

UIC Code

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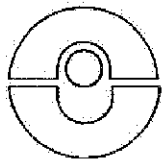
OR

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AND 1 1992.01.01
AND 2 1-07-1994

Regulations relating to fire protection
and fire-fighting measures
in passenger-carrying railway vehicles
or assimilated vehicles
used on international services

**NUMERISATION DANS
L'ETAT DU DOCUMENT**



International Union of Railways

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Leaflet to be classified in Volumes :

- IV - Operating
- V - Transport stock
- VI - Traction

Amendments

1	01.01.92		
2	01-07-94		

Obligatory provisions are preceded by an asterisk : *

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Note

This leaflet is part of a set which also includes :

- Leaflet 543 : Brakes — Regulations relative to the equipment of trailing stock.
- Leaflet 642 : Special provisions concerning fire precautions and fire-fighting measures on motive power units and driving trailers in international traffic.

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- Appendix 13 — Test method for determining the fire-resistance of seats.
- Appendix 14 — Full-scale fire tests.
- Appendix 15 — Test method for determining deterioration of visibility due to smoke released on combustion of materials.
- Annex 1 — Warning signs for liquefied gas installations.

1 - Field of application

The regulations set out below shall apply to all passenger-carrying railway vehicles and to assimilated vehicles.

In addition, the regulations contained in the following leaflets shall apply to specific types of vehicle :

- 543 (Section 3 concerning spark arrester shields),
- 642.

2 - Fire protection — General guidelines

* 2.1 - With respect to fire resistance, the seach design and interior fittings must above all prevent the spread of any fire.

2.2 - It is recommended that the materials selected for the construction of vehicles should present the lowest possible combustion capacity (1).

* 2.3 - The materials used for the construction of vehicles must in all cases comply with existing fire protection standards applied by the respective owner railway and in which the test criteria are specified.

* 2.4 - The fire-resistance of the materials used shall be tested by the railway concerned or by other bodies approved by the railways.

(1) The concept of combustion capacity in this case means the thermal combustion energy of all materials present in a specific area.

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* 2.5 - These examinations and tests shall be carried out in accordance with the methods or national standards used by the respective owner railway. The results must at least be equivalent (1) to the conditions (2) for Classes A or B of the test methods described in Section 3.

2.6 - The tests listed in section 3 are intended to serve as an assessment basis for railways, using common criteria for material characteristics with reference to their fire resistance. The railways can adopt these methods for their own use or examine the equivalence of results with these, or their own, methods.

2.7 - As regards the choice of materials other important properties must be observed, in particular :

2.7.1 - Combustion gases toxicity should be kept as low as possible.

* 2.7.2 - The use of insulating materials containing asbestos is prohibited.

* 2.8 - In order to determine the fire-resistance of materials used in the fabrication of vehicle seats, a fire test shall be carried out using the method specified under point 3.11.

2.9 - In order to determine the fire-resistance of materials used for interior furnishing of vehicles and, consequently, to confirm the selection made by reference to specimens in laboratory tests as well as

(1) Equivalence shall not be determined individually for each material but is defined by reference to general experience.

(2) The conditions for Class C may be acceptable in certain circumstances (e.g. for floors) if tests carried out in accordance with points 3.11 and 3.12 show that the fire risk is limited.

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construction properties, it is recommended that a full-scale fire test be carried out using the method specified in point 3.12.

3 - Fire protection — Fire-resistance of materials and components

The following methods are used to test the fire-resistance of materials and components :

3.1 - Test method for determining the fire-resistance of rigid non-thermoplastic materials (Appendix 4).

3.2 - Test method for determining the fire-resistance of coated and uncoated textiles — Appendix 5.

3.3 - Test method for determining the fire-resistance of rubber door and window seals — Appendix 6.

3.4 - Test method for determining the fire-resistance of materials by measuring the oxygen number — Appendix 7.

3.5 - Test method for determining the fire-resistance of foam materials — Appendix 8.

3.6 - Test method for determining the fire-resistance of electric cables — Appendix 9.

3.7 — Test method for determining the fire-resistance of interconnecting gangway rubber flanges — Appendix 10.

3.8 - Test method for determining the fire-resistance of rigid thermoplastic materials — Appendix 11.

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3.9 - Test method for determining the fire-resistance of floor coverings — Appendix 12.

3.10 - Test method for determining the fire-resistance of seats — Appendix 13.

3.11 - Full-scale fire tests — Appendix 14.

3.12 - Test method for determining deterioration of visibility due to smoke released on combustion of materials — Appendix 15.

4 - Fire protection — Special regulations

4.1 - Regulations concerning vehicle design

* **4.1.1 - Vehicles must be designed so that combustible products (waste, dust, brake dust, oil and grease) can be removed during maintenance operations.**

4.1.2 - In order to offer the least possible opportunity for combustion in areas with high fire ignition and propagation risk:

- protruding parts and overhangs must be avoided,
- sharp edges must be rounded off or chamfered.

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4.2 - Regulations concerning internal partitioning of vehicles

* **4.2.1 - In compartment coaches at least 2 partitions must be incorporated consisting of steel plate or other material strongly resistant to combustion (1). They must be arranged so as to protect the passenger area against fire propagation.**

4.2.1.1 - In sleeping cars the lengthwise partition - including compartment doors - must be made of material strongly resistant to combustion (1). The stipulations covering fire-proof partitions are consequently applicable in this case.

4.2.2 - The provision of partitions in non-compartment coaches is recommended.

* **4.2.3 - At least 3 bulkheads made of steel or other material strongly resistant to combustion (1) must be expertly arranged across the whole width of the coach between ceiling and roof. Any apertures required (air ducts or similar) must be sealed off.**

* **4.2.4 - A partition capable of resisting fire for at least 15 minutes (verified by a test method in accordance with ISO standard 834) must separate heat engines or electrical equipment (2) with a voltage higher than 500 V from the passenger compartments.**

* **4.2.5 - The coach ends must be designed in such a manner that with the end doors closed and application of the unit temperature curve as per ISO 834 the spread of fire, smoke and thermal radiation is prevented for 15 minutes in order that no fire shall occur in the adjoining vehicle and passengers are not endangered.**

(1) Materials corresponding to Class A of the test method laid down in Appendix 4 or complying with the equivalent national fire protection standards.

(2) Electric motors, generators, converters and transformers.

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4.2.6 - On vehicles fitted with underfloor electrical or thermal traction equipment, the floor structure must contain a plate made of steel or material strongly resistant to combustion.

4.3 - Regulations concerning electrical installations

* **4.3.1** - The national regulations in force in the country of the respective railway must be observed for the installation of electrical equipment.

* **4.3.2** - Electric cables with a voltage higher than 500 v must be metal sheathed.

* **4.3.3** - Electric cables must not be laid in ventilation ducts nor cross through them. They must be sealed off where they pass through walls and partitions.

* **4.3.4** - Electric cables must not run near areas where sparks may be produced by braking. Where this cannot be avoided, spark arrests must be installed.

* **4.3.5** - Cable joints must be in readily accessible places and executed in such a manner that no accidental separation of the joint can occur, causing unacceptable heat development in operation.

4.3.6 - It is recommended that the electric cable trunks be formed of parallel lines running side by side. They should preferably be arranged horizontally in the lower part of the vehicles.

* **4.3.7** - Exterior electrical cabinets must be made of metal, be easy to clean and not be located in the immediate vicinity of fuel tanks.

4.3.8 - It is recommended that exterior electrical cabinets be watertight and snowtight.

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* **4.3.9** - Strip lights must be installed :

- either perpendicular to the longitudinal coach centre line,
- or parallel to the longitudinal coach centre line, at intervals.

4.4 - Regulations concerning heating, air-conditioning and ventilation systems

* **4.4.1** - Heating equipment must be constructed in such a manner that the external temperature of the casing or housing does not exceed 60 °C. It must be so designed that heat propagation cannot be impeded by objects placed nearby. It must be easy to clean.

* **4.4.2** - The interior surfaces of the ventilation ducts must be made of metal or other material strongly resistant to combustion (1). The ventilation ducts must be so constructed and arranged that they do not impair the effectiveness of the fire-resistance partitions.

* **4.4.3** - Air-conditioning installations must switch off automatically when temperature of the radiators or at air outlets exceeds the normal values specified for the coach.

* **4.4.4** - The heating, ventilation and cooling ducts must be so designed that they may be cleaned.

(1) Materials corresponding to Class A of the test method laid down in Appendix 4 or complying with the equivalent national fire protection standards.

4.5 - Regulations concerning fire detection and extinguishing equipment

* 4.5.1 - Heat sensors with a display on premises occupied by staff must be provided in compartments containing heat engines.

* 4.5.2 - Fire extinguishers which can be operated manually by remote control must be installed at suitable points in compartments containing heat engines.

4.6 - Regulations concerning the use of liquefied gas in vehicles

* 4.6.1 - When liquefied gas is used for cooking and heating, the regulations in Appendix 1 relating to liquefied gas installations and the regulations in Appendix 2 for operating the installations must be observed.

* 4.6.2 - Instructions based on Appendix 2 shall be affixed at a suitable point inside the vehicle in the three UIC languages.

4.7 - Miscellaneous

* 4.7.1 - Ash-trays, litter-bins, paper towel dispensers and receptacles for used paper towels must be made of metal and fitted with a metal lid or be installed in such a manner as to prevent fire from spreading.

* 4.7.2 - All interior components made of wood that is not fire-resistant must be protected with a fire-resistant coating.

* 4.7.3 - In the event of fire, it must be possible to open doors of vehicles in service manually from inside and outside (without tools).

* 4.7.4 - The provisions concerning emergency exits (UIC Leaflets 560 and 564-1) must be observed.

5 - Fire-fighting agents

* 5.1 - General

* 5.1.1 - Environmentally harmful extinguishing agents (halon, for example) must not be used in railway vehicles with passengers on board.

* 5.1.2 - In order to increase the effectiveness of fire-fighting agents, it is necessary for staff to receive advance training in fire-extinguisher operation, followed by training sessions at subsequent regular intervals.

* 5.2 - Fire extinguishers

* 5.2.1 - Each coach (1) must be equipped with at least one extinguisher. Sleeping cars (2) and dining cars (2) must be equipped with two extinguishers.

5.2.1.1 - It is recommended that new couchette coaches be equipped with two extinguishers(2).

(1) In coaches where meals are served at the seat, one or more additional extinguishers with a minimum capacity of 2 kg each may be provided.

(2) If extinguishers are suitable for fighting liquefied gas as well as fuel oil fires, one extinguisher can be counted as part of the equipment to be provided in accordance with point 5.2.3.

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* 5.2.2 - Each extinguisher must have a total capacity of at least 6 kg. The contents must permit effective action to be taken in the event of a fire, due consideration being given to the degree of flammability and combustibility of the materials used in construction of the vehicle.

* 5.2.3 - Coaches equipped with individual oil heating systems and coaches equipped with liquefied gas or oil-fired heaters must be provided with one extinguisher for each unit in conformance with the regulations of the supervising authority of the railway.

* 5.2.4 - Extinguishers in coaches must be painted red. Operating instructions must be shown on the extinguishers.

* 5.2.5 - Extinguishers, filled and ready for use, must be sealed.

* 5.2.6 - Extinguishers must be visible and easily accessible and positioned at a suitable distance from possible fire areas to permit their effective use.

They may also be stored in cupboards. In this case, the cupboard must have glazed (safety glass) doors which cannot be locked.

* 5.2.7 - Extinguishers thus mounted must not be exposed to excessive heat. They must also remain effective down to a temperature of -20°C.

* 5.2.8 - Extinguishers must be inspected regularly. The date of the next inspection must be shown on the extinguisher.

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APPENDIX 1

Technical and safety regulations for liquefied gas installations in railway vehicles

1 - General

1.1 - This appendix defines regulations for the fitting, maintenance and use of installations using liquefied gas for supplying cooking or water heating equipment or radiant panel heating systems, in railway vehicles not transporting inflammable or explosive goods.

* 1.2 - In addition to the conditions set out below, the regulations laid down by the railways and by the national Authorities, as well as the instructions issued by national professional groups concerning the fitting and maintenance of liquefied gas installations, must be observed. Insofar as these regulations and instructions are not compatible with the conditions set out below, the latter shall apply (with the exception of any regulations of a legal nature which must be complied with in all cases).

1.3 - Examples of application of liquefied gas installations are given in Appendices 3a and 3b.

2 - Conditions of installations

* 2.1 - All fitting or alterations to the liquefied gas installations must conform to the plans or drawings approved by the competent railway, from the point of view of safety.

* 2.2 - All fitting and repair work must be carried out by specially qualified staff, ensuring full compliance with all the regulations in force.

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* 2.3 - Two cylinder cabinets are allowed per vehicle, each cabinet including two liquefied gas cylinders with a maximum capacity of 14 kg each. The cylinders must be appropriately marked.

* 2.3.1 - A sheet metal cabinet shall be provided for two cylinders.

* 2.3.2 - The cylinders must be placed in these cabinets in such a way that any gas escaping from them or from the pipes will not remain inside the cabinets.

* 2.3.3 - For safety reasons the liquefied gas cylinders must be arranged upright inside the cabinet and secured against overturning. If the metal cabinet is placed inside the vehicle, it should be sealed as tightly as possible towards the vehicle interior.

* 2.3.4 - When the same vehicle is equipped with two cylinder cabinets, they must be situated as far apart as possible.

2.3.4.1 - It is recommended that there should be a gap of at least 8 m between the cabinets and that they should be arranged on the two opposite sides of the vehicle.

* 2.3.5 - To ensure that any leaking gas escapes downwards, these cabinets must be suitably ventilated from below. The ventilation apertures situated at the bottom of the cabinets must have a total surface area of at least 200 cm² per cylinder; it must not be possible to close them nor must they be obstructed by the cylinders themselves.

* 2.3.6 - The outside of one of the doors of each cabinet must bear a danger sign in conjunction with a further sign (Figures 2 and 3 of Annex 1), the latter bearing the following inscription: "Liquefied gas cylinders" in the three UIC languages.

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The inside of each cabinet door must bear the pictogram, defined in Fig. 1 of Annex 1, meaning: "No naked flames or smoking".

* 2.4 - The gas cylinders and the equipment using the gas must be situated in the same vehicle. The coupling of liquefied gas installations between several vehicles is prohibited.

