

3.3.5. *Explosions*

3.3.5.1. Description of the risk

Strictly speaking explosions and bursts should be distinguished, the first resulting from a very quick thermal/chemical reaction, the second resulting from a burst in a system containing a gas under pressure. In this Interpretative Document, however, the term explosion is used to indicate the risk of both phenomena, explosions as well as bursts.

The risk of explosions in construction works has to be considered from two viewpoints. On the one hand the utilities or installations can constitute a risk to users:

— fuel supply lines (gas, oil);

— heat generation facilities (boilers, heaters, geysers);

— heating and heat storage facilities (pipes, boilers, storage waterheaters and heaters/radiators for water, steam or oil);

— installations under pressure (steam, gas, compressed air).

On the other hand, the risk of explosion can be caused by users due to their handling or employment of materials of an explosive nature, such as in

— facilities for storing, filling or transporting liquid fuels;

— facilities for storing explosive materials;

— sewage pumping stations;

— laboratories.

3.3.5.2. Performance of the works

The requirements for minimizing the risk of explosion to users in the first case refer to the operational safety of utilities or installations. Depending on the type of facilities and the pressures and temperatures for which they are designed, the construction materials, equipment and distribution facilities should be suitable for the goods to be stored or transported. All detachable connecting pieces for pipes, lines and other connections must be so designed as to ensure the tightness of all connections in all operating conditions.

Pipes or lines for flammable goods or goods of an explosive nature leading into closed buildings should be equipped with a cut-off or shut-off device at a safe distance.

In order to avoid excessive pressures or temperatures, facilities should be provided which limit or reduce pressures or temperatures or, if necessary, cut-off, shut-off or automatically stop the corresponding facilities or lines.

In this connection the following have to be observed:

— Council Directive on the approximation of the laws of the Member States relating to appliances burning gaseous fuels (90/396/EEC);

— Council Directive on the harmonization of the laws of the Member States relating to simple pressure vessels (87/404/EEC).

If the specific use entails a risk of explosion the facilities must be so installed, constructed and equipped as to protect the surrounding areas, in as far as Member States' regulations contain such risk. Such facilities have to meet requirements which minimize risk to users and others as far as practical.

In principle, measures have to be taken to prevent the development of a dangerous and explosive atmosphere due to the leakage of gases, fumes, fog or combustible dust as far as possible. If the development of such atmospheres cannot be prevented due to local or operating conditions, care has to be taken to provide the necessary safety measures. The type and scope of such measures depends on the probability of the development of a dangerous and explosive atmosphere. One of the measures can be the use of materials that do not lead to accumulation of static electricity.

3.3.5.3. Essential characteristics of the products

The requirements for individual construction products (pipes, lines, vessels, containers, controls and switches etc.) with respect to their explosion safety result from the requirements for construction works and the areas where they are to be used (e.g. compressive strength, temperature resistance, tightness, resistance against external impacts). The following Directives and their subsequent amendments shall be taken into consideration:

— Council Directive on the harmonization of the laws of the Member States relating to simple pressure vessels (87/404/EEC);

— Council Directive on the approximation of the laws of the Member States concerning electrical equipment for use in potentially explosive atmospheres (76/117/EEC);

— Council Directive on the approximation of the laws of the Member States concerning electrical equipment for use in potentially explosive atmospheres employing certain types of protection (79/196/EEC and 90/487/EEC);

— Council Directive on the approximation of the laws of the Member States concerning electrical equipment for use in potentially explosive atmospheres in mines susceptible to firedamp (82/130/EEC);

— Council Directive on the approximation of the laws of the Member States relating to the appliances burning gaseous fuels (90/396/EEC).

Further harmonization at the European level with respect to the requirements mentioned in the first sentence of this paragraph is needed, as detailed in Annex 2, tables 5.1 and 5.2 (columns 4 and 5).

3.3.6. *Accidents resulting from vehicle movement*

3.3.6.1. Description of the risk

This risk arises from the use of works by people in vehicles and concerns injury or death as result of accidents. The consequences can be serious for occupants of vehicles, people in the vicinity and also for the environment. The risk depends not only on the condition of the driving surface but also on the characteristics of the vehicle, the skill of the driver, the efficacy of signs and markings and the suitability of protective barriers and other equipment. For the purpose of this Interpretative Document only matters arising from the construction of the works and the characteristics of its products are dealt with.

Vehicles may:

— fall over unprotected edges or fall from bridges, etc.;

— collide with road equipment, barriers or obstacles beside the road;

— collide with other users of the works or vehicles especially on the other side of a central reservation;

— overturn or otherwise become unstable to a degree which causes risk of injury to occupants of the vehicle or other users of the works.

3.3.6.2. Performance of the works

The performances of the works include restricting the slipperiness of the driving surface, providing clear layout, visibility and legibility of signs for road safety, as well as markings and other road equipment for different conditions, including varied weather.

Road equipment should provide safety in case of impacts of vehicles (passive safety*).

Considering:

— individual road situations;

— speeds;

— nature of the edge of roads and types of risks (e.g. load-bearing components of structures, trees, poles, walls, buildings etc.);

— mass of vehicles;

different road safety devices* may be permanently installed. Such facilities should provide adequate impact safety, breakthrough resistance and acceptable rebound properties under all reasonable conditions.

3.3.6.3. Relevant characteristics of the products

The slipperiness of the driving surface depends on the materials involved and the way they are used (aggregates, laying procedure), including those for the marking of the road (paints, plastics compounds, bonded sheets and road studs).

Moreover, requirements for the skid resistance of items built into road surfaces (gully inlets, manholes etc.) are desirable.

The process and the conditions for the measurement of skid resistance and the polished stone value* have to be harmonized. The establishment of classes for both characteristics has to be considered.

Harmonization of the technical specifications of signs is needed, including sizes, colour (x/y co-ordinates), brightness, retroreflection*, legibility of letters (1).

Harmonization for road marking products including road studs has to be based on the aspects of skid resistance, day and night-time visibility respectively, retroreflection* and colour. In this connection the conditions or the measure of luminance and durability should be harmonized.

Harmonization should bear in mind different wear, weather and contrast situations and lead to a range of levels or classes from which Member States can choose.

The essential characteristics of (permanent) road equipment (e.g. posts, lighting columns, masts, poles, marker posts) should be examined by impact test with respect to break-away safety*. The test characteristics (vehicle mass, impact speed, impact characteristics such as point of contact or angle, acceleration severity index* or similar) need harmonization of definition and measurement/calculation.

A number of different protection systems are known to reduce the risk of falling down a bridge or slope and of striking against an obstacle or another vehicle. These include:

— safety fences;

— safety barriers* (steel, concrete, plastic);

— crash cushions*;

— bridge parapets.

Crash tests need harmonization. Impact safety could be determined in different classes with respect to aspects such as:

— vehicle mass;

— crash speed;

— angle between car/lorry and safety device;

— dynamic displacement of the safety device;

(1) The Commission of the European Communities has signalled its intention to bring forward legislation on road signs ('The White Paper on Transport' COM(92) 494 final; 2 December 1992; paragraph 374). The Construction Products Directive states that 'harmonised standards should be established as far as, and as quickly as, possible'. With the view to proceed in accordance with Article 2(3) of the Construction Products Directive and reduce possible conflict with any future Commission proposals, the topic of form, choice of colours and pictograms of signs for public traffic are not dealt with in this Interpretative Document.

— acceleration security index or similar indexes;

— longitudinal sliding limit;

— rebound limit.

4. TECHNICAL SPECIFICATIONS AND GUIDELINES FOR EUROPEAN TECHNICAL APPROVAL

4.1. General

(1) 'Technical specifications' means those referred to in Article 4 of the Directive. 'Guidelines for European Technical Approval' of a product or family of products means those referred to in Article 11 of the Directive.

(2) A general distinction is made between:

— *Category A:* These are standards which concern the design and execution of buildings and civil engineering works and their parts, or particular aspects thereof, with a view to the fulfilment of the Essential Requirements as set out in the Council Directive 89/106/EEC.

Category A standards should be taken into consideration within the scope of the Directive as far as the differences in laws, regulations and administrative provisions of Member States prevent the development of harmonized product standards.

— *Category B:* These are technical specifications and guidelines for European technical approval which exclusively concern construction products subject to an attestation of conformity and marking according to Articles 13, 14 and 15 of Council Directive 89/106/EEC. They concern requirements with regard to performance and/or other properties, including durability, of those characteristics that may influence the fulfilment of the Essential Requirements, testing and compliance criteria of a product.

Category B standards that concern a family of products, or several families of products, are of a different character and are called horizontal (Category Bh) standards.

(3) This distinction between Categories A and B is not intended to lay down different priorities for the work on the respective documents but to reflect the difference in the responsibilities of the authorities of Member States and in those of the bodies for European Standardisation and Technical Approval in implementing Directive 89/106/EEC.

(4) In order to ensure the quality of these documents with a view to the fulfilment of the Essential Requirement, the provisions of this Interpretative Document will result in specific conditions which will be included in the mandates for the preparation of the respective European standards and guidelines for the European technical approval.

(5) The assumptions made in Category A standards on the one hand and those made in Category B specifications on the other hand shall be compatible with each other.

(6) Category B technical specifications and guidelines for European technical approval shall indicate the intended use(s) of the respective product.

4.2. Performances of Products

(1) As far as practicable the characteristics of products should be described in performance terms in the technical specifications and guidelines for European technical approval. Methods of calculation, measurement, and testing (where possible), together with compliance criteria, shall be given either in the relevant technical specifications or in references called up in such specifications.