* 2.5 - Pressure regulators shall be installed which reduce gas pressure to the permissible safety and supply levels authorised by national standards. Pressure regulators shall be permanently installed on cylinders themselves or separately in the cylinder cabinet. In the case of installations supplied simultaneously from several cylinders, each cylinder must be fitted with a non-return valve and each cylinder group with a rapid-action valve. The gas cylinders must be connected to the non-return valve or change-over valve by an approved high-pressure hose.

* 2.5.1 - Below the non-return valves or change-over valves, all pipes, except hoses (1), must be made of weldless steel or copper. To compensate for any movement likely to occur, the gas pipes must incorporate expansion-bends or coils (with a winding diameter of not less than 15 times the external diameter of the tubing) after crossing the floor or passing through partitions or if the pipes are longer than 3 m. In the low-pressure area, hoses may be used for connecting the equipment.

(1) If pressure reducers are positioned directly on the cylinder, the connection with the permanent pipe may be made by means of hoses.

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* 2.5.2 - The pipes must be as short as possible and protected against wear by friction. They must not cross areas where people are likely to stay. They must cross the floor in the immediate vicinity of the equipment used.

In the kitchen areas, the pipes must cross the floor in protruding protective tubes (protection against corrosion caused by noxious detergent products). If possible, the pipes must be placed in a visible manner. Should this be impossible, the connecting points, at least, must be visible.

* 2.5.3 - The pipes must not be situated near structural members likely to reach a temperature of more than 400 °C. In cases where this is impossible, it is necessary to use deflectors or protective tubes to prevent any escaping gas from coming into contact with the heated section.

* 2.5.4 - It must be possible to shut off the whole pipe system behind the pressure limiting or regulating device by a main stop valve. If the cylinder cabinets are situated underneath the vehicle, the main stop valve must be placed underneath the vehicle body and be operable from inside the coach. Only rapid-action valves with propane-resistant seals may be used.

* 2.6 - Only equipment approved by the railways or by national professional bodies must be used. This equipment must incorporate an automatic device cutting off the gas supply in the event of the flame becoming extinguished, thus preventing any unburnt gas from escaping.

* 2.6.1 - Areas where this equipment is situated must be well ventilated to ensure an air supply for combustion purposes and for expelling the by-products produced. Sufficient non-adjustable ventilation

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apertures must be provided particularly in the lower part of the area, the upper edge of these apertures being no more than 0.20 m from the floor.

* 2.7 - A plate with indelible characters stipulating the instructions for the use of liquefied gas installations must be placed in a conspicuous position, close to the equipment using the gas supply.

3 - Extinguishers

* 3.1. - For every liquefied gas installation, one or more powder extinguishers (6 kg) (1), placed at a suitable distance from this installation and the equipment used to allow a fire to be extinguished in safety, must be provided.

* 3.1.1 - The extinguishers must be provided with a hose and an on/off mechanism (quick-acting valve). It must be possible to stop and restart them by hand during fire extinguishing activities. They must operate without being turned upside down.

* 3.1.2 - All extinguishers must also be suitable for use near live electric installations.

4 - Testing and overhaul of the installation

* 4.1 - Any liquefied gas installation, after assembly or modification, must first be tested by an expert approved by the competent Authority, the periodical overhaul intervals to be observed being defined by the Railway owning the vehicle in relation to its national standards.

(1) Extinguishers using dry ice or other substances may be used, provided that their effectiveness is equivalent.

Instructions concerning the operation of liquefied gas installations for cooking and heating in railway vehicles

1 - General

These provisions are applicable to the operation and servicing of liquefied gas installations for cooking and heating purposes in railway vehicles not used for the transport of inflammable goods or explosives.

2 - Operation and maintenance

* 2.1 - The use of the installations concerned is prohibited in enclosed buildings or above dismantling pits.

* 2.2 - The special instructions concerning the operation of liquefied gas equipment must be complied with.

* 2.3 - Only properly trained staff must be allowed to supervise the operation of the installation and the replacement of gas cylinders (see also paragraph 3.1).

* 2.4 - Only appropriately marked cylinders must be installed.

* 2.5 - It is strictly forbidden to transfer the contents from one cylinder to another.

* 2.6 - Both cylinders of a cabinet may be used at the same time, provided that adequate measures prevent any liquefied gas leakage when the cylinder changeover takes place.

* 2.6.1 - The running of vehicles equipped with 4 liquefied gas cylinders (installation specified in Appendix 3a) on the lines of the SNCB and SNCF is authorised, provided that no more than 2 cylinders are in use on the vehicle.

* 2.7 - In the case of an installation including more than one cylinder, each cylinder must be fitted with a non-return valve.

* 2.8 - The cylinders must only be replaced after the individual outlet valves and the main stop valve of the supply pipe have been closed.

* 2.9 - Owing to the high air consumption of liquefied gas equipment, the area where it operates must always be left unobstructed. The ventilation apertures must always be left unobstructed.

3 - Training of users

* 3.1 - Those using equipment supplied by liquefied gas must have been trained by a qualified expert or by a responsible person trained by such an expert, in the rules to be followed :

- for the use of liquefied gas,
- for the operation of the installations,
- for the replacement of cylinders,
- for the introduction of the safety measures to be provided, in the case of leakages with beginning of fire when the cylinders are replaced.

* 3.2 - The users must sign to the effect that they have received this training.

4 - Turning off and breakdowns

* 4.1 - When the installation is not in use, all stopcocks must be turned off.

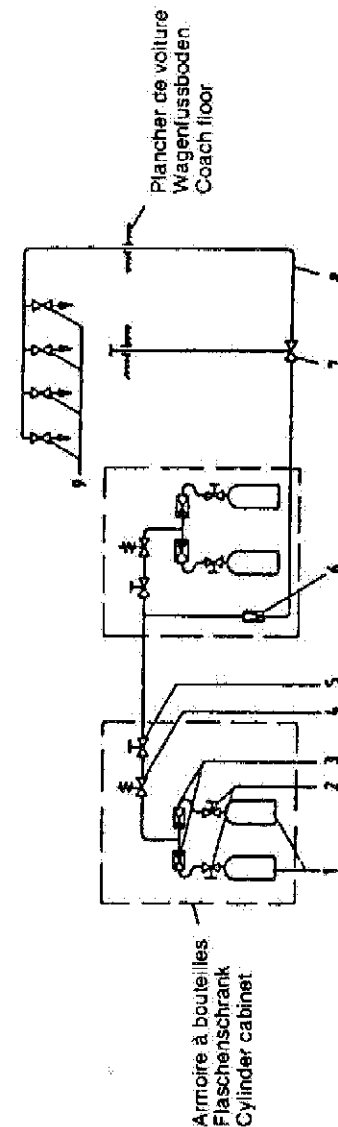
* 4.2 - In the case of a breakdown, it is essential to turn off the main stop valve and the individual outlet valves immediately and to stop the operation of the installation.

* 4.3 - Users are prohibited from carrying out any repair work.

5 - Instructions to be followed in case of fire

* 5.1 - In the event of fire in the vehicle, the cylinders must be removed from the area likely to be affected, or be cooled by constant spraying with water.

Installation à gaz liquéfié à 4 bouteilles pour voitures (exemple de réalisation)
4-Flaschen-Flüssiggasversorgungsanlage in Reisezugwagen
(Ausführungsbeispiel)
4-cylinder liquefied gas supply unit on passenger coach (example of installation)

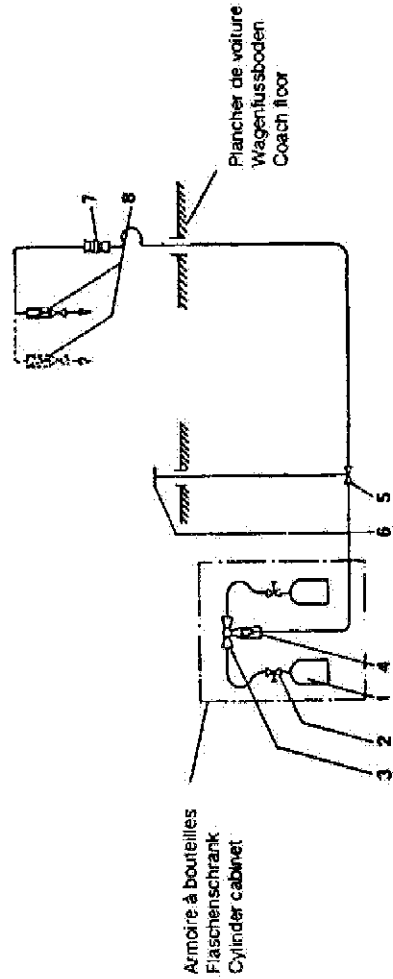


- 1 - Bouteille à gaz liquéfié
- 2 - Soupape de bouteille
- 3 - Soupape de retenue
- 4 - Electro-vanne
- 5 - Soupape d'arrêt
- 6 - Régulateur de pression
- 7 - Soupape d'arrêt général
- 8 - Conduite
- 9 - Soupape d'arrêt sur appareil

- 1 - Flüssiggasflasche
- 2 - Flaschenventil
- 3 - Rückschlagventil
- 4 - Magnetventil
- 5 - Absperrventil
- 6 - Druckregler
- 7 - Hauptabsperventil
- 8 - Rohrleitung
- 9 - Geräteabsperventil

- 1 - Liquefied gas cylinder
- 2 - Cylinder valve
- 3 - Non-return valve
- 4 - Electromagnetic valve
- 5 - Stop valve
- 6 - Pressure regulator
- 7 - Main stop valve
- 8 - Piping
- 9 - Stop valve on consuming appliance

Installation à gaz liquéfié à 2 bouteilles pour voitures (exemple de réalisation)
2-Flaschen-Flüssiggasversorgungsanlage in Reisezugwagen
(Ausführungsbeispiel)
2-cylinder liquefied gas supply unit on passenger coach (example of installation)



- 1 - Bouteille à gaz liquéfié
- 2 - Soupape de bouteille
- 3 - Bloc inverseur semi-automatique
- 4 - Limiteur de pression
- 5 - Robinet d'arrêt général
- 6 - Commande du robinet d'arrêt général
- 7 - Indicateur "service-réserve"
- 8 - Robinet détenteur de sécurité

- 1 - Flüssiggasflasche
- 2 - Flaschenventil
- 3 - Halbautomatisches Umschaltventil
- 4 - Druckbegrenzer
- 5 - Hauptabsperventil
- 6 - Betätigung des Hauptabsperventils
- 7 - Anzeiger "Betriebs-Reserve"
- 8 - Sicherheits - Druckminderhahn

- 1 - Liquefied gas cylinder
- 2 - Cylinder valve
- 3 - Semi-automatic changeover valve
- 4 - Pressure limiting device
- 5 - Main stop valve
- 6 - Actuation of main stop valve
- 7 - "Operation-reserve" indicator
- 8 - Safety pressure-reducing valve

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5 6 4 - 2
 ANNEXE 3b
 ANLAGE 3b
 APPENDIX 3b

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 OR
 APPENDIX 4

Test method for determining the fire-resistance of rigid non-thermoplastic materials

1 - Purpose

The object of this method is to determine the fire-resistance of rigid materials such as plywood, wood fibre sheets, chipboard, moulded laminated sheets, glass/polyester laminated sheets, etc., used in the construction of railway vehicles.

It can also be applied to partition walls composed of several materials (e.g. plywood and moulded laminated sheets).

It cannot be applied to thermoplastic materials.

2 - Principle

The underside of a test specimen inclined at an angle of 45° to the horizontal plane is exposed to the action of an alcohol flame.

The time during which the specimen continues to burn after extinction of the alcohol flame, release of burning drops and particles and the degree of damage to the specimen are noted.

3 - Equipment

3.1 - Specimen frame

U-shaped stainless steel frame as shown in Fig. 1.

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3.2 - Holder

Permits the specimen to be held at an angle of 45° to the horizontal plane and a crucible for the alcohol to be placed underneath the specimen.

As shown in Fig. 2, it consists of a base in the form of a rectangular steel plate and comprises :

- in the centre a bar which is adjustable in height and carries a plate for the crucible. This rests on a round cork disc (thickness $2 \text{ mm} \pm 0.5 \text{ mm}$), the diameter of which is equal to the external diameter of the crucible ;
- at the four corners four bars which are arranged perpendicular to the base and serve to hold the specimen at an angle of 45° to the base. A cross bar connects the ends of the two shortest perpendicular bars.

3.3 - Crucible

Consists of brass, is cylindrical in shape and has the following dimensions :

Internal diameter	: $35 \text{ mm} \pm 0.1 \text{ mm}$
Depth	: $14 \text{ mm} \pm 0.1 \text{ mm}$
Thickness (bottom and side)	: $1 \text{ mm} \pm 0.1 \text{ mm}$.

The height of the crucible resting on its round cork support is adjusted so that the distance along the axis of symmetry of the crucible between the inside bottom surface and the underside of the specimen is $50 \text{ mm} \pm 1 \text{ mm}$.

3.4 - Chronometer

Accuracy to within a second.

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4 - Reagent

Pure ethanol.

5 - Specimens

4 specimens measuring $160 \text{ mm} \times 400 \text{ mm}$ (2 longitudinal and 2 lateral). If the longitudinal and lateral directions are not marked, the specimens shall be taken from 2 directions at right angles to one another : 2 specimens from direction A, 2 specimens from direction B.

6 - Preparation of specimens

Before the test the specimens shall be conditioned to a temperature between 20°C and 24°C and a relative air humidity of between 50 % and 65 %.

7 - Procedure

7.1 - The test shall be carried out in still air under a closed hood of adequate dimensions (approx. 2 m^3).

7.2 - For materials up to and including 3 mm thick, the specimen shall be placed in the specimen frame, which is arranged on the holder in such a manner that the cross-bar of the frame rests on the cross-bar connecting the two shortest upright bars.

7.3 - The height of the plate shall be adjusted as shown in point 3.2.

7.4 - $4 \text{ ml} \pm 0.1 \text{ ml}$ pure ethanol at room temperature shall be poured into the crucible (care must be taken that the instruments and especially the crucible have the same temperature as the hood in which the test is carried out (20°C to 24°C)).

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7.5 - The crucible shall be placed on the round cork disc which covers the plate and has previously been adjusted to the desired height, and the ethanol shall be ignited.

7.6 - The progress of the test shall be observed and the following points shall be noted :

- length of time of continued burning or glowing after extinction of ethanol flame,
- release of burning drops or particles.

7.7 - After cooling, the specimen shall either be dried with a rag or cleaned with a rag soaked in a mixture of equal parts of acetone and alcohol. The maximum length and maximum width of the fire-damaged surface shall be measured. The fire-damaged surface is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area.

Note shall be taken of whether the specimen has burnt through to its upper surface.

The surface area can be measured by planimetry or by weighing an equivalent paper representation of the damaged area with a known unit area weight.

7.8 - Care must be taken that the tests with subsequent specimens are carried out only after the equipment (holder, crucible) have completely cooled down.

8 - Presentation of results

For each specimen the following points shall be noted :

- length of time of continued burning and glowing after extinction of ethanol flame,
- fire-damaged surface area in cm^2 ,
- release of burning particles or drops,
- whether specimen burnt through to upper surface or not.

OR

APPENDIX 4

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1)	$P \leq 2$	$2 < P \leq 10$	$P > 10$
Surface area (cm^2) (2)			
$S \leq 100$			X
$100 < S \leq 150$			X
$S > 150$	X	X	X

- (1) P = Continued burning time of flame after extinction of ethanol flame, in seconds.
 (2) S = Fire-damaged specimen surface after test, in cm^2 .

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- the upper surface reached,
- release of burning particles or drops observed,
- glowing of any part 10 s after extinction of the ethanol flame observed.

Class B :

The arithmetic mean of the continued burning times and the arithmetic mean of fire-damaged surfaces fall within the white or grey boxes.

OR

APPENDIX 4

Furthermore, on no specimen is :

- the upper surface reached,
- release of burning particles or drops noted,
- glowing of any part 10 s after extinction of the ethanol flame observed.

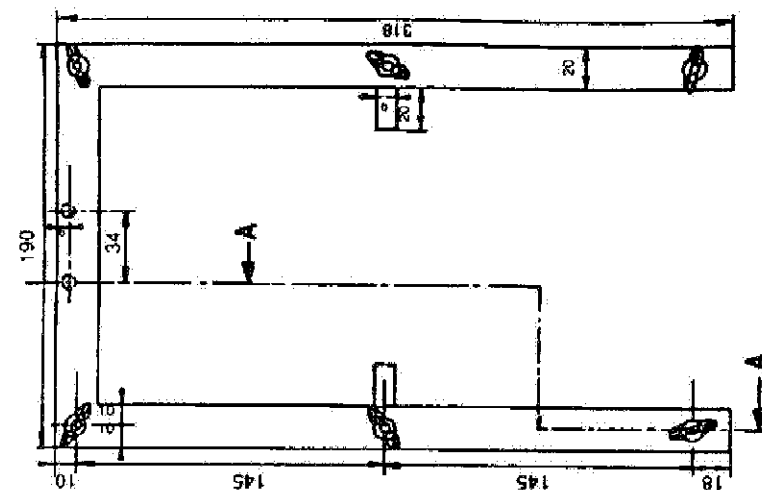
Class C :

Test results do not fulfil the conditions required for Classes A or B.

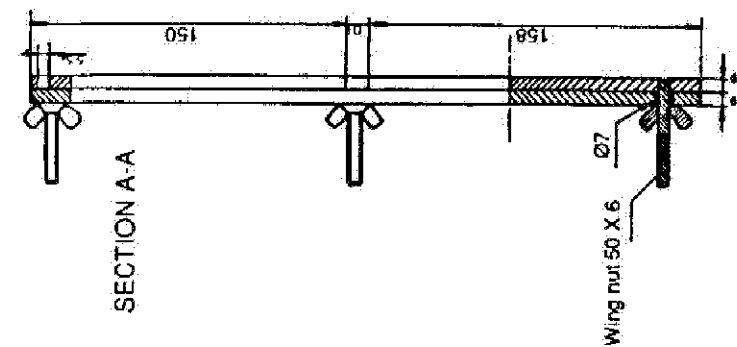
OR

APPENDIX 4

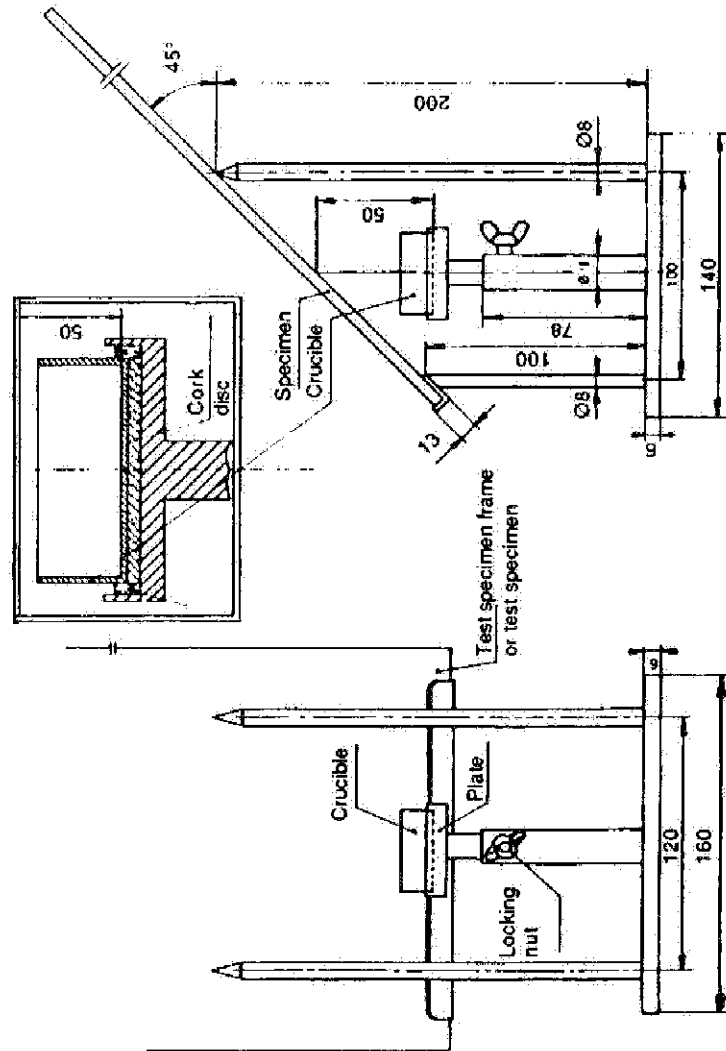
Figure 1



Test specimen frame



OR
APPENDIX 4
Figure 2



Test apparatus

OR
APPENDIX 5

Test method for determining the fire-resistance of coated and uncoated textiles

1 - Purpose

The object of this method is to determine the fire resistance of coated and uncoated textiles (curtains, seat covers, wall linings, etc.) used in the interior of railway vehicles.

2 - Principle

The specimen, held vertically in a frame, is exposed to a gas flame which is applied to the lower edge of the specimen.

3 - Equipment

3.1 - Test specimen frame

U-shaped stainless steel frame as shown in Fig. 1.

3.2 - Holder

Holds the specimen frame in a vertical position and allows the gas flame to be directed on to the specimen edge.

3.3 - Burner

Bunsen burner with butane or propane gas. The cylindrical body of the burner must have an internal diameter of $10 \text{ mm} \pm 2 \text{ mm}$.

3.4 - Chronometer

Accuracy to within a second.

OR

APPENDIX 5

4 - Specimens

6 specimens measuring 190 mm × 320 mm (3 in warp direction, 3 in weft direction).

Cutouts shall be made for the screws on both longitudinal sides in order to enable the specimen to be held in the specimen holder.

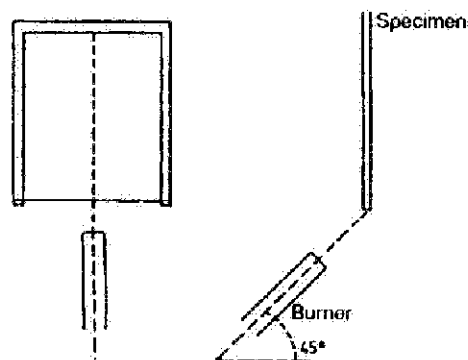
5 - Preparation of specimens

Before the test the specimens shall be conditioned to a temperature of between 20 °C and 24 °C and a relative air humidity of between 50 % and 65 %.

6 - Procedure

6.1 - Position of burner in relation to specimen

Burner shall be inclined at an angle of 45° to the horizontal and shall be placed perpendicular to the specimen surface through its longitudinal centre line. The distance of the burner edge from the horizontal base of the specimen shall be adjusted in accordance with point 6.5.



OR

APPENDIX 5

6.2 - The test shall be carried out in still air under a closed hood of adequate dimensions (approx. 2 m³).

6.3 - The specimen shall be placed in the specimen frame so that the specimen hangs vertically.

6.4 - The burner shall be lit and the flame adjusted so that with the burner vertical the blue cone reaches a height of 40 mm ± 5 mm.

6.5 - The burner shall be tilted 45° to the horizontal and brought closer to the specimen until the blue cone touches the horizontal base of the specimen at the intersection with its longitudinal centre line : exposure time to flame shall be 30 s ± 1 s.

6.6 - Burner shall be extinguished after this period.

Progress of the test shall be observed and the following points noted :

- length of time of continued burning or glowing after extinction of burner,
- release of burning particles or drops.

6.7 - After specimen has cooled, the surface of the fire-damaged area shall be measured. The fire-damaged area is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area.

Note shall be taken of whether the specimen has burnt through to its upper end.

The surface area can be measured by planimetry or by weighing an equivalent paper representation of the fire-damaged area with a known unit area weight.

OR
APPENDIX 5

7 - Presentation of results

For each specimen the following points shall be noted :

- length of time of continued burning and glowing after extinction of burner,
- size of fire-damaged surface in cm²,
- release of burning particles or drops,
- whether upper specimen edge reached or not.

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1) Surface area (cm ²) (2)	$P \leq 2$	$2 < P \leq 10$	$P > 10$
$S \leq 80$			X
$80 < S \leq 200$			X
$S > 200$	X	X	X

(1) P = Continued burning time of flame after extinction of burner, in seconds.

(2) S = Fire-damaged specimen surface after test, in cm².

OR
APPENDIX 5

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- the upper edge reached,
- release of burning particles or drops observed,
- glowing of any part 10 s after extinction of the burner flame observed.

Class B :

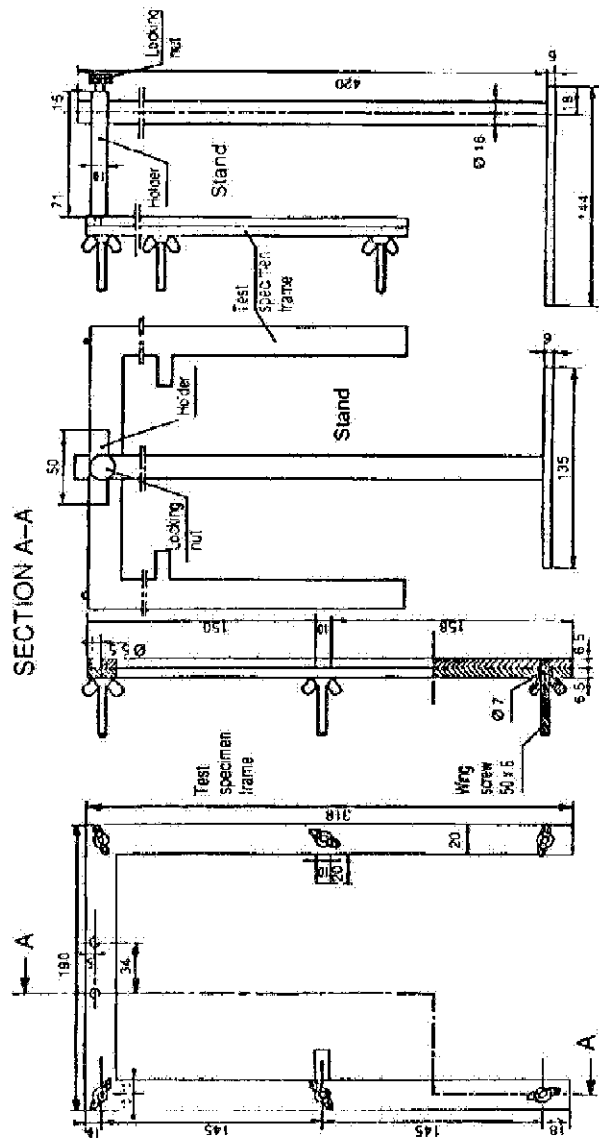
The arithmetic mean of the continued burning times and the arithmetic mean of fire-damaged surfaces fall within the white or grey boxes.

Furthermore, for no specimen is :

- the upper edge reached,
- release of burning particles or drops noted,
- glowing of any part 10 s after extinction of the burner flame observed.

Class C :

Test results do not fulfil the conditions required for Classes A or B.



Test method for determining the fire-resistance of rubber door and window seals

1 - Purpose

This method is intended to determine the fire-resistance of rubber mouldings and seals used for sealing window and door equipment.

2 - Principle

A vertically suspended specimen is exposed to a gas flame which is applied to its lower end.

3 - Equipment

3.1 - Holder

Laboratory stand with clamp and nut for holding the specimen in a vertical position.

3.2 - Burner

Bunsen burner with butane or propane gas. The cylindrical body of the burner must have an internal diameter of 10 mm \pm 2 mm.

3.3 - Chronometer

Accuracy to within a second.

OR
APPENDIX 6

4 - Specimens

3 specimens of 320 mm length.

5 - Preparation of specimens

Before the test the specimens shall be conditioned to a temperature between 20 °C and 24 °C and a relative air humidity of between 50 % and 65 %.

6 - Procedure

6.1 - The test shall be carried out in still air under a closed hood of adequate dimensions (approx. 2 m³).

6.2 - With the clamp fastened to the holder the specimen shall be suspended vertically by one end.

6.3 - The burner shall be lit and the flame adjusted so that with the burner vertical the blue cone reaches a height of 40 mm ± 5 mm.

6.4 - The burner shall be tilted 45° to the horizontal and brought closer to the specimen until the blue cone touches the bottom end of the specimen at a point on its longitudinal centre line. Exposure time to flame is 30 s ± 1 s.

6.5 - Burner shall be extinguished after this period.

Progress of the test shall be observed and the following points shall be noted :

- length of time of continued burning or glowing after extinction of burner,
- release of burning particles or drops.

OR
APPENDIX 6

6.6 - After specimen has cooled, the length of the fire-damaged surface shall be measured. The fire-damaged surface is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area. Note shall also be taken of whether the specimen has burnt through to its upper end.

7 - Presentation of results

For each specimen the following points shall be noted :

- length of time of continued burning and glowing after extinction of burner flame,
- length of fire-damaged area in mm,
- release of burning particles or drops,
- whether upper end of specimen reached or not.