(2) The expression of the product performances should be compatible with the basis for the verification of the Essential Requirement as currently in use in Member States and referred to in Chapter 3 and as provided in the European Category A standards referred to in 4.1(2), taking into account the actual implementation of these documents.

4.3. **Attestation of conformity of products**

(1) 'Attestation of conformity' of products means that the provisions and procedures laid down in Articles 13, 14 and 15 of Annex III to the Directive are followed. These provisions aim to ensure that, with acceptable probability, the performance of a product will be achieved as specified in the relevant technical specification.

(2) The mandates will include indications concerning the conformity attestation procedures within the framework of Annex III to the Directive and related provisions to be indicated in the technical specifications and guidelines for European technical approval.

5. WORKING LIFE, DURABILITY

5.1. **Treatment of working life of construction works in relation to the Essential Requirement**

(1) It is up to the Member States, when and where they feel it necessary, to take measures concerning the working life which can be considered reasonable for each type of works, or for some of them, or for parts of the works, in relation to the satisfaction of the essential requirements.

(2) Where provisions concerning the durability of works in relation to the Essential Requirement are connected with the characteristics of products, the mandates for the preparation of the European standards and guidelines for European technical approvals, related to these products, will also cover durability aspects.

5.2. **Treatment of working life of construction products in relation to the Essential Requirement**

(1) Category B specifications and guidelines for European technical approval should include indications concerning the working life of the products in relation to the intended uses and the methods for its assessment.

(2) The indications given on the working life of a product cannot be interpreted as a guarantee given by the producer, but are regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

ANNEX 1

GLOSSARY

Acceleration Severity Index

The index is used as a measure for ascertaining the severity of impacts of vehicles against road equipment devices. It takes into account the decelerations of vehicles in the longitudinal, transverse, and vertical directions compared to maximum tolerable values.

Accessibility

The accessibility of a works or a product related to a specific risk concerns the degree of proximity of the user to a works or product, where the risk can occur.

Depending on the particular risk, this concept may concern a person or only a part of his/her body (e.g. hand, finger) or even a thing handled by a person, and applies to the possibility of contact (shocks, hot surfaces etc.) or critical distances (electrical shocks, radiation, etc.).

Break-away safety

Passive safety of road equipment that ensures that the equipment readily disengages, fractures, or bends away from impacting vehicles.

Crash cushion

Frontal passive safety device usually at the beginning of verges intended to attenuate an impact of a vehicle with kinetic energy absorption by deformation or impulse transfer.

Failsafe devices

A safety device is called a 'failsafe device' if the conditions defined by its 'safety position' are automatically realized when the device fails.

Passive safety

Safety which will be provided by road equipment in case of impacts of vehicles to protect people from injuries.

Polished Stone Value (PSV)

Frictional index of aggregates after a time accelerator polishing test as a measure of its polishing resistance.

Retroreflection

Reflection in which the reflected rays are preferentially returned in direction close to the opposite of the direction of the incident rays, characterized by the coefficient of luminous intensity and the coefficient of retroreflection of plane retroreflection surface.

Road safety device

Generically all devices for guiding and protecting vehicles on the road; in this document superior term for safety barriers and crash cushions (similar English term: vehicle restraint system).

Safety barrier

Substantial barrier alongside a road intended to prevent errant vehicles leaving the road and to limit consequential injury to occupants of vehicles and users of the road or damage.

Shatter properties

A general expression describing the way in which a material (e.g. glass) breaks or fractures following an impact.

ANNEX 2

ANALYSIS SHEETS PER RISK

RISK I A — FALLING AFTER SLIPPING

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (quantitative)	4. Relevant Products	5. Essential Characteristics
Slipping when walking	Limited slipperiness of the floor or pavement under different circumstances	Slipperiness of the floor/ pavement in relation to shoes and bare feet	Floor coverings and pavement	Slipperiness

RISK I B — FALLING AFTER STUMBLING/TRIPPING

Poor visibility	Provide suitable lighting in indoor circulation areas and in escape routes	Min. illuminance on horizontal routes and on stairs, ramps	Luminaires Emergency lighting units	Power, capacity Time lag before start light output per W
	Provide secure lighting in escape routes	Following mains failure, min. time duration	Luminaires	Power

RISK I C — FALLING DUE TO CHANGES IN LEVEL AND SUDDEN DROPS

Sudden drops	Protect all sudden changes in floor level and vertical drops	Provide barriers of appropriate height, integrity, strength and resistance to climbing	Balustrades, guardrails, parapets	Height without openings which permit passage of ... diam. sphere; resistance to horizontal load at top; without features which provide step between ... and ... above floor level
	Make safe accessible openings in external wall	Provide rails or other barriers of sufficient height and strength; no unprotected openings above certain levels	Opening windows and doors	Safety catches and hinges

RISK I C — FALLING DUE TO CHANGES IN LEVEL AND SUDDEN DROPS

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (quantitative)	4. Relevant Products	5. Essential Characteristics
Changes in level	Provide safe means of vertical circulation (stairs)	Limit uninterrupted height	Stairs, straight flights	Steps of consistent dimension through-flight; shape of steps Pitch in degrees Max. height of steps Min. depth of steps Min. width
			Open risers	Min. overlap between adjacent steps and max. opening
			Landing	At least same width and min. depth
			Handrails	Height above pitchline
			Balustrade	Without openings which permit passage of ... sphere
			Curved stairs	Above to apply in relation to pitchline not less than ... from edge of stairs
			Fixed ladders	Above to apply

RISK II — DIRECT IMPACTS

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (quantitative)	4. Relevant Products	5. Essential Characteristics
Hitting head — on ceiling or stairways and landings — on door openings and doors	Minimize risk of injury to head and possible resultant falling by impact with ceiling above stairways or in doorways	Provide minimum head room by specifying height of ceiling, stairs and stairways, landings or of door openings	Straight stairs/ramps Spiral stairs Doors and their frames	Headroom Headroom Height
Collision/impacts with people/ objects while moving in works	Minimize risk of collision by provision of suitable visual condition (a) during normal use (b) when main lighting fails	Provide minimum illuminance for (a) and (b) and appropriate signs for (b)	Luminaires (fittings) (a) and (b) Signs for escape routes (b) Batteries (b) Standby power units (b)	Power Light output Light intensity Letter or symbol size and/or luminance Capacity Power
	Minimize risk by visible warnings Minimize risk of squeezing in automatic doors	Suitable transparency of doors	Swing doors Automatic doors	Size of transparent element, visibility Performances of safety devices to protect people
Being hit by vehicle within a work	Limit the risk of injury/death from impact/collision with vehicle	Provide barriers/guarding of sufficient height and strength (KN/m)	Guarding/barriers	Height Horizontal resistance to forces
Impacts with 'projections' on exteriors or circulation areas	Minimize risk of collision with fixed or moveable projections in and around buildings	Design to avoid dangerous obstructions	see 3	see 3
Impact with brittle elements	Minimize risk of injury (cuts)/death from collision with brittle elements in doors, windows, balustrades, roofs	Restrictions on use of brittle elements such as glass pane size (m), type of glazing and its placement, warning labels or markings	Brittle elements including glazing/glass (and plastics) doors, windows, guardrails, balustrades, roofing elements	Pane size, geometry of glass in doors, etc., shatter properties/ impact behaviour and resistance

RISK III — BURNS

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (qualitative)	4. Relevant Products	5. Essential Characteristics
Contact with hot surfaces	Not to be burnt after a contact with such a surface	Temperature of heating fluids — air — liquids — vapour (in that case saturated vapour pressure) Temperature of accessible parts	1. Heating systems including	Reliability to maintain the fluids below the required max. temperature (saturated vapour)
			2. Heating generators	Pressure
			3. Emitters (and other parts of 1)	Temperature of accessible parts
			4. Safety devices related to 1, 2, 3	Fidelity Sensitivity
	Prevention of contacts with hot surfaces	Non-accessibility of warning device	Heating generators, heating emitters, flues	Accessibility of hot parts
Contacts with hot water (fluids) — spraying — immersion	Not to be burnt by contacts with hot water (fluids, chemicals)	— Max. level of the water temperature at the delivery point	— Safety devices for limiting the temperature at the production site — Safety mixing valves after production — Mixing taps at the delivery site (place)	Fidelity, sensitivity, reliability Fidelity, sensitivity, temperature constancy Fidelity, sensitivity, temperature constancy
		— Limit risk of being sprayed by hot liquid	— Heating systems	Watertightness of the system
		— Limit risk of falling into pitssumps	— Fencing, guard-rails	Fixing Height Mechanical resistance
Effect of hot radiant, heaters, lamps	Not to be burnt staying or passing near such equipment		Radiant panels or apparatus	Effect of the temperature level of a reference testing surface (test method)

RISK IV — ELECTROCUTION AND ELECTRICAL SHOCK

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (quantitative)	4. Relevant Products	5. Essential Characteristics
Lightning	Protection of the work and users being struck by lightning	Effectiveness of the interception devices of the lightning protection systems, its earthing resistance, etc.	Components of lightning protective systems like: Interceptors, conductors, connectors, earling electrodes	To be specified
By the voltage of electrical supply system	— Impossibility of touching parts of electrical supply systems that are under charge (more than X volt) under normal conditions — Impossibility of being within a certain distance of parts that are under voltages higher than Y volt — Impossibility of having charge on reachable parts of the system under specific conditions (wet, etc.)		Components of low-voltage systems incl. sockets, high-voltage systems, lightning armatures, electrical built-in apparatus	Accessibility*) of parts that are under charge, geometry, etc.
By the voltage of the electrical supply system of road traffic signals, road lighting, etc.	— Impossibility of having charge on accessible* parts of systems by touching (direct contact of people) or bumping (indirect contact of vehicle)	Protection against electrical risks under all reasonable conditions	Traffic lights, lane management signals, variable message signing devices, traffic detectors, monitoring equipment, transmission equipment, power supplies	Insulation, voltage, cut-out devices