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1)	$P \leq 2$	$2 < P \leq 10$	$P > 10$
Length (mm) (2)			
$L \leq 80$			X
$80 < L \leq 250$			X
$L > 250$	X	X	X

- (1) P = Continued burning time of flame after extinction of burner, in seconds.
(2) L = Fire-damaged length of specimen after test, in mm.

OR
APPENDIX 6

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- release of burning particles or drops observed,
- glowing of any part 10 s after extinction of the burner flame observed.

Class B :

The arithmetic mean of the continued burning time and the arithmetic mean of the lengths of fire-damaged areas fall within the white or grey boxes.

Furthermore, for no specimen is :

- release of burning particles or drops noted,
- glowing of any part 10 s after extinction of burner observed.

Class C :

Test results do not fulfil the conditions required for Classes A or B.

OR
APPENDIX 7

Test-method for determining the fire-resistance of materials by measuring their oxygen number

The oxygen number of a material is the minimum oxygen content of the oxygen-nitrogen mixture required to maintain fire propagation on the tested material as accurately as possible within customary procedures.

In order to enable the fire-resistance of materials to be classified into three Classes A, B and C :

- Class A : material with very good fire-resistance,
- Class B : material with acceptable fire-resistance,
- Class C : material with poor fire-resistance ;

it is recommended that the following oxygen numbers be adopted :

- Class A : oxygen number ≥ 35
- Class B : $28 \leq$ oxygen number < 35
- Class C : oxygen number < 28 .

Test method for determining the fire-resistance of foam materials**1 - Purpose**

This procedure is intended to determine the fire-resistance of foam materials used in railway vehicles.

2 - Procedure

The test shall be carried out in accordance with the procedure laid down in ISO standard 3582, with due allowance for the following features :

- Specimens

4 specimens, conditioned before the test to a temperature between 20 to 24 °C and a relative air humidity of between 50 % to 65 % (the specimens shall be taken from two directions at right angles to one another : two specimens each from directions A and B).

- Burner

The burner shall have a broad jet attachment, i.e. :

- either an attachment complying with the specification in ISO standard 3582 with an outflow aperture 48 mm \pm 1 mm long and 3.0 mm \pm 0.2 mm wide ;
- or an attachment with an outflow aperture 42 mm \pm 0.5 mm long and 5 mm wide as used by the Deutsche Bundesbahn.

3 - Presentation of results

For each specimen the following points shall be noted :

- length of time of continued burning and glowing after extinction of burner,
- length of burnt area,
- release of burning particles or drops.

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1) Length (mm) (2)	$P \leq 5$	$5 < P \leq 30$	$P > 30$
$L \leq 25$			X
$25 < L \leq 125$			X
$L > 125$	X	X	X

(1) P = Continued burning time of flame after extinction of burner, in seconds.

(2) L = Fire-damaged length of specimen after test, in mm.

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- release of burning particles or drops noted,
- glowing of any part 10 s after extinction of the burner flame observed.

Class B :

The arithmetic mean of the continued burning time and the arithmetic mean of the lengths of fire-damaged areas fall within the white or grey boxes.

Furthermore, for no specimen is :

- release of burning particles or drops noted,
- glowing of any part 10 s after extinction of burner flame observed.

Class C :

Test results do not fulfil the conditions required for Classes A or B.

Test method for determining the fire-resistance of electric cables

1 - Purpose

This method is intended to determine the fire-resistance of electric cables used in railway vehicles.

2 - Procedure

The test shall be carried out in accordance with the procedure laid down in Appendix VI to Leaflet 895 (combustibility test), with due allowance for the following features :

— Specimens :

3 specimens 600 mm \pm 10 mm long, conditioned before the test to a temperature of between 20 °C and 24 °C and a relative air humidity of between 50 % and 65 %.

3 - Presentation of results

For each specimen the following points shall be noted :

- length of time flame continued to burn after extinction of burner,
- release of burning particles or drops,
- length of fire-damaged area (the fire-damaged area is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area).

OR

APPENDIX 9

The cable tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1) Length (mm) (2)	$P \leq 5$	$5 < P \leq 30$	$P > 30$
$L \leq 150$			X
$150 < L \leq 300$			X
$L > 300$	X	X	X

(1) P = Continued burning time of flame after extinction of burner, in seconds.

(2) L = Fire-damaged length of specimen after test, in mm.

Class A :

The individual results of all specimens fall within the white box and for no specimen is release of burning particles or drops observed.

Class B :

The arithmetic mean of continued burning times and the arithmetic mean of the lengths of fire-damaged sections fall within the white or grey boxes. Furthermore, for no specimen is :

- the upper end reached by fire,
- release of burning particles or drops noted.

Class C :

Test results do not fulfil the conditions required for Classes A or B.

OR

APPENDIX 10

Test method for determining the fire-resistance of inter-connecting gangway rubber flanges

1 - Purpose

This method is intended to determine how the rubber flanges of inter-communicating gangways react to fire.

It consists of two methods, A and B, between which the railways may choose.

Method A

1 - Principle

The end of a specimen which is held in a vertical plane and at an angle of 70° to the horizontal, shall be exposed to a gas flame, as specified below, for a set period of time. The length of time during which the flame continues to burn after the gas burner has been extinguished shall be noted.

2 - Equipment

2.1 - Holder

The holder allows the specimen to be maintained vertically at an angle of 70° to the horizontal. The specimen shall be held in a clamp at its upper end.

OR

APPENDIX 10

2.2 - Burner

Bunsen burner with butane gas. The cylindrical part of the burner must have an internal diameter of $10 \text{ mm} \pm 1 \text{ mm}$.

2.3 - Chronometer

Accuracy to within a second.

3 - Specimens

12 specimens measuring $220 \text{ mm} \times 20 \text{ mm}$ shall be taken (6 longitudinally, 6 laterally).

4 - Preparation of specimens

Before the test the specimens shall be conditioned to a temperature of between $20 \text{ }^\circ\text{C}$ and $24 \text{ }^\circ\text{C}$ with an air humidity of between 50 % and 65 %.

5 - Procedure

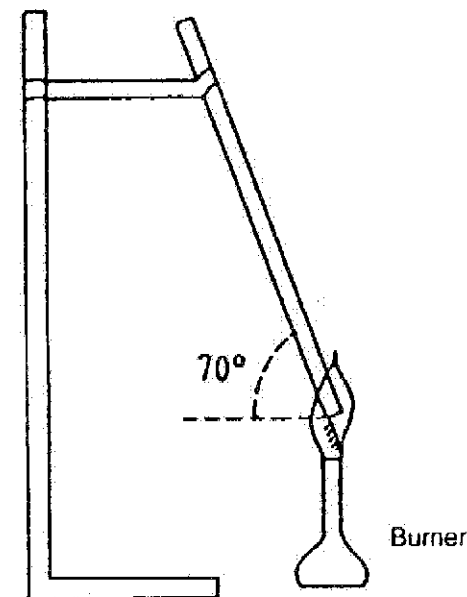
5.1 - The test shall be carried out in still air under a hood of adequate dimensions (approximately 2 m^3).

5.2 - The specimen shall be fastened in the holder so that its longitudinal centre line is vertical and inclined at an angle of $70^\circ \pm 5^\circ$ to the horizontal plane.

OR

APPENDIX 10

5.3 - The Bunsen burner shall then be lit and adjusted so that a flame with a blue cone of $40 \text{ mm} \pm 5 \text{ mm}$ height is produced. The relative positions of burner and specimen must conform with the diagram below.



5.4 - The lit burner shall be placed underneath the lower end of the specimen so that this end is just touched by the tip of the blue cone.

The flame shall remain in contact for a period of t_1 seconds. The burner shall then be extinguished and note shall be taken of whether and for how long a flame continues to burn on the specimen after extinction of the burner (time T_2 in seconds).

OR
APPENDIX 10

5.5 - 6 specimens taken in the longitudinal direction shall be tested successively and the burner flame shall remain in contact with the individual specimens for the following periods of time :

- $t_1 = 5$ seconds for the 1st specimen
- $t_2 = 10$ seconds for the 2nd specimen
- $t_3 = 15$ seconds for the 3rd specimen
- $t_4 = 20$ seconds for the 4th specimen
- $t_5 = 25$ seconds for the 5th specimen
- $t_6 = 30$ seconds for the 6th specimen

For each specimen it shall be recorded whether and for how long a flame continues to burn after the gas burner has been extinguished (times T_1, T_2, T_3, T_4, T_5 and T_6).

5.6 - The same procedure shall be repeated with the 6 specimens taken laterally.

6 - Presentation of the results

Time periods t_i (application of flame) and T_i (continued burning of flame) for the longitudinal and lateral specimens shall be juxtaposed.

Longitudinal specimens		Lateral specimens	
t_i	T_i	t_i	T_i
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	

OR
APPENDIX 10

The material tested shall be classified in accordance with the following guidelines :

Class A :

T_i values (duration of continued burning after extinction of burner) for all 12 specimens are zero and release of burning drops or particles is not observed.

Class B :

T_i values (duration of continued burning) for all 12 specimens are less than or equal to the corresponding t_i values (flame exposure time) and release of burning drops or particles is not observed.

Class C :

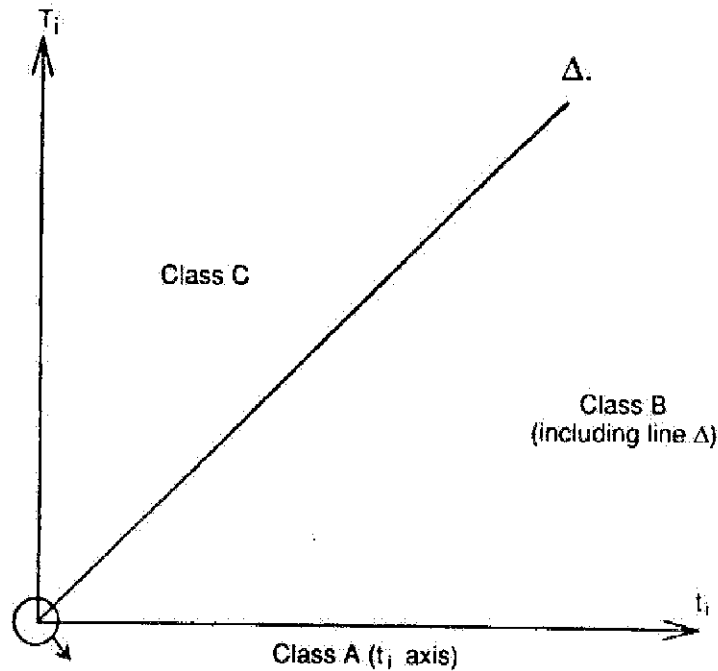
Results obtained do not fulfil the requirements of Classes A and B.

Note :

If the t_i and T_i values are plotted in a right-angled coordinate system, the three classes may be represented diagrammatically as follows :

OR

APPENDIX 10

**Method B****1 - Principle**

The specimen shall be held vertically in a frame and exposed to a gas flame which is applied to the bottom edge of the specimen.

2 - Equipment**2.1 - Specimen frame**

U-shaped stainless steel frame as shown in Fig. 1.

OR

APPENDIX 10

2.2 - Holder

Must allow the specimen frame to be held vertically and the gas flame to be applied to the bottom edge of the specimen.

2.3 - Burner

Bunsen burner with butane or propane gas. The cylindrical part of the burner must have an internal diameter of $10 \text{ mm} \pm 2 \text{ mm}$.

2.4 - Chronometer

Accuracy to within a second.

3 - Specimens

4 specimens measuring $160 \text{ mm} \times 300 \text{ mm}$ (2 longitudinally and 2 laterally).

4 - Preparation of specimens

Before the test the specimens shall be conditioned to a temperature of between $20 \text{ }^\circ\text{C}$ and $24 \text{ }^\circ\text{C}$ with an air humidity of between 50 % and 65 %.

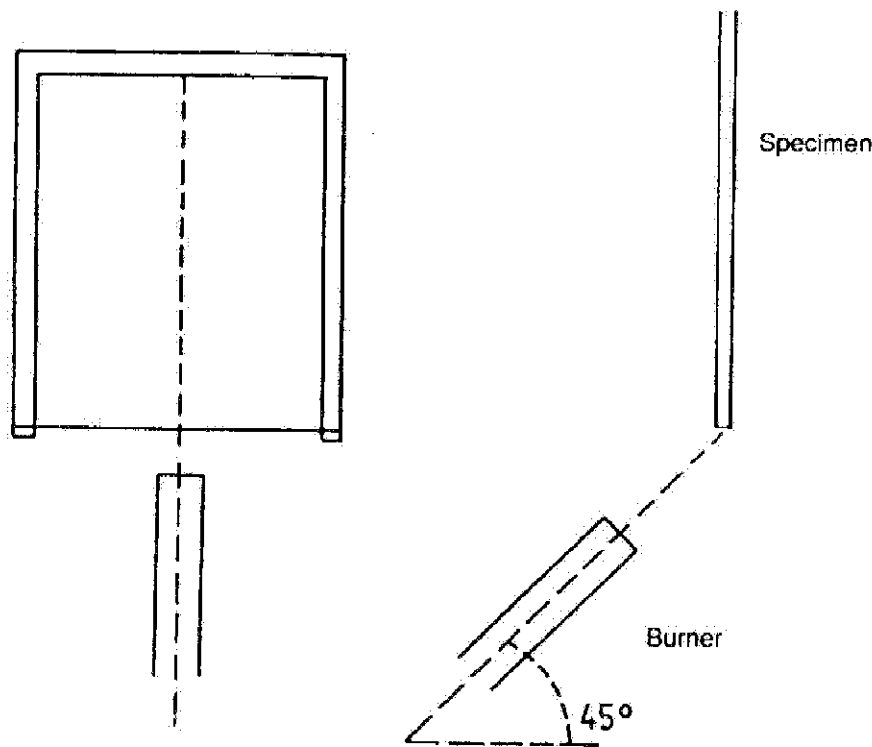
OR

APPENDIX 10

5 - Procedure

5.1 - Position of burner in relation to specimen

The centre line of the burner, which forms an angle of 45° with the horizontal plane, and the centre line of the specimen must lie in the same vertical plane. The distance from the end of the burner to the horizontal base of the specimen shall be adjusted as indicated in point 5.5.



OR

APPENDIX 10

5.2 - The test shall be carried out in still air under a closed hood of adequate dimensions (approximately 2 m^3).