RISK V — EXPLOSIONS

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (quantitative)	4. Relevant Products	5. Essential Characteristics
Explosions	Fire-producing appliances, connections, chimneys, ancillary fuel systems, flues, ducts, tanks and conduit-pipes for flammable gases and liquids	Reliability in service and fire	Pipes including their equipment and connections	Pressure, temperature tightness, resistance against external influences
	Pipes and connections for flammable gases	Visibility, reachability, admissibility of connections, ventilations, stoppage from a safe position, prevention against electrical sparks	Connection material	Tightness, discharge, strength, flexibility, pressure, internal diameter
Bursts	Unvented hot water systems	Temperature, storage capacity, general configuration, safe working conditions	Thermostats, thermal cut-outs, temperature relief valves, gauges, access, pressure relief valves	Reliability, sensitivity, temperature
	Storage systems		Steam boilers, air receiver, gasholders	Reliability Pressure
Explosive atmosphere in (part of) works	Risk for explosive atmosphere	Prevention of dangerous and explosive atmosphere	Vessels, containers, fittings, filling and draining installations, connections of pipes	Tightness, pressure, temperature

RISK VI — ACCIDENTS BY MOVING VEHICLES

1. Cause	Requirements total works		Characteristics of products	
	2. Functional (qualitative)	3. Performances (quantitative)	4. Relevant Products	5. Essential Characteristics
Skidding	Not to be injured or dead after skidding on a road (cycling, motorcycling, being in a car or bus, or any motor vehicle)	Limited slipperiness of the road surface; evenness, water drainage, texture	Materials used in the execution of the pavement or on the road surface: paving stones, etc. Road markings, manholes, gully inlets, etc.	Polished stone value Skid resistance
Skidding and/or driving mistake	Not to be surprised or disorientated by illegible or wrongly positioned signals beside or above road	Visibility of signs in all weather conditions	Road signs, road marking incl. studs, optical guidance devices (marker posts, chevron curve, delineators, distance indicators, etc.)	Size Colour (x/y co-ordinates) Brightness, legibility of letters Retroreflection
	Not to be injured or dead on roads (cycling, motorcycling, being in a car or bus, or any motor vehicle)	Provide safety of road equipment in all reasonable conditions	Posts, lighting columns, masts, marker posts, guiding beacons	Break-away safety Impact safety determined with vehicle crash tests (vehicle mass, speed, angle, acceleration severity index) or similar
	Not to be injured or dead as a result of falling down a slope or bridge or as a result of bump against an obstacle beside the carrigeway or a vehicle on the other side of a central reservation	Provide barriers of appropriate height, impact safety, break-through resistance and rebound properties under all reasonable conditions	Safety fences, safety barriers, crash cushions, bridge parapets	Impact safety etc. determined with vehicle crash tests (vehicle mass, speed, angle, dynamic displacement, acceleration severity index longidutinal sliding limit, rebound limit

INTERPRETATIVE DOCUMENT

Essential Requirement No 5

'PROTECTION AGAINST NOISE'

CONTENTS

ESSENTIAL REQUIREMENT: PROTECTION AGAINST NOISE

1. GENERAL

1.1. Purpose and Scope

(1) This Interpretative Document relates to Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products, hereinafter referred to as 'the Directive'.

(2) Article 3 of the Directive stipulates that the purpose of the Interpretative Documents is to give concrete form to the Essential Requirements for the creation of the necessary links between the Essential Requirements set out in Annex I to the Directive and the mandates for the preparation of harmonized standards and guidelines for European technical approvals or the recognition of other technical specifications within the meaning of Articles 4 and 5 of the Directive.

Where considered necessary, the provisions of this Interpretative Document will be further specified in each particular mandate. In drafting the mandates, account will be taken, if necessary, of the other Essential Requirements of the Directive, as well as of other relevant Directives concerning construction products.

(3) This Interpretative Document deals with the aspects of the works where 'protection against noise' may be concerned. It identifies products or product families and characteristics relating to their satisfactory performance.

For each intended use of the product, the mandates will indicate in further detail which of those characteristics shall be dealt with in the harmonized specifications, using a step-by-step procedure with CEN/Cenelec/EOTA, which will allow the product characteristics to be modified or complemented, if necessary.

Annex 1 to the Directive gives the following definition of the Essential Requirement which is applicable when and where the works are subject to regulations containing such a requirement:

'The construction works must be designed and built in such a way that noise perceived by the occupants or by people nearby is kept down to a level that will not threaten their health and will allow them to sleep, rest and work in satisfactory conditions.'

(4) In accordance with Council Resolution of 7 May 1985 (New Approach) and the preamble to the Directive, this interpretation of the Essential Requirement is intended not to reduce the existing and justified levels of protection for works in the Member States.

1.2. Levels or classes for Essential Requirements and for related product performances

1.2.1. Where differences specified in Article 3 (2) of the Directive are identified and justified in conformity with Community law, classes for Essential Requirements and for related product performances may be necessary. The purpose of such classes is to achieve the free circulation and free use of construction products.

In this case such classes shall be determined either in the Interpretative Document or according to the procedure provided for in Article 20 (2) (a) of the Directive. Where through this procedure a classification of product performance is identified as the means of expressing the range of requirement levels of the work, the Commission will within the mandate request CEN, Cenelec or EOTA to make the appropriate proposal.

The range of requirement levels covered by the classes depends on the existing and justified levels encountered in Member States.

In cases where a Member State determines in conformity to Article 6 (3) of the Directive among the classes only one or some classes to be observed in its territory (or part of it), it shall do so only on the basis of the differences specified in Article 3 (2) of the Directive.

1.2.2. Where justified differences specified in Article 3 (2) of the Directive are not identified, classes (or levels) of product performances may also be used by the standardizers as a means of convenience for specifiers, manufacturers and purchasers. For certain products, classes (or levels) make it easier to use the standard to relate product performance to its intended use.

Such performance classes (or levels) for products may with reference to Article 4 (1) of the Directive therefore be established by the standardizers who will keep the Commission and the Standing Committee informed of the ongoing work on this matter in the framework of the execution of mandates.

1.2.3. Each time classes are defined for works or for products, it is necessary to set up a class called 'no performance determined' when and where at least one Member State has no legal requirement at all in that field.

1.3. **Meaning of general terms used in the Interpretative Documents**

1.3.1. *Construction works*

'Construction works' means everything that is constructed or results from construction operations and is fixed to the ground. This term covers both ***buildings*** and ***civil engineering*** works. In the Interpretative Documents 'construction works' are also referred to as the 'works'. Construction works include for example: dwellings, industrial, commercial, office, health, educational, recreational and agricultural buildings, bridges, roads and highways, railways, pipe networks, stadiums, swimming pools, wharfs, platforms, docks, locks, channels, dams, towers, tanks, tunnels, etc.

1.3.2. *Construction products*

(1) This term refers to products which are produced for incorporation in a permanent manner in the works and placed as such on the market. The terms 'construction products' or 'products', where used in the Interpretative Documents, include materials, elements and components (single or in a kit) of prefabricated systems or installations which enable the works to meet the Essential Requirements.

(2) Incorporation of a product in a permanent manner in the works means:

— that its removal reduces the performance capabilities of the works; and

— that the dismantling or the replacement of the product are operations which involve construction activities.

1.3.3. *Normal maintenance*

(1) Maintenance is a set of preventive and other measures which are applied to the works in order to enable the works to fulfil all its functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc.

(2) Normal maintenance generally includes inspections and occurs at a time when the costs of the intervention which has to be made are not disproportionate to the value of the part of the works concerned, consequential costs being taken into account.

1.3.4. *Intended use*

The intended use of a product refers to the role(s) that the product is intended to play in the fulfilment of the Essential Requirements.

1.3.5. *Economically reasonable working life*

(1) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

(2) An economically reasonable working life presumes that all relevant aspects are taken into account, such as:

— costs of design, construction and use;

— costs arising from hindrance of use;

— risks and consequences of failure of the works during its working life and costs of insurance covering these risks;

— planned partial renewal;

— costs of inspections, maintenance, care and repair;

— costs of operation and administration;

— disposal;

— environmental aspects.

1.3.6. *Actions*

Actions which may affect the compliance of the works with the Essential Requirements are brought about by agents acting on the works or parts of the works. Such agents include mechanical, chemical, biological, thermal and electro-agnetic agents.

1.3.7. *Performance*

Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product, for an action to which it is subject or which it generates under the intended service conditions (for the works or parts of works) or intended use conditions (for products).

2. EXPLANATION OF THE ESSENTIAL REQUIREMENT 'PROTECTION AGAINST NOISE'

2.1. Field of application

The requirement given above may concern all works which are occupied by people, or in whose vicinity people are found, insofar as their health could be affected by the noise level to which they are exposed. It is then completed by the notion of comfort applicable to sleep, rest, and working activities.

Other Community Directives define, or will define, noise protection measures, as is the case for certain machines, vehicles, etc., whose noise emission levels are restricted by limit values. It is also the case for the protection of workers at their place of work, for which noise level exposure is taken into consideration.

2.2. Nature of the requirement

The requirement deals with how people perceive the acoustical conditions of their environment, insofar as the construction works play a role in this perception.