5.3 - The specimen shall be inserted in the frame, which in turn is arranged in the holder so that the specimen hangs vertically.

5.4 - The Bunsen burner shall then be lit and adjusted so that when the burner is vertical a flame with a blue cone of height $40 \text{ mm} \pm 5 \text{ mm}$ is produced.

5.5 - The burner shall be inclined at an angle of 45° to the horizontal and brought close to the specimen so that the blue cone of the flame touches the horizontal base of the specimen at a point on its longitudinal centre line. The flame shall be applied to the specimen for $30 \text{ s} \pm 1 \text{ second}$.

5.6 - After this period, the burner shall be extinguished.

Progress of the test shall be observed and the following points shall be recorded :

- length of time of continued burning or glowing after extinction of burner,
- release of burning particles or drops.

5.7 - After specimen has cooled, the surface of the fire-damaged area shall be measured. The fire-damaged area is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area.

Note shall be taken of whether the specimen has burnt through to its upper end. The surface area can be measured by planimetry or by weighing an equivalent paper representation of the fire-damaged area (with a known unit area weight).

OR

APPENDIX 10

6 - Presentation of results

For each specimen the following points shall be noted :

- length of time of continued burning and glowing after extinction of burner,
- size of fire-damaged surface in cm^2 ,
- release of burning particles or drops,
- whether specimen burnt through to upper edge or not.

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1)	$P \leq 2$	$2 < P \leq 30$	$P > 30$
Surface area (cm^2) (2)			
$S \leq 40$			X
$40 < S \leq 200$			X
$S > 200$	X	X	X

(1) P = Continued burning time of flame after extinction of burner, in seconds.

(2) S = Fire-damaged specimen surface after test, in cm^2 .

OR

APPENDIX 10

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- the upper edge reached,
- release of burning particles or drops observed,
- glowing of any part 10 s after extinction of the burner flame observed.

Class B :

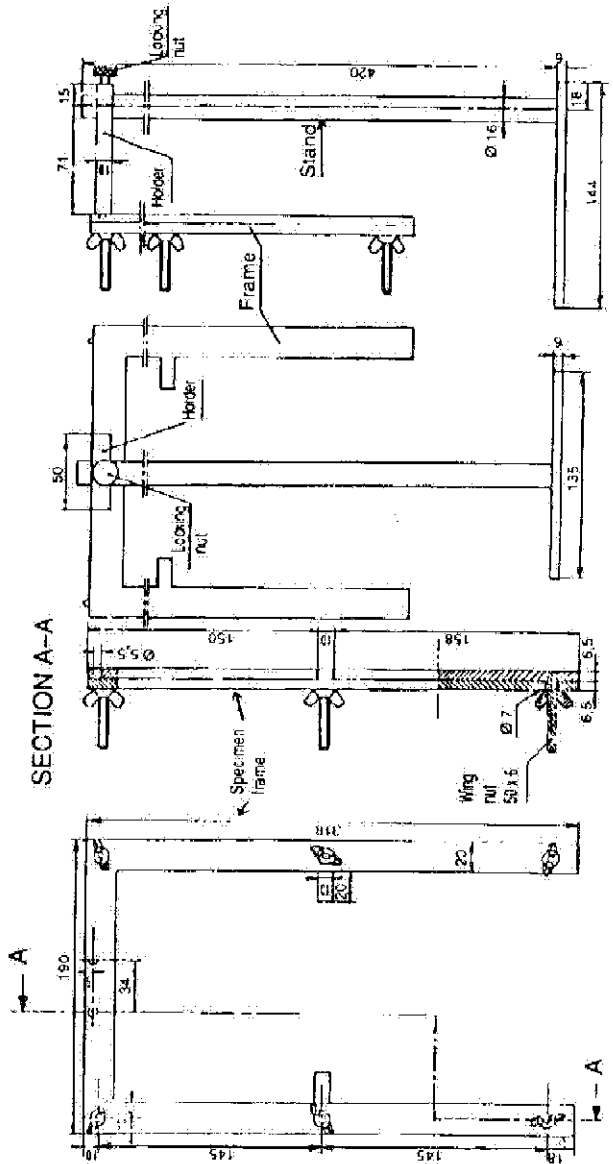
The arithmetic mean of the continued burning times and the arithmetic mean of fire-damaged surfaces fall within the white or grey boxes.

Furthermore, for no specimen is :

- the upper edge reached,
- release of burning particles or drops noted,
- glowing of any part 10 s after extinction of the burner flame observed.

Class C :

Test results do not fulfil the conditions required for Classes A or B.



Test method for determining the fire-resistance of rigid thermoplastic materials

1 - Purpose

The object of this method is to determine the fire-resistance of rigid thermoplastic materials used in railway vehicles.

2 - Principle

The specimen, held vertically in a frame, shall be exposed to a gas flame which is directed on to the surface of the specimen.

3 - Equipment

3.1 - Test specimen frame

U-shaped stainless steel frame as shown in Fig. 1.

3.2 - Holder

Allows the specimen frame to be held in a vertical position and the gas flame to be applied to the specimen surface.

3.3 - Burner

Bunsen/Teclu burner with butane gas. The cylindrical part of the burner must have an internal diameter of $10 \text{ mm} \pm 2 \text{ mm}$. The burner must have a broad jet attachment, i.e. :

- either an attachment complying with the specification in ISO standard 3582 with an outflow aperture $48 \text{ mm} \pm 1 \text{ mm}$ long and $3.0 \text{ mm} \pm 0.2 \text{ mm}$ wide ;
- or an attachment with an outflow aperture $42 \text{ mm} \pm 0.5 \text{ mm}$ long and 5 mm wide as used by the Deutsche Bundesbahn.

3.4 - Chronometer

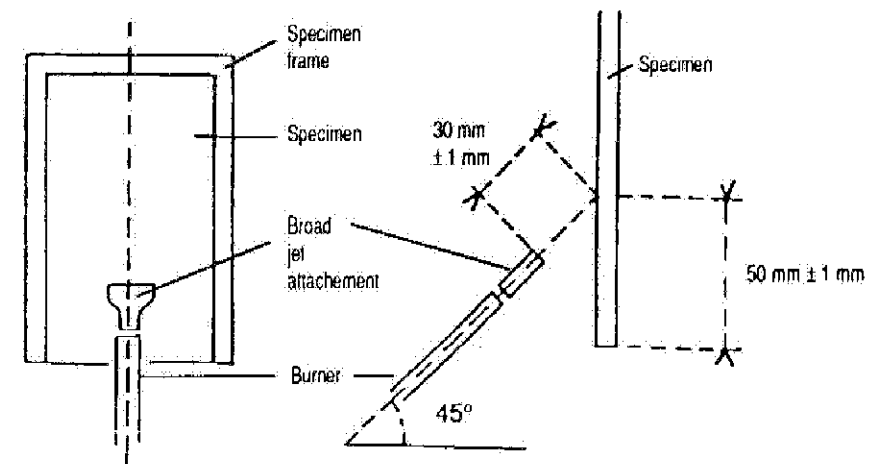
Accuracy to within a second.

4 - Specimens

4 specimens measuring $160 \text{ mm} \times 300 \text{ mm}$ (2 taken longitudinally and 2 laterally).

5 - Preparation of specimens

Before the test the specimens shall be conditioned to a temperature of between $20 \text{ }^\circ\text{C}$ and $24 \text{ }^\circ\text{C}$ with an air humidity of between 50 % and 65 %.

6 - Test procedure**6.1 - Position of burner in relation to specimen**

6.2 - The test shall be carried out in still air under a closed hood of adequate dimensions (approximately 2 m^3).

6.3 - The specimen shall be placed in the frame, which in turn shall be arranged in the holder so that the specimen hangs vertically.

6.4 - The burner with the broad jet attachment shall then be lit and the flame adjusted so that the blue cone reaches a height of $6 \text{ mm} \pm 1 \text{ mm}$.

6.5 - The burner shall be tilted at an angle of 45° to the horizontal and maintained in this position. The flame shall be applied to the specimen surface for 3 minutes.

OR

APPENDIX 11

6.6 - Burner shall be extinguished after this period.

Progress of the test shall be observed and the following points noted :

- length of time of continued burning or glowing after extinction of burner,
- release of burning particles or drops.

6.7 - After specimen has cooled, the surface of the fire-damaged area shall be measured. The fire-damaged area is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area as defined above. Note shall be taken of whether the specimen has burnt through to its upper end. The surface area can be measured by planimetry or by weighing an equivalent paper representation of the fire-damaged area with a known unit area weight.

7 - Presentation of results

For each specimen the following points shall be noted :

- continued burning time after extinction of burner,
- size of fire-damaged surface in cm^2 ,
- release of burning particles or drops,
- whether specimen burnt through to upper edge or not.

OR

APPENDIX 11

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1)	$P \leq 2$	$2 < P \leq 20$	$P > 20$
Surface area (cm^2) (2)			
$S \leq 100$			X
$100 < S \leq 200$			X
$S > 200$	X	X	X

(1) P = Continued burning time of flame after extinction of burner, in seconds.

(2) S = Fire-damaged surface area of specimen after test, in cm^2 .

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- the upper edge reached,
- release of burning particles or drops observed.

Class B :

The arithmetic mean of the continued burning times and the arithmetic mean of the fire-damaged areas fall within the white or grey boxes.

OR

APPENDIX 11

Furthermore, for no specimen is :

- the upper edge reached,
- release of burning particles or drops observed.

Class C :

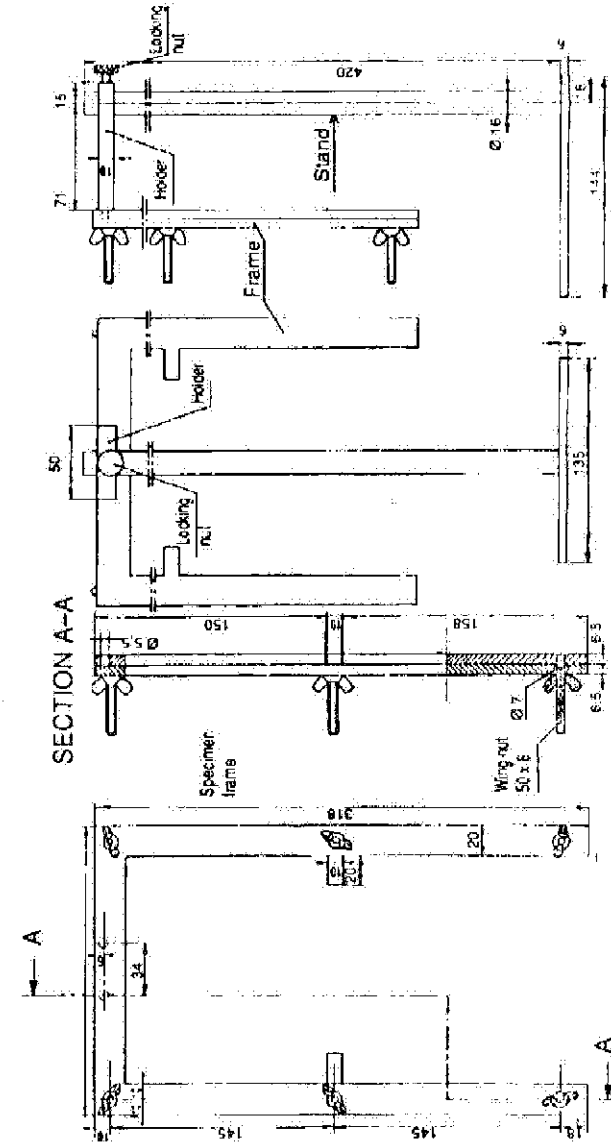
Test results do not fulfil the conditions required for Classes A or B.

OR

APPENDIX 11

Figure 1.

Specimen frame and holder



Test method for determining the fire-resistance of floor coverings**1 - Purpose**

The object of this method is to determine the fire-resistance of floor coverings used in railway vehicles.

It is applicable to textile and other floor coverings (rubber, PVC, linoleum, etc.).

2 - Principle

The specimen shall be attached to a plywood backing of the same size and shall be held vertically in a frame. Its surface shall be exposed to a gas flame.

3 - Equipment**3.1 - Specimen backing**

Plywood measuring 160 mm X 300 mm and 10 mm thick. Its fire-resistance must comply with Class A as defined in Appendix 4.

3.2 - Test specimen frame

U-shaped stainless steel frame, as shown in Fig. 1.

3.3 Holder

Allow the specimen frame to be held in a vertical position and the gas flame to be applied to the specimen surface.

3.4 - Burner

Bunsen/Teclu burner with butane or propane gas. The cylindrical body of the burner must have an internal diameter of $10 \text{ mm} \pm 2 \text{ mm}$. The burner must have a broad jet attachment with an outflow aperture $48 \text{ mm} \pm 1 \text{ mm}$ long and $3.0 \text{ mm} \pm 0.2 \text{ mm}$ wide.

3.5 - Chronometer

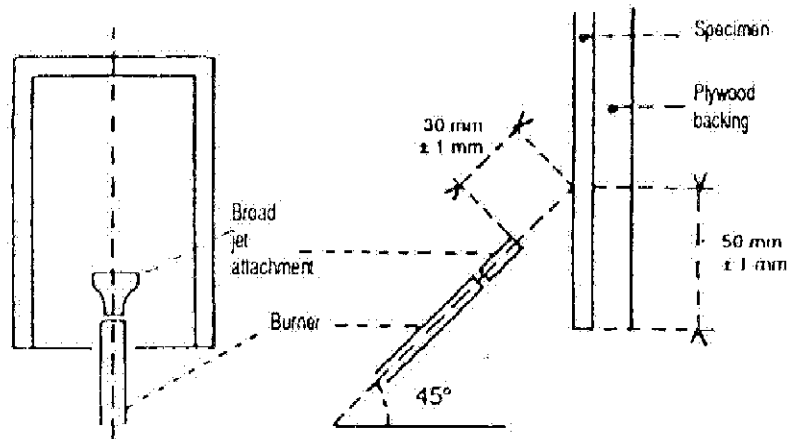
Accuracy to within a second.

4 - Specimens

3 specimens measuring 160 mm X 300 mm.

5 - Preparation of specimens

Before the test the specimens and their backing sheets shall be conditioned to a temperature of between $20 \text{ }^\circ\text{C}$ and $24 \text{ }^\circ\text{C}$ with an air humidity of between 50 % and 65 %.