The protection referred to by the Essential Requirement 'Protection against noise' involves the following different aspects:

— protection against airborne noise from outside of the works;

— protection against airborne noise from another enclosed space;

— protection against impact noise;

— protection against equipment noise;

— protection against excessive reverberant noise;

— protection of the environment against the noise produced by sources inside or associated with works.

2.3. **Definition of quantities for acoustic properties**

The following units are used in the definitions of acoustic properties:

volume V: m^3

surface area S: m^2

equivalent absorption area A: m^2

reverberation time T: s

sound pressure level L: dB ref 20 μPa

2.3.1. *Protection against airborne noise from outside of the works*

This protection is characterised by the insulation existing between an enclosed space and the noise prevalent outside, which can be calculated by:

$$L_1 - L_2 + 10 \lg T + K$$

where

K: constant *(see 2.3.7)*

and by frequency bands

L_1: is the sound pressure level in front of the façade

L_2: is the average sound pressure level in the receiving room

T: reverberation time in the receiving room

This insulation is expressed by a single number rating.

2.3.2. *Protection against airborne noise between enclosed spaces*

This protection is characterised by the insulation existing between two enclosed spaces, which can be calculated by:

$$L_1 - L_2 + 10 \lg T + K$$

where

K: constant *(see 2.3.7)*

and by frequency bands

L_1: is the average sound pressure level in the source room

L_2: is the average sound pressure level in the receiving room

T: reverberation time in the receiving room

This insulation is expressed by a single number rating.

2.3.3. *Protection against impact noise*

This requirement concerns essentially the protection against noise resulting from impacts on works, or parts of the works. In fact, they are all represented by the noise due to the movement of objects or persons on a floor, stairs, etc.

Protection against this type of noise is characterised by the sound pressure level transmitted by works, or parts of the works, which can be calculated by:

$$L_1 - 10 \lg T - K$$

where

K: constant *(see 2.3.7)*

and by frequency bands

L_1: average sound pressure level in the receiving room when the floor under test is excited by a standardised impact sound source

T: reverberation time in the receiving room

This transmission is expressed by a single number rating.

2.3.4. *Protection against equipment noise*

This protection is characterised by the sound pressure level transmitted, which can be calculated by:

$$L_p - 10 \lg T - K$$

where

K: constant *(see 2.3.7)*

and by frequency bands

L_p: measured sound pressure level

T: reverberation time in the receiving room

This noise level is expressed by a single number rating.

2.3.5. *Protection against excessive reverberant noise*

The noise within a room is a function, on the one hand, of the acoustic power level of the sources and of the geometric characteristics of the room, which are neutral with regard to products, and on the other hand, of the acoustic absorption coefficient of the materials comprising the different walls and the other furniture. This protection is characterised by the reverberation time T of the room or by the equivalent absorption area.

The equivalent absorption area can be calculated by:

$$\Sigma S_\iota \alpha_\iota + \Sigma A_j$$

where,

S_ι: surface areas with subscript ι

and by frequency bands:

α_ι: sound absorption coefficient of the surfaces with the subscript ι

A_j: equivalent sound absorption area of other surfaces than S_ι

This equivalent sound absorption area and the reverberation time T are expressed by their single number ratings or in frequency bands as appropriate.

2.3.6 *Protection of the environment against the noise produced by sources inside or associated with works*

Works include any type of building, e.g. places of entertainment, industrial complexes, and also civil engineering works, e.g. roads, barriers, bridges.

The protection is in general characterised by the sound pressure level, measured at the relevant position. This level is expressed by its single number rating, the A-weighted sound pressure level, sometimes adjusted to take into account the character of the noise.

Since this noise level is determined as much by the source as it is by the effect the work has on the sound transmission, and the Directive does not deal with the noise level produced by these sources, this noise level is in itself no descriptor for the works. Methods used for the design and evaluation of these works, if they relate to acoustic characteristics of the works, shall be consistent with those specified for the products used for the works.

2.3.7 *Constant 'K'*

This constant, associated with the reverberation time T, allows the correction of calculated and measured results, so as to cancel the absorption effect, due to furniture for instance, and thus make it possible to compare both requirements and results, independently of the inner state of rooms.

Four expressions are in current use, according to the measurement.

$10 \lg T/T_o$ and $K = -10 \lg T_o$

$10 \lg S/A$ and $K = +10 \lg (S/0.16\ V)$

$10 \lg A_o/A$ and $K = +10 \lg (A_o/0.16\ V)$

$10 \lg 4\ (S \cos \Theta/A)$ and $K = 10 \lg (4\ S \cos \Theta/0.16\ V)$

where

T_o: reference reverberation time, 0.5 s for dwellings

S: area of partition

V: receiving room volume

A_o: reference absorption area, 10 m2 for dwellings

Θ: angle, expressed in degrees, of sound incidence with respect to the normal to the surface of a façade

and by frequency bands

T: reverberation time in the receiving room

A: equivalent absorption area in the receiving room.

3. BASIS FOR VERIFICATION OF THE SATISFACTION OF THE ESSENTIAL REQUIREMENT 'PROTECTION AGAINST NOISE'

3.1 General

(1) This chapter identifies basic principles prevailing in Member States for the verification of the satisfaction of the essential requirement 'Protection against noise'. These principles are currently complied with when and where the works are subject to regulations containing this Essential Requirement. Chapter 4 provides guidance on how to meet this Essential Requirement by compliance with the technical specifications referred to in Article 4 of the Directive.

(2) The Essential Requirement, as far as applicable, is satisfied with acceptable probability during an economically reasonable working life of the works.

(3) The satisfaction of the Essential Requirement is assured by a number of interrelated measures concerned in particular with:

— the planning and design of the works, the execution of the works and necessary maintenance;

— the properties, performances and use of the construction products.

(4) It is up to the Member States, when and where they feel it necessary, to take measures concerning the supervision of planning, design and execution of the works, and concerning the qualifications of parties and persons involved. Where this supervision and this control of qualifications are directly connected with the characteristics of products, the relevant provisions shall be laid down in the context of the mandate for the preparation of the standards and guidelines for European technical approval related to the products concerned.

3.2 Actions

The actions *(see 1.3.6)* taken into account in this document are all associated with noise.

The behaviour of construction works and products related to noise protection is expressed in terms of insulation or transmission, or sound pressure or sound power levels.

For the first two ways, the product characterisation implies the choice of representative noise sources as a reference.

3.3 Verification of the satisfaction of the Essential Requirement

The expression of the requirement in the national regulations is currently made in accordance with one of three different options, or a combination of these:

— Statement of a minimum performance requirement of the work, in numerical or general terms.

— Statement of minimum acoustic performance requirement of the products.

— Statement of the maximum noise level which people in or near the works may be exposed to.

This section states the principles prevailing in the Member States relevant to the methods for assessing acoustic performance and the methods for verifying compliance with the requirements.

Any of the following methods or a combination of them are used:

a) *Calculation methods*

Methods based on procedures which allow determination of the performance of the complete works, based on values from the harmonized performance tests of the products.

b) *Tests on prototype*

Methods based on tests conducted on either a full-size prototype or a mock-up incorporating all important features.

c) *Descriptive methods*

Methods based on the description of designs that have been found to be satisfactory. They apply to elements or a combination of elements, and must be described in a general way, e.g. type of material, surface mass.

d) *Verification methods based on in situ tests (during and after the construction of the works)*

According to different requirements of Member States, for each test, two approaches are used: one of high complexity (engineering) and one of lower complexity and therefore lower precision (survey).

The Member States may use any of the various methods for verifying that the Essential Requirement is satisfied. None of these methods shall create barriers to the use of products, which would comply with the relevant harmonized technical specifications.

The harmonization of the national regulations on works could be helpful in the application of harmonized technical specifications of products.

4. TECHNICAL SPECIFICATIONS AND GUIDELINES FOR TECHNICAL APPROVAL

4.1. General

(1) 'Technical specifications' means those referred to in Article 4 of the Directive. 'Guidelines for European Technical Approval' of a product or family of products means those referred to in Article 11 of the Directive.

(2) A general distinction is made between:

— *Category A:* These are standards which concern the design and execution of buildings and civil engineering works and their parts, or particular aspects thereof, with a view to the fulfilment of the Essential Requirements as set out in Council Directive 89/106/EEC.

Category A standards should be taken into consideration within the scope of the Directive as far as the differences in laws, regulations and administrative provisions of Member States prevent the development of harmonized product standards.

— *Category B:* These are technical specifications and guidelines for European technical approval which exclusively concern construction products subject to an attestation of conformity and marking according to Articles 13, 14 and 15 of the Council Directive 89/106/EEC. They concern requirements with regard to performance and/or other properties, including durability, of those characteristics that may influence the fulfilment of the Essential Requirements, testing and compliance criteria of a product.

Category B standards that concern a family of products, or several families of products, are of a different character and are called horizontal (Category Bh) standards.

(3) This distinction between Categories A and B is not intended to lay down different priorities for the work on the respective documents but to reflect the difference in the responsibilities of the authorities of Member States and in those of the bodies for European Standardisation and Technical Approval in implementing Directive 89/106/EEC.

(4) In order to ensure the quality of these documents with a view to the fulfilment of the Essential Requirement, the provisions of this Interpretative Document will result in specific conditions which will be included in the mandates for the preparation of the respective European standards and guidelines for the European technical approval.

(5) The assumptions made in Category A standards on the one hand and those made in Category B specifications on the other hand shall be compatible with each other.

(6) Category B technical specifications and guidelines for European technical approval shall indicate the intended use(s) of the respective products.

4.2. Provisions concerning works or parts of them

4.2.1. *Calculation methods*

Calculation methods for the acoustic characterisation of works, or parts of the works, are useful for designing works and to establish the required properties for products.

These methods can, where appropriate, cover the aspects mentioned hereunder:

— insulation for noise from outside,

— insulation for noise from another enclosed space,

— transmission of impact noise,

— sound pressure levels due to equipment,

— reverberation time or absorption area,

— sound pressure level outside a works produced by sources inside or associated with the works.

They are applicable to the performance of the complete works or part of the works.

The acoustic properties of works, or parts of the works, can also be expressed by a group of single values, called single number ratings, each being representative of the protection against noise for a given aspect of the requirement above. The single number ratings for works must be expressed in a harmonized way, in units which are the same as, or compatible with, those employed in the harmonized technical specifications concerning products referred to in Chapter *4.3.*

4.2.2. *Laboratory methods*

Acoustic measurements are carried out on full-size prototypes of parts of the works, such as walls, partitions, floors, ceilings and roofs and on installations such as ventilation systems. In this case, there is an association of several products, as for example, a brick wall receiving a rendering on one side and a lining composed of an insulating material and a facing on the other side. Tests may be carried out in the laboratory or on full size mock-ups incorporating all important features as appropriate.

Technical specifications can, where appropriate, quantify the following:

— Direct airborne sound reduction of an element of known surface area,

— Direct airborne sound reduction of a small size element,

— Flanking airborne sound reduction of a construction element,

— Direct transmission of impact noise,

— Flanking transmission of impact noise,

— Reduction of transmitted impact noise,

— Airflow resistance,

— Dynamic stiffness,

— Acoustic absorption of flat elements,

— Structure-borne noise emission levels of permanently installed equipment.

A standard about barriers characterisation should be established, taking account of different national standards.

4.2.3. *Descriptive Methods*

The harmonized technical specifications for products shall be used.

4.2.4. *Verification methods based on in situ tests (during and after construction)*

To provide for different requirements of Member States, for each test, two approaches are used: one of high complexity (engineering) and the other of lower complexity and therefore lower precision (survey).

The relevant methods shall allow the measurement of the following properties:

— Insulation against outside noise,

— Insulation between two enclosed spaces,

— Transmission of impact noise,

— Sound pressure level from equipment,

— Reverberation time and absorption area,

— Sound pressure level outside a work produced by sources inside or associated with the work.

4.3. **Provisions concerning products**

4.3.1. *General*

For products which influence the acoustic characteristics of works, the harmonized technical specifications and the guidelines for European technical approval, drawn up by reference to this document, shall permit characterisation of the products in such a harmonized way that it is possible to evaluate (with regard to the 'Protection against Noise' requirement) the performances of the works covered by this requirement and in which these products will be incorporated in a permanent manner.

This implies that certain definitions, quantities, units, and symbols must be harmonized.

The acoustic performance of products is either expressed in acoustic properties, or in product characteristics, like surface mass, which are relevant for the acoustic performance. These properties shall be used either directly for the descriptive methods mentioned in 3.3 concerning works, or to calculate the acoustic performance of works.

Depending on the type of product and its use, one or more of the following properties may have to be called for by the harmonized technical specifications, as appropriate:

— Dimensions,

— Density,

— Elasticity,

— Surface mass,

— Dynamic stiffness,

— Airflow resistance.

The next paragraphs of this chapter will deal only with the acoustic properties.

4.3.2. *The acoustic properties and their expression*

The properties, symbols and units used to describe products, as well as the methods for measurement or assessment by calculation of these values, shall be unified through the elaboration of harmonized technical specifications.

4.3.2.1. Acoustic properties of building products

Laboratory acoustic measurements are also carried out on products like panels, doors, windows, valves.

The properties and their symbols shall, without any possible ambiguity, be representative of the laboratory measurements, or of an assessment by calculation, in accordance with a harmonized method.

The acoustic characteristics of products required from the Essential Requirement, can also be derived from calculation methods described in *3.3.*

Harmonized technical specifications can, where appropriate, for construction products, quantify the following:

— Direct airborne sound reduction,

— Flanking airborne sound reduction,

— Reduction of transmitted impact noise,

— Direct transmission of impact noise,

— Flanking transmission of impact noise,

— Acoustic absorption properties of the various products,

— Acoustic characteristics of products used in water installations,

— Acoustic characteristics of products used in waste water discharge installations,

— Sound power levels of permanently installed components of equipment.

Where possible calculation methods should be established for the assessment of acoustic characteristics of products from the properties of the materials.

4.3.2.2. Acoustic properties of products used in the civil engineering field

It is necessary to define a certain number of properties to specify the relevant acoustic characteristics of such products, separately or in combination, as follows:

— sound insulation,

— sound absorption (or reflection),

— sound radiation,

— damping.

It is then essential to refer to harmonized technical specifications.

4.3.2.3. Single number ratings of products

Single number ratings could be identified for the aspects mentioned hereunder, because they give important information relating to the Essential Requirement 'Protection against Noise'.

These indices indicate the performance of the products by a single value, appropriate to the noise from which protection is sought and which is consistent with the requirement and the way in which it is expressed in Chapter 2.

They are calculated usually starting from results of measurements obtained by frequency bands.

Harmonized standards could be developed for the aspects mentioned hereunder. Unless otherwise stated they should be applicable to the performance of products tested in the laboratory. The single number ratings must be expressed in a harmonized way.

1. Single number ratings of insulation against airborne noise

   (a) Insulation between an enclosed space and the space outside (i.e. insulation by the products used to construct the building envelope);

   (b) Insulation between enclosed spaces (i.e. insulation by interior building elements).

2. Single number rating of impact noise transmission

3. Single number rating of reduction in impact noise transmission by a floor covering

4. Single number rating of acoustic absorption

   The method should characterise the absorbent properties of construction products, and should be consistent with methods for rating sound insulation.

5. Single number rating of equipment noise

   The method (or methods) should characterise the sound power or sound pressure level of permanently installed equipment.

6. Single number rating of noise from taps and appliances used in water supply installations and from products used in waste water discharge installations

7. Single number rating of products for civil engineering works

   It is necessary to define one or more ratings to characterise the acoustic properties of products used in civil engineering works such as barriers and road surfaces.

4.3.3. *Product families*

For each type of product the relevant properties to be taken into account in the technical specifications shall be specified, as appropriate, from the lists in clauses *4.3.1* and *4.3.2.*

The acoustic characteristics of a product are obtained either from a harmonized test carried out by an appropriate laboratory, or by using harmonized calculation procedures. They shall be distributed as follows according to their function:

Windows:

The acoustic data consists of:

— direct airborne sound reduction, measured and expressed according to a harmonized standard and the single number rating calculated with regard to inside and outside noise.

Doors:

The acoustic data consists of:

— direct airborne sound reduction, measured and expressed according to a harmonized standard and the single number rating calculated with regard to inside noise.

If necessary, single number rating calculated with regard to outside noise.

Floor coverings, floating floor slabs:

The acoustic data consists of:

— reduction of transmitted impact noise measured and expressed according to a harmonized standard, and the single number rating.

For coverings possessing absorbent properties:

— absorption coefficient, measured and expressed according to a harmonized standard, and the single number rating.

Components of:

a) Water installations:

The acoustic data consists of:

— the sound level produced by the component, measured and expressed according to a harmonized standard, and the single number rating.

b) Air inlets:

The acoustic data consists of:

— direct sound reduction, measured and expressed according to a harmonized standard, and the single number rating calculated with regard to outside noise.

c) Exhaust air ventilation systems (dwellings):

The acoustic data consists of:

— flanking sound reduction of the component, measured and expressed according to a harmonized standard, and the single number rating calculated with regard to inside noise

— sound power level of the different devices measured and expressed according to a harmonized standard, and the single number rating.

d) Other permanent equipment:

The acoustic data consists of:

— sound power level of the component, measured and expressed according to a harmonized standard, and the single number rating

Products for noise barriers:

The acoustic data consists of:

— direct airborne sound reduction, absorption or reflection coefficient, and the sound scattering measured and expressed according to a harmonized standard, and the single number rating.

Other construction products (including components, single or in a kit, for walls or partitions, roofs, floors, ceilings):

The appropriate acoustic data measured and expressed according to a harmonized standard are to be determined among those listed in clauses *4.3.1* and *4.3.2* according to the intended use of the product.

The interrelationship between these characteristics may also need to be considered.

4.3.4. *Performances of Products*

(1) As far as practicable the characteristics of products should be described in performance terms in the technical specifications and guidelines for European technical approval. Methods of calculation, measurement, and testing (where possible), together with compliance, criteria shall be given either in the relevant technical specifications or in references called up in such specifications.

(2) The expression of the product performances should be compatible with the basis for the verification of the essential requirement as currently in use in Member States and referred to in Chapter 3 and as provided in the European Category A standards referred to in *4.1* (2), taking into account the actual implementation of these documents.

4.3.5. *Attestation of Conformity of Products*

(1) 'Attestation of conformity' of products means that the provisions and procedures laid down in Articles 13, 14 and 15 of Annex III to the Directive are followed. These provisions aim to ensure that, with acceptable probability, the performance of a product will be achieved as specified in the relevant technical specification.

(2) The mandates will include indications concerning the conformity attestation procedures within the framework of Annex III to the Directive and related provisions to be indicated in the technical specifications and guidelines for European technical approval.