6 - Procedure**6.1 - Position of burner in relation to specimen**

6.2 - The test shall be carried out in still air under a closed hood with adequate dimensions (approximately 2 m³).

6.3 - The reverse side of the specimen shall be attached to its plywood backing and the whole shall be placed in the frame. The latter shall be fixed to the holder so that the specimen hangs vertically.

6.4 - The burner with the broad jet attachment shall then be lit and the flame adjusted so that the blue cone reaches a height of approximately 6 mm.

6.5 - The burner shall be tilted at an angle of 45° to the horizontal and maintained in this position. The specimen surface shall be exposed to the flame for 2 minutes.

6.6 - Burner shall be extinguished after this period.

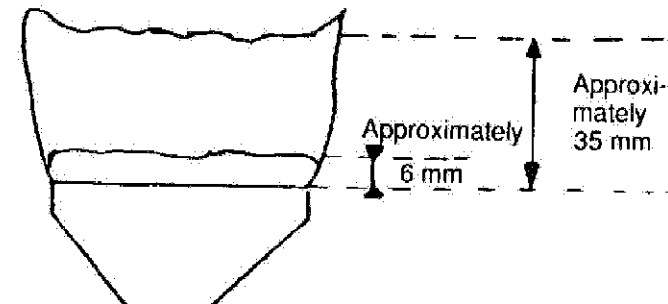
Progress of the test shall be observed and the following points noted :

- length of time of continued burning after extinction of burner,
- release of burning particles or drops.

6.7 - After specimen has cooled, the surface of the fire-damaged area shall be measured. The fire-damaged area is defined as the area actually charred and destroyed. Areas where deformation, blistering, colour change, etc., have occurred do not form part of the fire-damaged area as defined above.

Note shall be taken of whether the specimen has burnt through to its upper edge.

The surface area can be measured by planimetry or by weighing an equivalent paper representation of the fire-damaged area with a known unit area weight.



7 - Presentation of results

For each specimen the following points shall be noted :

- continued burning time after extinction of burner,
- size of fire-damaged area in cm²,
- release of burning particles or drops,
- whether specimen burnt through to upper edge or not.

The material tested shall be classified in accordance with the following guidelines :

Continued burning time (s) (1) Surface area (cm ²) (2)	$P \leq 10$	$10 < P \leq 30$	$P > 30$
$S \leq 100$			X
$100 < S \leq 200$			X
$S > 200$	X	X	X

(1) P - Continued burning time of flame after extinction of burner, in seconds.
(2) S - Fire-damaged surface area of specimen after test, in cm².

Class A :

The individual results of all specimens fall within the white box and for no specimen is :

- the upper edge reached,
- release of burning particles or drops observed.

Class B :

The arithmetic mean of the continued burning times and the arithmetic mean of the fire-damaged areas fall within the white or grey boxes.

Furthermore, for no specimen is :

- the upper edge reached,
- release of burning particles or drops observed.

Class C :

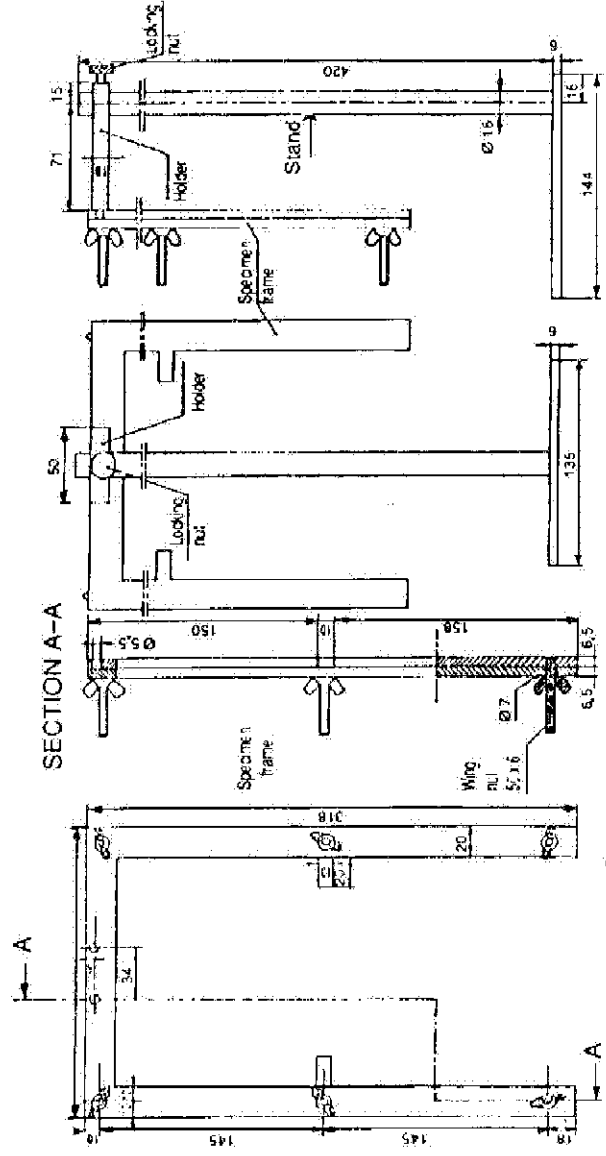
Test results do not fulfil the conditions required for Classes A or B.

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OR
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Figure 1

Specimen frame and holder



Test method for determining the fire-resistance of seats (1)

The test shall be carried out in the following conditions :

1 - Test specimens

1.1 - Complete seat (seat pan and back) of actual dimensions or seat model (seat pan and back, each measuring 40 cm X 40 cm) with structure and thickness identical to actual seat.

1.2 - If a seat model is used, the back shall be placed perpendicular to the seat pan.

2 - Fire source

2.1 - 100 g of newspaper dried for 3 hours at 70 °C.

2.2 - One sheet (approx. 60 cm X 42 cm) shall be folded in two, parallel to its smaller side.

The other sheets shall be crumpled up individually and placed between the two halves of the folded sheet. The folded sheet shall then be stapled together with metal staples. The whole forms a "cushion" measuring approximately 39 cm X 27 cm.

2.3 - This cushion must be checked as a fire source before the tests. For this purpose it must be placed on a plate 5 mm thick, 600 mm long and 500 mm wide made of a fireproof, non-heat conducting mineral substance. After being ignited at its four corners, the cushion must burn on this plate for approximately 3 minutes.

(1) This test method was included in the previous edition of this leaflet as "Test A".

3 - Procedure

3.1 - The test shall be carried out in a draught-free room. The newspaper "cushion" must be placed on the seat pan in such a manner that one of its longitudinal sides touches the back and the cushion lies flat on the seat.

3.2 - The four corners of the cushion shall be set on fire. The progress of the fire must be observed and changes recorded every 30 seconds.

3.3 - In cases where the bottom of the seat is not protected by a protective plate, a further test must be performed in which the newspaper "cushion" must be placed, on an asbestos sheet, on the floor underneath the seat.

4 - Results to be obtained

*** 4.1 - The fire must die out spontaneously at the latest 10 minutes after the beginning of the test.**

*** 4.2 - No burning particles must be released.**

Full-scale fire tests

1 - Principle

- simulation of a full-scale compartment corner in a clearly defined chamber in order to ensure that all tests are performed in identical conditions,
- ignition in clearly defined conditions,
- observation of progress of fire and recording of the characteristic parameters.

2 - Test chamber (1)

This is described in Appendix E4 of the UITP-APTA specifications (2) of October 1981. Its main characteristics are as follows :

A cube-shaped chamber with an inside edge of 3.00 m ± 0.03 m, constructed of steel plate 2 mm in thickness which is attached to an angular reinforcement gusset. A door with a glass viewing window shall be set in the front of the chamber and shall be provided with suitable sealing to ensure that the window is hermetically sealed.

The side walls of the test chamber contain openings at floor level with a total area less than or equal to 50 cm² to ensure a balance between internal and atmospheric pressure.

The test chamber is placed in premises sheltered from direct sunlight, with a still atmosphere and a temperature of 20 °C ± 5 °C.

(1) A coach suitably equipped for the test can also be used.

(2) UITP : International Public Transport Association.
APTA - American Public Transit Association
19, rue de l'Uruguay - B 1050 BRUSSELS (Belgium).

3 - Test assembly

As the assembly is intended to simulate a corner of a coach compartment, it has the following basic elements :

- 2 vertical partitions connected to form a right-angle and approximately 1.20 m wide and 2 m high,
- a floor element and a ceiling element,
- a seat or bench attached to one of the partitions.

Various other interior fittings, such as curtain, window frame, lighting, electric cables, etc., may be added.

4 - Ignition

This is carried out in accordance with the procedure laid down in UIC Leaflet 564-2, Appendix 13, using a paper cushion placed on the seat pan against the back rest or underneath the seat (1).

5 - Observation of the progress of fire — Recording of parameters — Characteristics

5.1 - The main stages of the progress of fire shall be noted as they occur, e.g. :

- flame height,
- smoke release,
- spread of fire to various components,
- release of burning drops,
- extinction time,
- ...

5.2 - Progress of fire shall be filmed or photographs taken at specific intervals.

(1) Or any other given critical point.

OR
APPENDIX 14

5.3 - Continuous reading of temperatures at two points on a vertical line passing through the centre point of the ceiling element in the test assembly at a distance of approximately :

- 150 cm above the floor element and
- 10 cm below the ceiling element.

5.4 - After the test the maximum distances travelled by the flame from the fire source and, if applicable, the degree of surface damage of the various fittings shall be measured.

6 - Presentation of results (1)

- film and/or photographs,
- comments from observers,
- list of damage observed after test,
- list of temperatures.

On the basis of the temperatures recorded at the 4th minute and the time taken by the fire to die out spontaneously, Classes A, B or C shall be allocated according to the information in the following table :

	Results		
	A (2)	B	C
Temperature at the 4th minute :			
- 10 cm below ceiling element	< 100 °C	between 100 °C and 200 °C	> 200 °C
- 150 cm above floor element	< 60 °C	between 60 °C and 100 °C	> 100 °C

(1) The use of results is to be decided by the railway concerned if the fire starts at a given critical point (see point 4, footnote 1).

(2) Class A is assigned if the fire dies out spontaneously 10 minutes after it has started, irrespective of temperature.

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7 - Comments

As designed at present, this procedure is basically limited to recording temperatures. However, a full-scale test seems to be very well suited to determining further parameters in actual conditions, especially with regard to heat flows, the values for which are directly associated with the propagation and extent of fire. Nevertheless, due to insufficient experience the railways are not yet able to specify limiting values for the heat flows generated. The "fire model" described here defines the framework for further studies.

Test method for determining deterioration of visibility due to smoke released on combustion of materials**1 - Purpose**

This method is intended to determine the deterioration of visibility due to smoke produced when materials burn in a given sealed chamber, by assessing the attenuation of a light beam passing through the chamber.

2 - Principle

Combustion of a specimen in a chamber measuring approximately 0.5 m^3 . This chamber has two glazed openings in its roof and floor which permit a light beam produced by an incandescent mat bulb to pass from bottom to top through the inside of the chamber, which contains the smoke released by burning of the specimen.

The light intensity of the bulb shall be held constant throughout the test.

While smoke is developing, the light attenuation shall be recorded by means of a light meter cell positioned at the upper opening of the chamber.

Measurement of:

- the curve $E = f(t)$ where E = illumination intensity at the cell in lux and t = time in seconds ;
- the illumination intensity measured by the cell at the 4th minute (E_4),
- the total light volume transmitted during the first 4 minutes by calculation of the area between the coordinate axes and the curve $E = f(t)$.

3 - Equipment**3.1 - Smoke chamber (see Fig. 1)**

The smoke chamber is constructed of heatproof material (such as reinforced plywood, or plywood coated with fireproof paint) in accordance with the diagrams shown in Fig. 1.

It rests on supports approximately 250 mm high.

- Internal dimensions :

- height $H = 1\ 000 \text{ mm} \pm 5 \text{ mm}$
- width $L = 750 \text{ mm} \pm 5 \text{ mm}$
- depth $P = 750 \text{ mm} \pm 5 \text{ mm}$.

- Door with seals ensures chamber can be hermetically sealed.

- Ceiling (A) :

Opening of diameter slightly larger than that of lightmeter cell (3.3), glazed and positioned at distance $d = 250 \text{ mm} \pm 2 \text{ mm}$ from nearest side walls.

- Floor (B) :

Opening of $80 \text{ mm} \pm 1 \text{ mm}$ diameter, glazed and positioned centrally on the vertical line passing through the centre of the opening in ceiling (A).

Opening to introduce the burner (3.7), which permits the burner to be tilted at an angle of 45° to the horizontal.

- Underneath the floor (B) :

Light bulb holder approximately 215 mm from bottom edge, positioned on vertical line through centre of floor opening (B). The bulb shall be placed in this holder in a vertical position.

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— Side wall (C) :

Opening of approximately 130 mm diameter situated near the bottom and connected to a smoke discharge pipe, fitted with a sealing shutter at the chamber outlet.

— Side wall (D) :

Ventilation inlet which can be closed during the test and opened after the test to admit scavenging air and facilitate smoke expulsion.

- The smoke chamber may be fitted with a glass window to enable the interior volume to be observed. This window must be covered with a black curtain throughout the measurement period in order to prevent stray light from entering.

3.2 - Electrical equipment

- incandescent electric bulb 220 V - 100 W (clear glass bulb).

3.3 - Light meter

- At least 2 measuring scales 0-100 and 0-10 Lux.

3.4 - Plate of non-combustible, fireproof and non-heat-conducting material

- Quality : aluminium silicate (cement + glass).
— Dimensions : 122 mm × 100 mm - thickness 6 mm.

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3.5 - Stainless steel plate

- Dimensions : 122 mm × 100 mm - thickness 2 mm.

3.6 - Specimen frame

The specimen frame enables the specimen to be held at an angle of 20° to the vertical (see Fig. 2.2).

The specimen shall be fixed with 4 nuts between the front of the specimen frame (which contains an opening 100 mm × 50 mm, see Fig. 2.1), the fireproof plate (point 3.4) placed against the reverse side of the specimen, and the stainless steel plate (point 3.5).

Mounting of the specimen : see Fig. 4.

3.7 - Burner

Butane or propane gas burner in accordance with the diagram in Fig. 3.

The burner shall be tilted at an angle of 45° to the horizontal and shall be placed on the floor (B) of the smoke chamber so that the flame produced is inside and the air inlet outside the smoke chamber.