5. WORKING LIFE, DURABILITY

5.1. **Treatment of working life of construction works in relation to the Essential Requirement**

(1) It is up to the Member States, when and where they feel it necessary, to take measures concerning the working life which can be considered reasonable for each type of works, or for some of them, or for parts of the works, in relation to the satisfaction of the Essential Requirements.

(2) Where provisions concerning the durability of works in relation to the Essential Requirement are connected with the characteristics of products, the mandates for the preparation of the European standards and guidelines for European technical approvals, related to these products, will also cover durability aspects.

5.2. **Treatment of working life of construction products in relation to the Essential Requirement**

(1) Category B specifications and guidelines for European technical approval should include indications concerning the working life of the products in relation to the intended uses and the methods for its assessment.

(2) The indications given on the working life of a product cannot be interpreted as a guarantee given by the producer, but are regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

INTERPRETATIVE DOCUMENT

Essential Requirement No 6

'ENERGY ECONOMY AND HEAT RETENTION'

CONTENTS

ESSENTIAL REQUIREMENT: ENERGY ECONOMY AND HEAT RETENTION

1. GENERAL

1.1. Purpose and Scope

(1) This Interpretative Document relates to Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products, hereinafter referred to as 'the Directive'.

(2) Article 3 of the Directive stipulates that the purpose of the Interpretative Documents is to give concrete form to the Essential Requirements for the creation of the necessary links between the Essential Requirements set out in Annex I to the Directive and the mandates for the preparation of harmonized standards and guidelines for European technical approvals or the recognition of other technical specifications within the meaning of Articles 4 and 5 of the Directive.

Where considered necessary, the provisions of this Interpretative Document will be further specified in each particular mandate. In drafting the mandates, account will be taken, if necessary, of the other Essential Requirements of the Directive, as well as of other relevant Directives concerning construction products.

(3) This Interpretative Document deals with the aspects of the works where 'Energy economy and heat retention' may be concerned. It identifies products or product families and characteristics relating to their satisfactory performance.

For each intended use of the product, the mandates will indicate in further detail which of those characteristics shall be dealt with in the harmonized specifications, using a step-by-step procedure with CEN/Cenelec/EOTA, which will allow the product characteristics to be modified or complemented, if necessary.

Annex 1 to the Directive gives the following definition of the Essential Requirement which is applicable when and where the works are subject to regulations containing such a requirement:

'The construction works and its heating, cooling and ventilation installations must be designed and built in such a way that the amount of energy required in use shall be low, having regard to the climatic conditions of the location and the occupants'.

(4) In accordance with the Council Resolution of 7 May 1985 (New Approach) and the preamble to the Directive, this interpretation of the Essential Requirement is intended not to reduce the existing and justified levels of protection for works in the Member States.

1.2. Levels or classes for Essential Requirements and for related product performances

1.2.1. Where differences specified in Article 3 (2) of the Directive are identified and justified in conformity to Community law, classes for Essential Requirements and for related product performances may be necessary. The purpose of such classes is to achieve the free circulation and free use of construction products.

In this case such classes shall be determined either in the Interpretative Document or according to the procedure provided for in Article 20 (2) (a) of the Directive. Where through this procedure a classification of product performance is identified as the means of expressing the range of requirement levels of the work, the Commission will within the mandate request CEN, Cenelec or EOTA to make the appropriate proposal.

The range of requirement levels covered by the classes depends on the existing and justified levels encountered in Member States.

In cases where a Member State determines in conformity to Article 6 (3) of the Directive among the classes only one or some classes to be observed in its territory (or part of it), it shall do so only on the basis of the differences specified in Article 3 (2) of the Directive.

1.2.2. Where justified differences specified in Article 3 (2) of the Directive are not identified, classes (or levels) of product performances may also be used by the standardizers as a means of convenience for specifiers, manufacturers and purchasers. For certain products, classes (or levels) make it easier to use the standard to relate product performance to its intended use.

Such performance classes (or levels) for products may with reference to Article 4 (1) of the Directive therefore be established by the standardizers who will keep the Commission and the Standing Committee informed of the ongoing work on this matter in the framework of the execution of mandates.

1.2.3. Each time classes are defined for works or for products, it is necessary to set up a class called 'no performance determined' when and where at least one Member State has no legal requirement at all in that field.

1.3. **Meaning of general terms used in the Interpretative Documents**

1.3.1. *Construction works*

'Construction works' means everything that is constructed or results from construction operations and is fixed to the ground. This term covers both *buildings* and *civil engineering* works. In the Interpretative Documents 'construction works' are also referred to as the 'works'. Construction works include for example: dwellings; industrial, commercial, office, health, educational, recreational and agricultural buildings; bridges; roads and highways; railways; pipe networks; stadiums; swimming pools; wharfs; platforms; docks; locks; channels; dams; towers; tanks; tunnels; etc.

1.3.2. *Construction products*

(1) This term refers to products which are produced for incorporation in a permanent manner in the works and placed as such on the market. The terms 'construction products' or 'products', where used in the Interpretative Documents, include materials, elements and components (single or in a kit) of prefabricated systems or installations which enable the works to meet the Essential Requirements.

(2) Incorporation of a product in a permanent manner in the works means:

— that its removal reduces the performance capabilities of the works; and

— that the dismantling or the replacement of the product are operations which refer to construction activities.

1.3.3. *Normal maintenance*

(1) Maintenance is a set of preventive and other measures which are applied to the works in order to enable the works to fulfil all their functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc.

(2) Normal maintenance generally includes inspections and occurs at a time when the costs of the intervention which has to be made are not disproportionate to the value of the part of the works concerned, consequential costs being taken into account.

1.3.4. *Intended use*

The intended use of a product refers to the role(s) that the product is intended to play in the fulfilment of the Essential Requirements.

1.3.5. *Economically reasonable working life*

(1) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

(2) An economically reasonable working life presumes that all relevant aspects are taken into account, such as:

— costs of design, construction and use;

— costs arising from hindrance of use;

— risks and consequences of failure of the works during its working life and costs of insurance covering these risks;

— planned partial renewal;

— costs of inspections, maintenance, care and repair;

— costs of operation and administration;

— disposal;

— environmental aspects.

1.3.6. *Actions*

Actions which may affect the compliance of the works with the Essential Requirements are brought about by agents acting on the works or parts of the works. Such agents include mechanical, chemical, biological, thermal and electro-magnetic agents.

1.3.7. *Performance*

Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product for an action to which it is subject or which it generates under the intended service conditions (for the works or parts of works) or intended use conditions (for products).

2. EXPLANATION OF THE ESSENTIAL REQUIREMENT 'ENERGY ECONOMY AND HEAT RETENTION'

2.1. Energy uses considered by this Interpretative Document

The interpretation of the Essential Requirement 'ENERGY ECONOMY AND HEAT RETENTION' is that the works must be energy efficient in use having regard to the climatic conditions of the location and the intended use of the works. For that purpose energy economy provisions may be related to the following energy uses:

— Space heating;

— Space cooling;

— Humidity control;

— Sanitary hot water production;

— Ventilation.

These uses include achievement of environmental conditions required for the works to be used.

2.2. Specific Terminology

2.2.1. *Fabric*

Fabric is the construction work including external construction elements and internal partitions with their finishing but without the technical equipment.

2.2.2. *Fabric materials*

Fabric materials are homogeneous materials being either:

— bulk materials;

— homogeneous products with a simple shape (blocks, panels, sheets), which may be characterised through the properties of the constituent material and their dimensions.

2.2.3. *Fabric components*

Fabric components are products which are heterogeneous or have a complex shape, produced and put on the market to be used as part of the fabric. Fabric components are all those which form part or the whole of the roof, ceiling, floor, wall, door and window, façade and partition. Also chimneys and service ducts can, in some cases, be fabric components.

2.2.4. *Technical equipment systems*

Technical equipment systems include the components of the energy consuming systems which are needed for the construction works to be used, according to the different uses of energy listed in 2.1.

2.2.5. *Prefabricated works*

Prefabricated works, possibly transported completely finished or in three-dimensional modules, fitted or not with their technical equipment, are construction products.

2.2.6. *Reference value*

The reference value of a product characteristic is the value determined by a harmonized method, as representing the value during its lifetime, under reference conditions.

Remark: The reference value will form part of the attestation of conformity for a CE marking in accordance with the appropriate technical specification.

2.2.7. *Design value*

The design value of a product characteristic is the value determined for specific conditions of use and for the purpose of the calculations by harmonized methods, based among other things, on the reference value.

Remark: In the absence of reference values, generally accepted design values may be used based on harmonized tabulated data.

3. BASIS FOR VERIFICATION OF THE SATISFACTION OF THE ESSENTIAL REQUIREMENT 'ENERGY ECONOMY AND HEAT RETENTION'

3.1. General

(1) This chapter identifies basic principles prevailing in Member States for the verification of the satisfaction of the Essential Requirement 'Energy economy and heat retention'. These principles are currently complied with when and where the works are subject to regulations containing this Essential Requirement. Chapter 4 provides guidance on how to meet this Essential Requirement by compliance with the technical specifications referred to in Article 4 of the Directive.

(2) The Essential Requirement, as far as applicable, is satisfied with acceptable probability during an economically reasonable working life of the works.

(3) The satisfaction of the Essential Requirement is assured by a number of interrelated measures concerned in particular with:

— the planning and design of the works, the execution of the works and necessary maintenance;

— the properties, performances and use of the construction products.

(4) It is up to the Member States when and where they feel it necessary to take measures concerning the supervision of planning, design and execution of the works, and concerning the qualifications of parties and persons involved. Where this supervision and this control of qualifications are directly connected with the characteristics of products, the relevant provisions shall be laid down in the context of the mandate for the preparation of the standards and guidelines for European technical approval related to the products concerned.