3.8 - Device for adjusting the distance between specimen frame and burner

A device may be used, operated from outside with the chamber closed, which makes it possible to move the specimen frame towards the burner or the burner towards the specimen frame so that their relative positions correspond with point 4.1.4.

4 - Determination of deterioration of visibility due to smoke released on combustion of a material**4.1 - Preparation of equipment for burning the specimen (Fig. 4)****4.1.1 - Test specimen :**

length 120 mm
width 100 mm
thickness = that of material actually used.

4.1.2 - Insert the following successively into the specimen frame :

- specimen (top side to front of frame),
- plate of fireproof material (point 3.4),
- plate of stainless steel (point 3.5).

All components are firmly bolted together.

4.1.3 - Air supply, gas consumption and pressure of burner

Gas = 24 l/min \pm 2 l/min
Pressure = 0.5 \pm 0.1 bar.

The air supply, together with the gas consumption and pressure of burner (point 3.7) shall be regulated so that the blue cone of the flame has a length of 30 mm \pm 5 mm when the burner is tilted at 45°.

4.1.4 - The specimen frame shall be positioned on the floor of the smoke chamber so that the tip of the blue cone of the Bunsen burner flame touches a point on the longitudinal centre line of the specimen surface 25 mm distant from the base of the opening in the front of the specimen frame (see Fig. 4).

4.2 - Procedure

4.2.1 - The specimen frame with the specimen and the burner (unlit) shall be introduced into the smoke chamber as described in points 3.7, 4.1.3 and 4.1.4.

4.2.2 - The door of the chamber shall be closed.

4.2.3 - Shutter V of the smoke discharge pipe shall be closed and care shall be taken that the smoke extractor is switched off.

4.2.4 - The air intake opening on side (D) shall be closed.

4.2.5 - The light meter cell shall be placed at the opening in ceiling (A) and at the same time care shall be taken to prevent any stray light, emanating from outside the smoke chamber, from entering, for example by covering the cell with a black cloth (in the most sensitive measuring scale the light meter must indicate less than 0.3 lux). Adjust to zero.

4.2.6 - Alter the measuring scale to the lowest sensitivity.

4.2.7 - Switch on the electric light bulb and adjust the current flow to obtain an illumination intensity of 100 lux.

4.2.8 - Open the door of the chamber and the air intake opening in side (D) (1).

(1) If the smoke chamber is provided with a device for adjusting the distance between specimen frame and burner (point 3.8), the following procedure shall be adopted :
Open the door, light the burner (if necessary, regulate the flame as indicated in point 4.1.3) and close the door of the chamber. Move specimen frame (or burner) until they are in the position specified in point 4.1.4. Start chronometer immediately.

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Note : Opening the air intake aperture helps to prevent extinction of burner when door is closed (point 4.2.9).

4.2.9 - Light the burner (1). Start the chronometer. Close the door and the air intake opening and ensure that the burner has not been extinguished.

All these operations must be completed within 5 seconds.

4.2.10 - Note the times t_i for which illumination intensity E is equal to 90, 80, 70, etc. lux. Change the measuring scale in order to obtain greater accuracy when reading the illumination intensity, especially for values of under 10 lux.

4.2.11 - Extinguish the burner as soon as illumination intensity falls below 1 lux or, if this does not occur, after 5 minutes.

4.2.12 - Before starting another test, any soot deposited on the glass covers of the openings in the ceiling (A) and floor (B) must be removed. The side walls of the chamber are cleaned at regular intervals.

4.2.13 - Three tests shall be carried out for each material.

4.3 - Presentation of results (see Fig. 5)

4.3.1 - State the recorded illumination intensities as a function of time (individual values for each specimen and arithmetic mean).

(1) If the smoke chamber is provided with a device for adjusting the distance between specimen frame and burner (point 3.8), the following procedure shall be adopted :

Open the door, light the burner (if necessary, regulate the flame as indicated in point 4.1.3) and close the door of the chamber. Move specimen frame (or burner) until they are in the position specified in point 4.1.4. Start chronometer immediately.

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4.3.2 - Draw the curve for the material by entering the times on the x-axis and the arithmetic mean of the corresponding illumination intensities (in lux) on the y-axis.

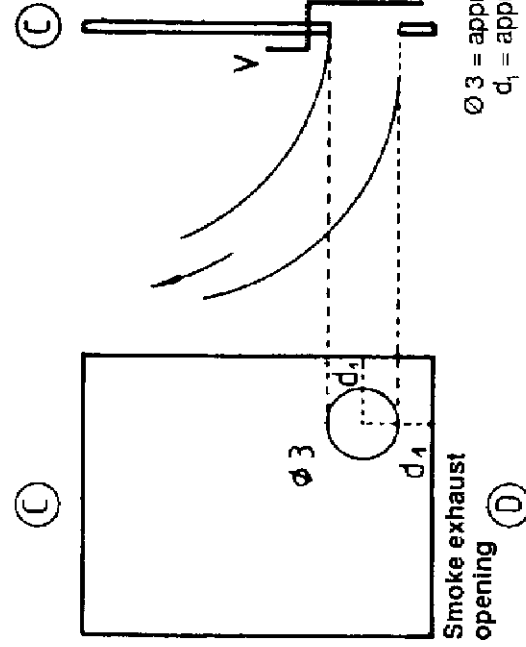
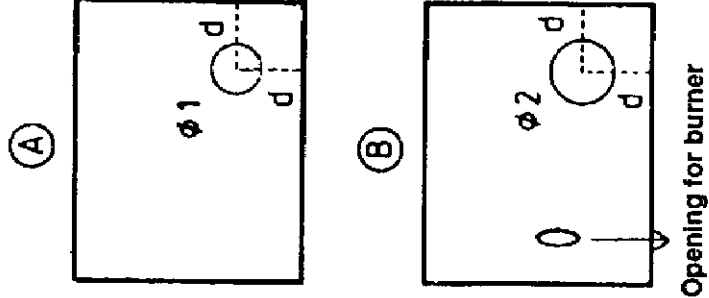
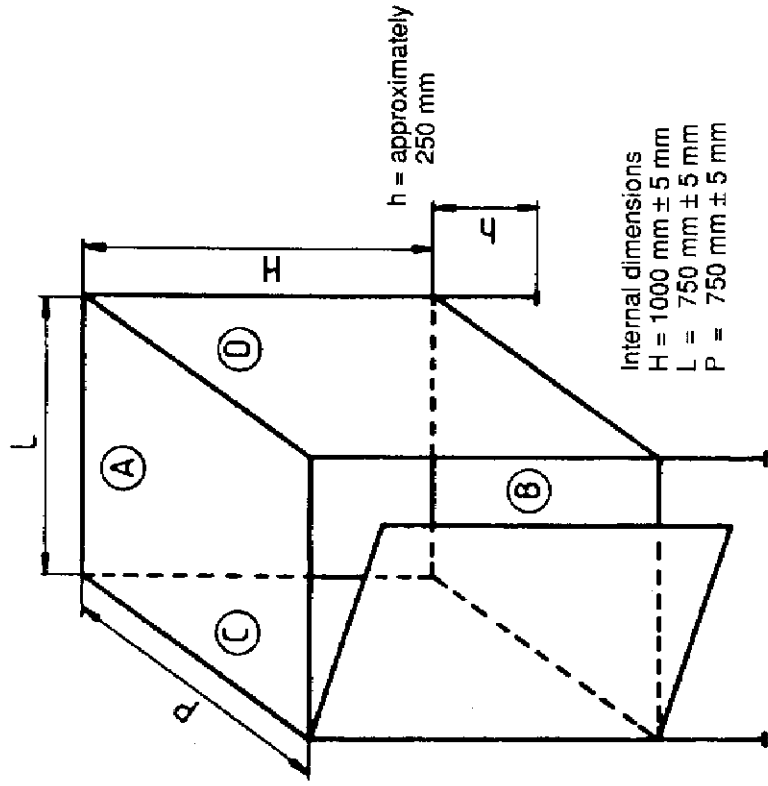
4.3.3 - Based on this curve, indicate :

- 1 - the value of illumination intensity E_4 in lux obtained in the 4th minute,
- 2 - the light volume T in lux-minutes obtained during the first 4 minutes by calculating the area between the coordinate axes and the curve $E = f(t)$ drawn in accordance with point 4.3.2.
- 3 - the material graded into classes A, B and C, based on the values of E_4 and T and in accordance with the table below :

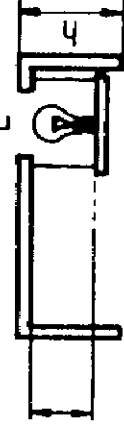
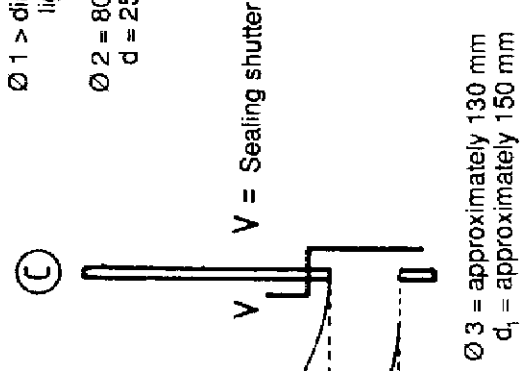
E_4 (lx)	$E_4 \geq 50$	$20 \leq E_4 \leq 50$	$E_4 < 20$
$T_{(lx \cdot min)}$			
$T \geq 300$	A	B	B
$150 \leq T < 300$	B	B	C
$T < 150$	C	C	C

Smoke chamber

General view



$\phi 1 >$ diameter of light meter cell
 $\phi 2 = 80 \text{ mm} + 1 \text{ mm}$
 $d = 250 \text{ mm} \pm 2 \text{ mm}$