3.2. **Actions**

3.2.1. *General*

The energy needs of construction works are determined by a number of factors, and for each of them there are many influences including:

— the external environment;

— the internal environment, the use and operation of the work;

— the design of the work;

— the characteristics of its materials and components.

Also the type of energy, its cost, the time of use and peak value of the energy demand may be considered. The following paragraphs give the main technical bases which may be referred to in regulations on energy economy.

3.2.2. *Space heating, space cooling and humidity control*

The amount of energy required for heating, cooling and humidity control results from:

— the internal conditions (comfort requirements and internal gains);

— the external environment conditions (temperature, humidity, radiation, wind, etc.);

— the specific heat transmission of the building, or the thermal insulation quality of the building;

— the water vapour transmission through the building fabric and the water vapour generation within the building;

— the air permeability of the building fabric;

— the minimum and maximum ventilation rates due to the natural or mechanical ventilation means;

— the area, orientation and solar factors of transparent elements and the effects of shading and solar protection;

— the dynamic thermal characteristics of the fabric and the heating/cooling installations;

— the efficiency and mode of operation and control of the heating/air-conditioning or humidification installation.

3.2.3. *Sanitary hot water production*

The important factors include:

— the amount of water used;

— the temperature increase required;

— the efficiency of heating and pumping devices;

— the power consumption of automatic controls, electromagnetic valves, etc.;

— the distribution and storage heat losses.

3.2.4. *Ventilation*

The required air change rate mainly derives from the essential requirement 'Hygiene, health and the environment'. In addition, wind and stack effects may cause undesired ventilation.

Ventilation results in a significant part of the heating and air-conditioning loads, which may be limited through:

— provisions on airtightness of buildings;

— appropriate design and sizing of the ventilation installations, in relation to air quality requirements;

— appropriate rules for ventilation systems control and operation;

— energy recovery devices.

The main relevant works' characteristics are:

— the design air change rate;

— the air permeability of the building envelope, characterizing filtration airflow in relation to the pressure difference between inside and outside;

— the openable area of windows, doors, etc.

Natural ventilation can in some cases meet comfort and air quality requirements without the need for mechanical ventilation systems or for air-conditioning. Appropriate design and specification of natural or mechanical ventilation systems (including motor-fan selection) can help limit heating or cooling needs and the energy consumption of fans.

3.3. **Verification of the satisfaction of the Essential Requirement**

This review of the influencing factors (3.2) indicates that energy economy provisions may involve many factors including:

— the location, orientation and geometry of the construction work;

— the physical characteristics of the fabric materials and components;

— the design of their technical equipment systems;

— the performances of the components of these systems;

— the behaviour of the occupants;

— etc.

Energy economy may be regulated in a number of ways including separate provisions for individual factors, or by combinations of requirement levels for different factors, or by provisions covering overall energy requirements.

The following main options of expressing requirements, or a combination thereof, have been identified in the Member States:

Option No 1

Provisions on the characteristics of fabric materials (e.g. thermal resistance of an insulating material, water vapour diffusion resistance of a vapour barrier, emissivity of an infrared reflecting layer).

Option No 2

Provisions on the characteristics of the fabric and systems components (e.g. thermal transmittance of walls, roofs, floors, doors and windows; airtightness of doors and windows, efficiency of boilers, fans, cooling units).

Option No 3

Provisions on performance characteristics which are specific to the construction works itself or of a technical equipment system considered as a whole (for instance specific transmission heat losses of a building, overall air permeability of a building, design airflow rate, heating or cooling system overall efficiency at design conditions).

Option No 4

Provisions on the expected energy output required from the technical equipment system, based upon conventional data representative of the expected use and environment conditions of the construction work (e.g. annual thermal energy required in the premises for heating and/or cooling a building to a given indoor temperature, taking account of internal and solar gains).

Option No 5

Provisions on the expected energy input to a technical equipment system to achieve a given performance in given conditions, taking account of the efficiency of the system (e.g. expected heating and/or cooling energy consumption); the relevant criteria may be weighted according to the nature or the cost of the energy source.

The Member States may use any of the various options for verifying that the Essential Requirement is satisfied. None of these methods shall create barriers to the use of products which comply with the relevant harmonized technical specifications.

4. TECHNICAL SPECIFICATIONS AND GUIDELINES FOR EUROPEAN TECHNICAL APPROVAL

4.1. General

(1) 'Technical specifications' means those referred to in Article 4 of the Directive. 'Guidelines for European Technical Approval' of a product or family of products means those referred to in Article 11 of the Directive.

(2) A general distinction is made between:

— *Category A:* These are standards which concern the design and execution of buildings and civil engineering works and their parts, or particular aspects thereof, with a view to the fulfilment of the Essential Requirements as set out in Council Directive 89/106/EEC.

Category A standards should be taken into consideration within the scope of the Directive as far as the differences in laws, regulations and administrative provisions of Member States prevent the development of harmonized product standards.

— *Category B:* These are technical specifications and guidelines for European technical approval which exclusively concern construction products subject to an attestation of conformity and marking according to Articles 13, 14 and 15 of Council Directive 89/106/EEC. They concern requirements with regard to performance and/or other properties including durability of those characteristics that may influence the fulfilment of the Essential Requirements, testing, compliance criteria of a product. Category B standards that concern a family of products, or several families of products, are of a different character and are called horizontal (category Bh) standards.

(3) This distinction between Categories A and B is not intended to lay down different priorities for the work on the respective documents but to reflect the difference in the responsibilities of the authorities of Member States and in those of the Bodies for European Standardisation and Technical Approval in implementing Directive 89/106/EEC.

(4) In order to ensure the quality of these documents with a view to the fulfilment of the Essential Requirement, the provisions of this Interpretative Document will result in specific conditions which will be included in the mandates for the preparation of the respective European standards and guidelines for the European technical approval.

(5) The assumptions made in Category A standards on the one hand and those made in Category B specifications on the other hand shall be compatible with each other.

(6) Category B technical specifications and guidelines for European technical approval shall indicate the intended use(s) of the respective products.

4.2. Provisions concerning works or parts of them

4.2.1. *General*

In order to limit energy consumption, requirements can be expressed using different options referred to in clause 3.3. These requirements must be linked to harmonized product characteristics.

The energy consumption is related on the one hand to the works or to parts of them and on the other to the needs of the occupants.

In the following a review is given of the methods prevailing in the Member States as they relate to:

— the expression of the occupants' needs *(clause 4.2.2)*

— the expression of the energy requirements and their link to the product characteristics *(clause 4.2.3).*

4.2.2. *Expression of the occupants' needs*

The following items are identified:

1. Evaluation of the thermal comfort in rooms or spaces, taking into account all the relevant parameters in winter as well as in summer conditions;

2. Evaluation of the likely use of hot water for sanitary purposes;

3. Expression of the indoor air quality or the ventilation needs.

4.2.3. *Expression of the energy requirements and their relation to the product characteristics*

4.2.3.1. Options Nos 1 and 2 of expressing requirements

Options No 1 and No 2 of expressing the energy economy requirement are directly linked to the product characteristics. These are listed in Chapter 4.3 concerning the provisions for products.

When expressing the energy economy requirements through Options No 1 and No 2 account shall be taken of the provisions of clause *1.2.1* above.

4.2.3.2. Option No 3 of expressing requirements

Option No 3 requires procedures using input data which are specific to the construction works itself, including product characteristics and design data. The main methods concern:

1. Calculation of the specific transmission heat losses or thermal insulation level of a building envelope taking account of the 2 and 3 dimensional heat flow through the fabric and heat transfer through the ground and unheated spaces;

2. Assessment of the overall air permeability of a building from the individual permeability of the components of the envelope (doors, windows, etc.) and from assembly tightness characteristics taking account of workmanship conditions;

3. Measurement of the overall air permeability of a building;

4. Calculation of the design airflow rate of mechanical ventilation systems, based upon the flow-pressure characteristics of ventilation components (fans, ducts, air inlets and outlets);

5. Calculation of the design efficiency of heating and cooling systems, based upon the full load efficiency and sizing ratio of the generator, and the amount and rate of recovery of the various heat losses of the system at design conditions.

4.2.3.3. Option No 4 of expressing requirements

Option No 4 uses the same product and workmanship characteristics as Option No 3 and also needs data on expected use and environment conditions.

The main methods concern:

1. Definition of climatic data to be used for energy using systems;

2. Estimation of the ventilation energy loads (including infiltration as well as deliberate ventilation);

3. Calculation of the heating and cooling loads under design conditions in order to define the capacities of the cooling and or heating system;

4. Calculation of the internal temperature with no or limited heating or cooling under given winter or summer conditions;

5. Estimation of the effect of variable internal condition requirements, control systems and control strategies;

6. Estimation of the seasonal solar gains through glazed areas, taking account of latitude, climate and orientation as well as product characteristics;

7. Estimation of the magnitude of internal energy gains (metabolism and various energy uses);

8. Estimation of the usefulness of solar and internal energy gains;

9. Estimation of the energy needed to operate pumps, fans, refrigeration equipment and auxiliaries, when installed, taking into account of the efficiency of the motive power system;

10. Measurement of air infiltration of works and relating to the results of the measurements to the actual temperature and wind conditions.

4.2.3.4. Option No 5 of expressing requirements

Option No 5 is based on the knowledge of the required energy output from the systems (Option No 4) and of the overall efficiency of the systems and leads to the expected energy consumption of the systems.

Procedures can evaluate:

— the average efficiency of heating and cooling generators;

— the energy input (expected gross energy consumption) of all the energy consuming systems based on the required energy output (Option No 4) and average efficiencies of these systems.

4.3. **Provisions concerning products**

4.3.1. *General requirements*

The characteristics of the products in use may be determined by either:

(a) the use of generally accepted design values which are safe estimates of the characteristics of the construction products in use (in most countries data lists giving this information already exist);

(b) the calculation of the design values;

(c) the measurement of the design values;

(d) the determination of the design values from the reference values.

Remark: Design values allow for typical conditions and ageing effects for the products in use.

Conventional simplified calculation methods must indicate the resolution of the input and output values, taking account of their likely accuracy. Measurements and measurement evaluation procedures must indicate their accuracy and define the resolution.

4.3.2. *Characteristics of Products which may be relevant to the Essential Requirement*

4.3.2.1. Fabric materials

(1) The relevant fabric materials are identified in most national standards, which define the way of calculating heat losses. An example is the following non-exhaustive list of the materials concerned:

— finishing layers' materials;

— mortars, plasters and renderings;

— all kinds of concrete;

— timber, wood materials, boards, natural stones, bricks, blocks;

— gravel, sand, soil;

— glass, plastics, metals;

— thermal insulation materials.

(2) For these products a range of generally accepted design values shall be defined for various sets of conditions, which can be used by designers without further measurements. The characteristics to be considered, where appropriate for the material concerned, are listed in Table 4.1.

(3) For materials for which better design values for a characteristic than those indicated in the list of generally accepted values *(see 1)* are claimed or in cases where the user asks for confirmation of a given value, harmonized determination methods are required so that the claimed better design values can be verified.

Remark: In most cases these harmonized determination methods will define:

— the measuring method and the reference test conditions leading to reference values;

— the procedure for arriving at the design values on the basis of the reference value and the specific use conditions.

TABLE 4.1

Characteristics of Fabric Materials to be considered where appropriate

No	Characteristics
1	Density, geometry, dimensional stability
2	Thermal conductivity or thermal resistance for several humidities
3	Specific heat capacity
4	Thermal expansion coefficient
5	Water vapour diffusion resistance
6	Hygrometric expansion coefficient
7	Hygroscopic humidity content for several relative humidities
8	Liquid water absorption
9	Air permeability
10	Mechanical characteristics, for example: compression resistance; tensile strength; modulus of elasticity; Poisson ratio
11	Emissivity for long wave radiation
12	Transmissivity for long wave radiation
13	Transmissivity and absorptivity for solar radiation

4.3.2.2. Fabric Components

For these components, the characteristics listed in Table 4.2 have to be considered when appropriate. For their evaluation it is necessary to establish:

— generally accepted design values;

— common, simple, manual calculation methods;

— harmonized precise calculation methods;

— harmonized determination methods, based on measurements.

One of the last three procedures must be used when better values are claimed than those obtained following the first procedure.

Remark: The last method will define:

— the test method and the reference conditions leading to the reference value;

— the procedure for arriving at the design value on the basis of the reference value, and the specific use conditions.

TABLE 4.2

Characteristics of fabric components to be considered where appropriate

No	Component characteristics
1	Transmittance (*) or thermal resistance (*) [one dimensional heat flux (**) two or three dimensional heat flux]
2	Equivalent conductivity or thermal resistance for all kinds of masonry
3	Moisture transfer
4	Driving rain resistance
5	Air permeability (*), (**)
6	Thermal inertia characteristics
7	Solar energy transmission (*), (**)
8	Effective areas and flow characteristics of openings for ventilation purposes (**)

(*) Effects of shutters and blinds should be considered.
(**) Includes an agreed way of interpolating for different sizes.

4.3.2.3. System Components

(1) This category includes all the components of the technical equipment systems referred to in 2.2.4, the characteristics of which have an influence on the energy consumption. Examples include:

— Heating and cooling generators;

— Atmospheric and solar collectors and water heaters;

— Energy storage devices;

— Heat exchangers;

— Heating and cooling emitters;

— Air inlets and outlets;

— Air and water distribution network elements;

— Pumps and fans;

— Passive stack ventilators;

— Valves and dampers;

— Filters;

— Relevant control devices.

(2) In general, harmonized technical specifications for reference values shall provide all the product-related information needed for:

— Performance comparison of similar components at unified reference conditions;

— Energy consumption and peak load assessment, taking account of in-use performances including part-load operating conditions;

— Adequate design and sizing of installations;

— Appropriate operation, control and maintenance.

(3) Harmonized determination procedures are required and must include methods of measurement and methods for estimating design values for both full- and part-load operation.

(4) No need for generally accepted design values for these systems' components characteristics has been identified.

(5) Where relevant, harmonized procedures should be defined for:

— Deriving the characteristics of all the devices of the same type in a range of sizes, from measurements made on a limited number of them in this range;

— Using on-site measurements in order to verify the claimed characteristics of components which cannot be tested in a laboratory, for reasons of size or limited production.

(6) Table 4.3 indicates, for each of the main families of systems' components, the characteristics to be defined in a common European way where appropriate.

TABLE 4.3

Characteristics of Systems Components to be considered where appropriate

No	Component	Characteristics
1	Heating and cooling generators including boilers, air heaters, cooling units, heat pumps, water heaters, etc. using fuels or electricity, taking account of consumptions of all integrated auxiliary equipment	Reference output (*)
		Standing consumption (*)
		Full-load efficiency (*)
		Part-load efficiency (*) (e.g. 20, 40, 60, 80 %)
		Thermal inertia
		Internal air and water pressure drop characteristics
		Integral pump and fan characteristics for flow and pressure drop
		Pump and fan motor efficiencies and power
2	Atmospheric and solar collectors, solar water heaters	Idem for heating and cooling generators
		Optical and thermal characteristics (*)
3	Energy storage systems	Capacity of storage vessel
		Heat loss characteristics for the full range of operating conditions
4	Heat exchangers	Rated output (*)
		Effectiveness (*)
		Heat losses (*)
		Flow-pressure characteristics (*)
		Integrated auxiliary equipment power and efficiency (*)

No	Component	Characteristics
5	Heating and cooling emitters	Rated output for different operating conditions (*)
		Radiant and convective components of the output for a range of operating conditions (*)
		Thermal inertia
6	Heat emitters incorporated within the structure (cables, pipes, sheets, etc.)	Rated emission
		Full- and part-load surface temperature and emission rates
		Thermal inertia
7	Valves and dampers	Flow-pressure drop characteristics
8	Pipes and ductwork elements including flow meters, etc.	Flow-pressure drop characteristics
9	Filters	Filter efficiency
		Flow-pressure drop characteristics
		Dust-holding capacity
10	Air inlets and outlets	Flow-pressure drop characteristics (*)
		Induced airflow characteristics (*)
11	Pipe and duct insulation	Thermal resistance
		Water vapour diffusion resistance
12	Trace heaters	Power rating
13	Control equipment (for space and sanitary water heating, humidity, ventilation, air-conditioning) for example: control devices for boilers, control devices for the room temperature, thermostatic valves, digital automation devices, central units and data transmission systems for the relevant systems installed in the building	Accuracy of sensors
		Proportional range
		Differential
		Deadband
		Time constants
		Part-load characteristics
14	Fans and pumps	Flow-pressure curves (*)
		Power and efficiency curves (*)

(*) Includes an agreed way of interpolating for different sizes.

4.3.2.4. Supplementary Considerations or Remarks

Tables 4.1, 4.2, 4.3 are not exhaustive and are indicative of the types of characteristics which need to be taken into account in the preparation of the mandates for European standards and guidelines for European technical approval relevant to the Essential Requirement. The interrelationship of these characteristics may also need to be taken into account.

4.3.3. *Performances of Products*

(1) As far as practicable the characteristics of products should be described in performance terms in the technical specifications and guidelines for European technical approval. Methods of calculation, measurement, and testing (where possible), together with compliance criteria, shall be given either in the relevant technical specifications or in references called up in such specifications.

(2) The expression of the product performances should be compatible with the basis for the verification of the Essential Requirement as currently in use in Member States and referred to in Chapter 3 and as provided in the European Category A standards referred to in 4.1 (2), taking into account the actual implementation of these documents.

4.3.4. *Attestation of Conformity of Products*

(1) 'Attestation of conformity' of products means that the provisions and procedures laid down in Articles 13, 14 and 15 of Annex III to the Directive are followed. These provisions aim to ensure that, with acceptable probability, the performance of a product will be achieved as specified in the relevant technical specification.

(2) The mandates will include indications concerning the conformity attestation procedures within the framework of Annex III to the Directive and related provisions to be indicated in the technical specifications and guidelines for European technical approval.

5. WORKING LIFE, DURABILITY

5.1. **Treatment of working life of construction works in relation to the Essential Requirement**

(1) It is up to the Member States, when and where they feel it necessary, to take measures concerning the working life which can be considered reasonable for each type of works, or for some of them, or for parts of the works, in relation to the satisfaction of the Essential Requirements.

(2) Where provisions concerning the durability of works in relation to the Essential Requirement are connected with the characteristics of products, the mandates for the preparation of the European standards and guidelines for European technical approvals, related to these products, will also cover durability aspects.

5.2. **Treatment of working life of construction products in relation to the Essential Requirement**

(1) Category B specifications and guidelines for European technical approval should include indications concerning the working life of the products in relation to the intended uses and the methods for its assessment.

(2) The indications given on the working life of a product cannot be interpreted as a guarantee given by the producer, but are regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.