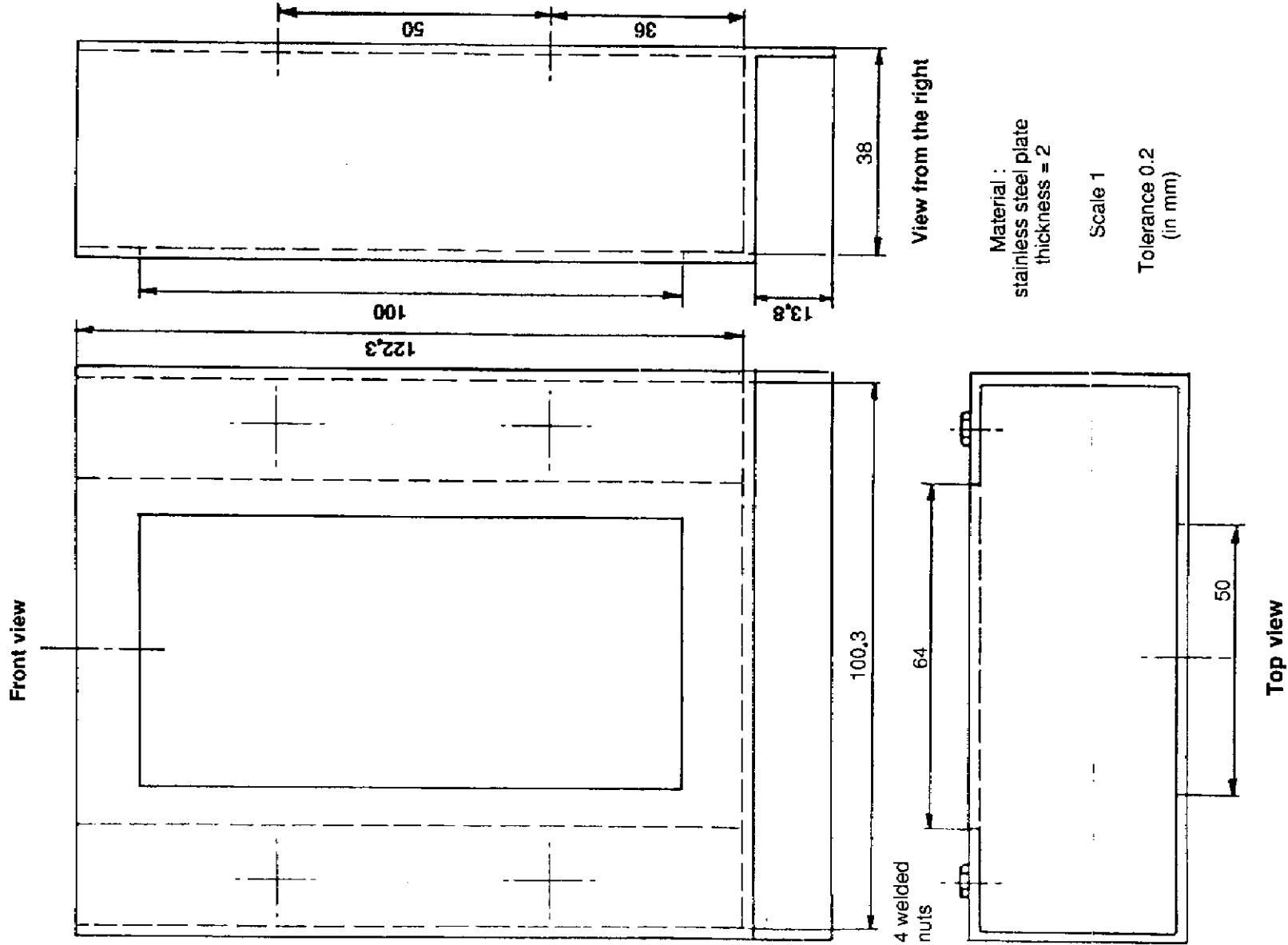


L = light bulb
 h = approx. 250 mm

d₂ = approximately 100 mm

Air inlet opening

Specimen frame

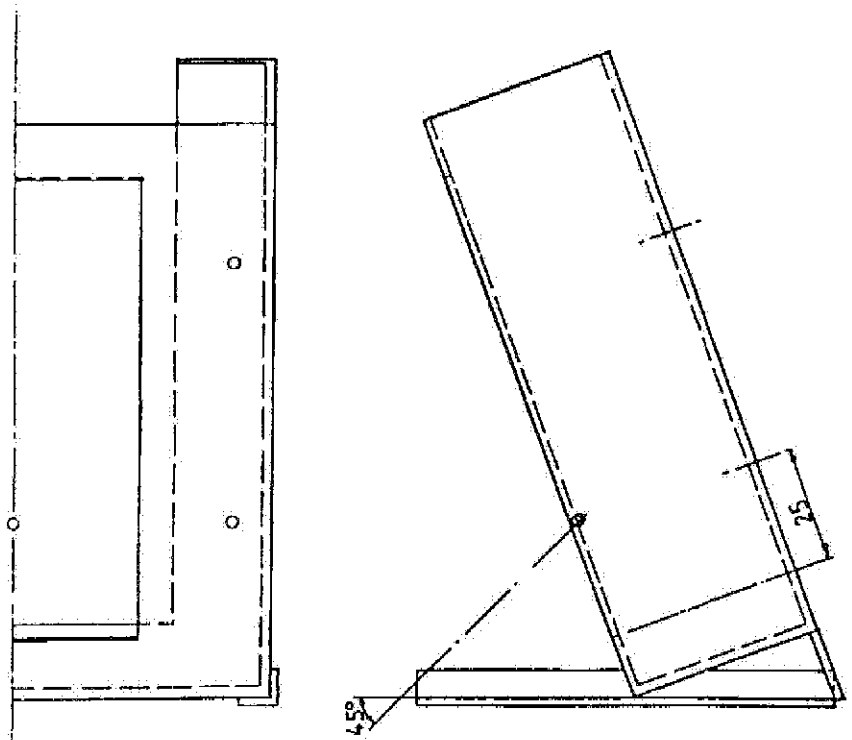


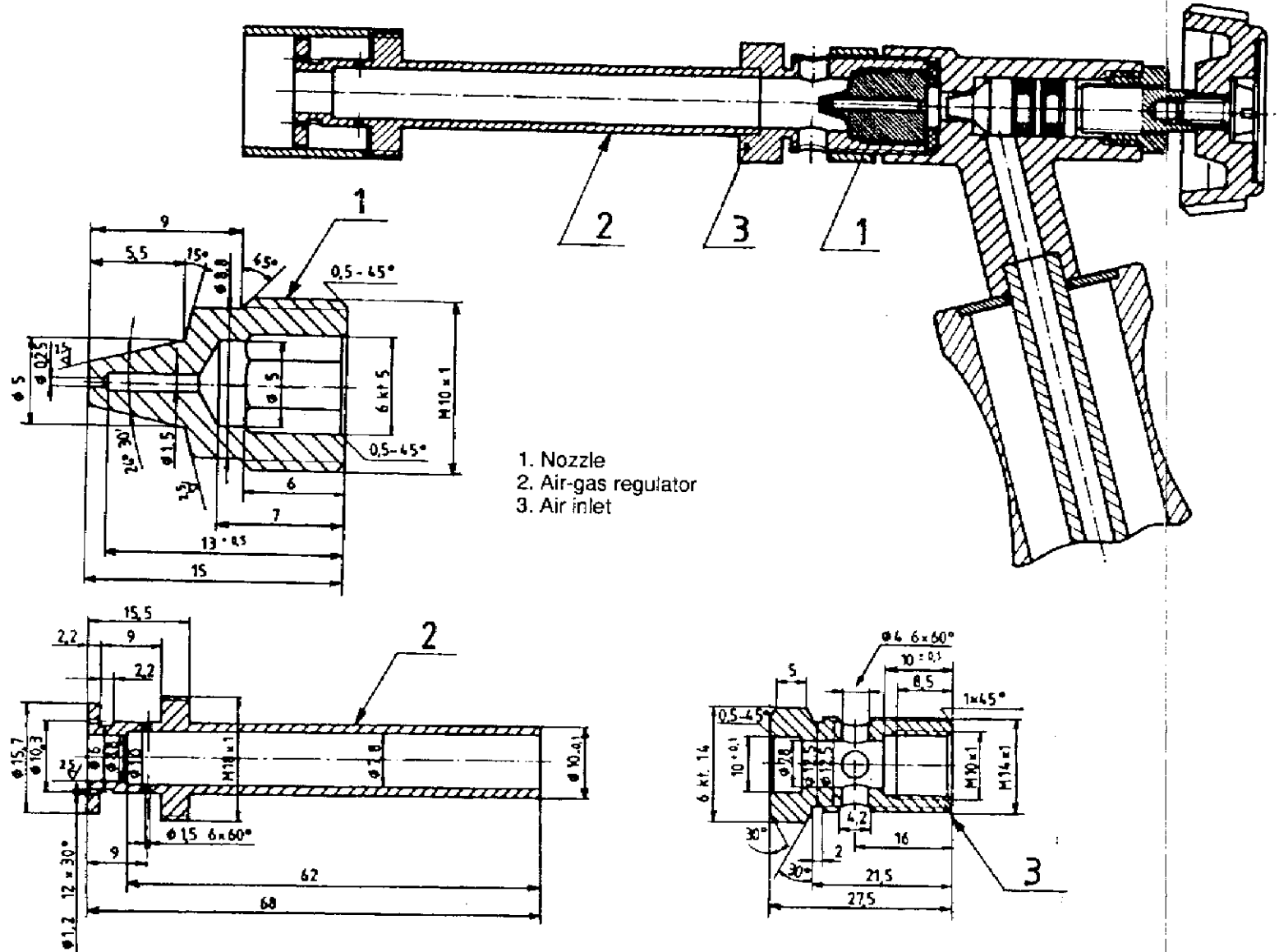
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OR
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Figure 2.2

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Specimen frame tilted at an angle of 20° to the vertical

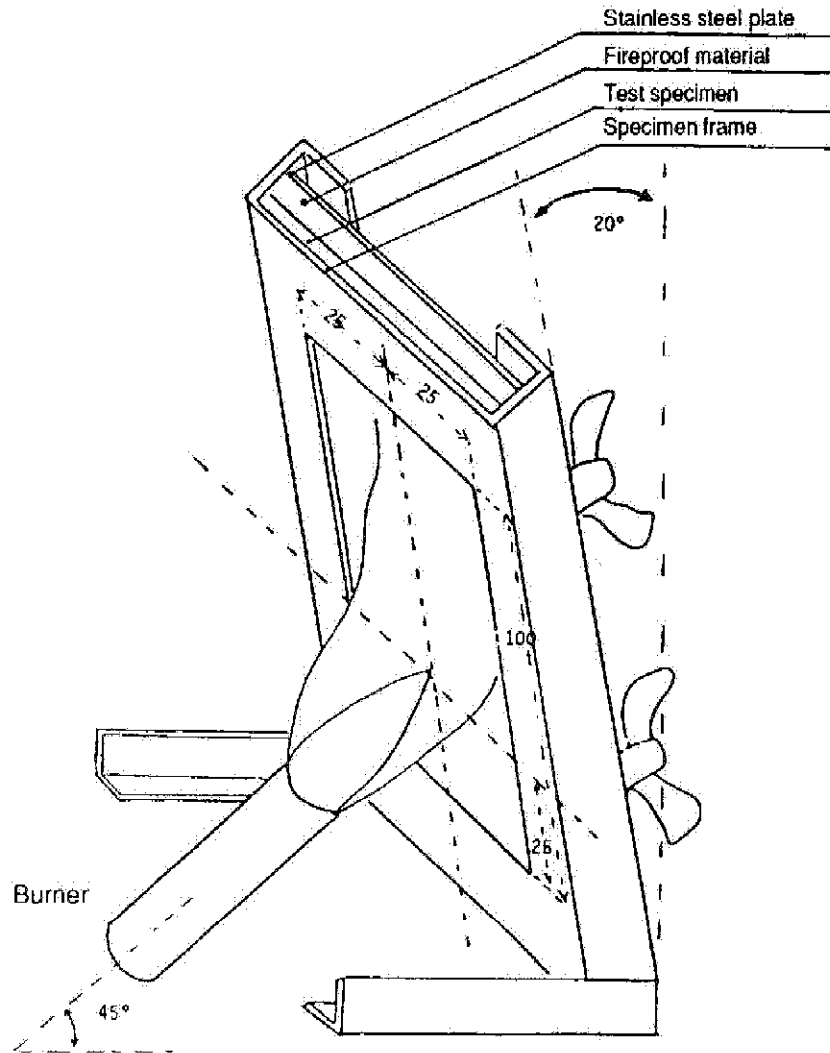




Gas burner

OR
APPENDIX 15
Figure 4

Arrangement for combustion of specimen



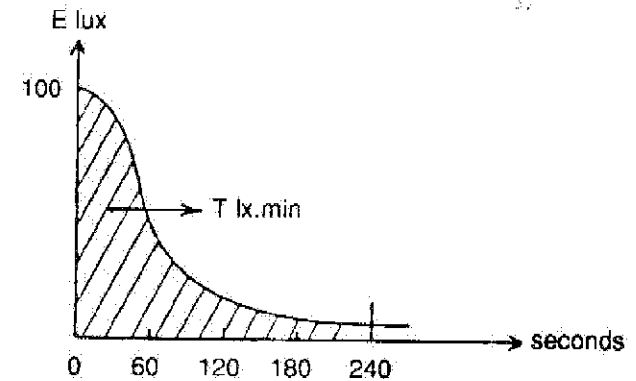
OR
APPENDIX 15
Figure 5

Model representation of results to determine deterioration of visibility due to smoke produced by a material

Point 4.3.1

E (lux)	t (seconds)			
	1st test	2nd test	3rd test	Arithmetic mean
100	0	0	0	0
90				
80				
70				
⋮				
⋮				

Point 4.3.2



Point 4.3.3

1 - Illumination intensity in the 4th minute $E_4 =$

$$2 - T = \int_0^4 E(t) dt =$$

Plaques d'avertissement relatives aux installations à gaz liquéfié
Warnschilder für Flüssiggasanlagen
Danger signs for liquefied gas installations

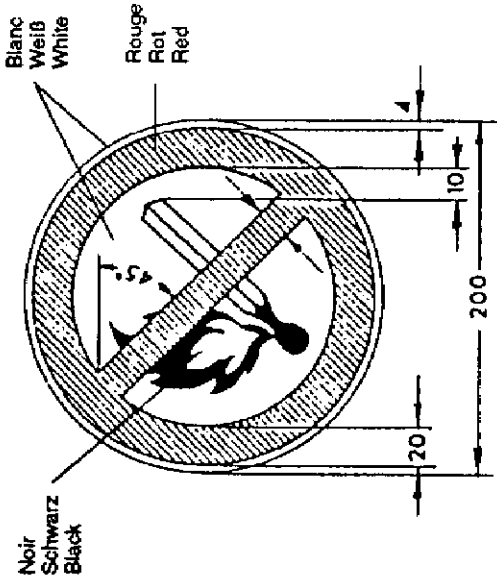


Figure 1
 Bild 1
 Figure 1

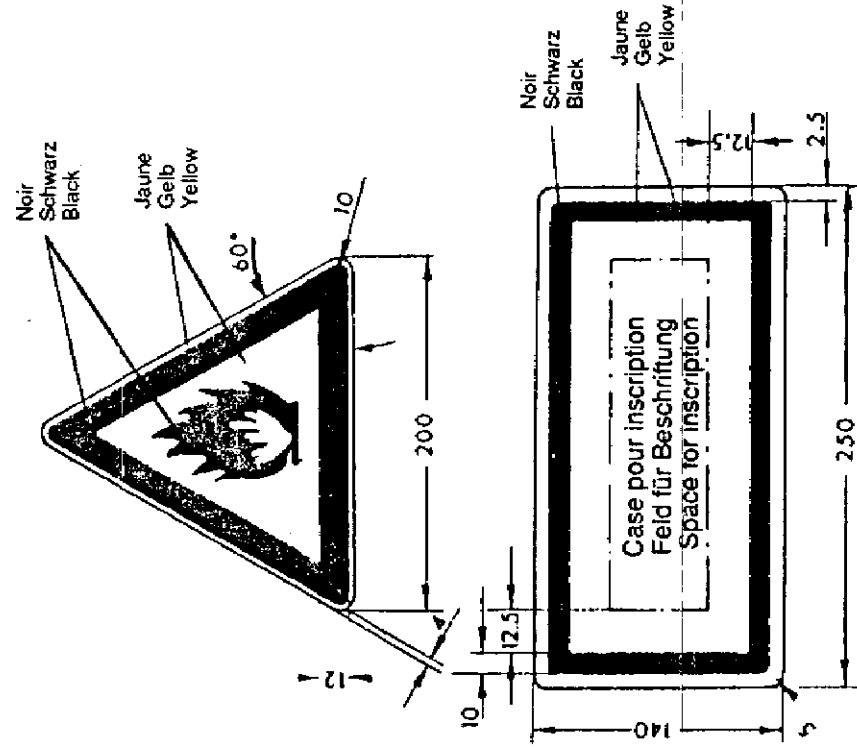


Figure 2
 Bild 2
 Figure 2

Figure 3
 Bild 3
 Figure 3

OR

Application

- 1 - All vehicles built after 1 July 1982.
- 2 - Point 5.2.1 to all existing vehicles equipped with movable cooking implements with a naked flame supplied by liquefied gas.
- 3 - With effect from 1 January 1990, all vehicles must be fitted with fire extinguishers.
- 4 - It is recommended that existing vehicles be adapted to the provisions of this leaflet at their next major overhaul.

In derogation of points 2.3 and 2.3.1 of Appendix 1, the MAV shall be authorised to install 3 liquefied gas cylinders with a capacity of 11 kg each in one cabinet (maximum 33 kg per coach).

In connection with point 3.1 of Appendix 1, the SNCF shall be authorised to distribute the total capacity of 6 kg between several extinguishers.

- Point 5.1.1, 5.1.2 (for all coaching stock used on international services).....1.1.95

Point 4.2.1. - Obligatory for new sleeping cars built after 1.1.96; recommended for existing stock subject to significant changes.

All UIC Railways.

OR

Record references

Last headings under which the question has been examined :

- *Question 45/A/FIC - Revision of UIC leaflets.*
4.3 - Leaflet 564-2
(joint Sub-Committee for Coaches : Paris, January 1985).
- *Question 45/A/FIC - Revision of UIC Leaflets.*
8.6 - Approval of a supplement to Leaflet 564-2
(joint Sub-Committee for Coaches : Paris, January 1990).
- *Question 45/A/FIC - Revision of UIC Leaflets.*
17.4 - Approval of revised Leaflet 564-2 "Regulations relating to fire protection and fire-fighting measures in passenger-carrying railway vehicles or assimilated vehicles used on international services".
(Traction and Rolling Stock Committee : Paris, June 1990).
- *Question 45/A/FIC - Approval of amendments to Leaflet 564-2.*
(Traction an Rolling Stock Committee : Stockholm, June 1991).
- *Question 45/A/20 - Point 2.3.3 - Development of Leaflet 564-2.*
(joint Sub-Committee for coaches - Paris, February 1994).