2.2. Test results

2.2.1. The result expressed in milliradians (mrad) shall be considered as acceptable when the absolute value $\Delta r_I = r_3 - r_{60}$ recorded on the headlamp is not more than 1.0 mrad ($\Delta r_I \leq 1.0$ mrad).

2.2.2. However, if this value is more than 1.0 mrad but not more than 1.5 mrad (1.0 mrad < $\Delta r_I \leq 1.5$ mrad) a second headlamp shall be tested as described in paragraph 2.1 of this annex after being subjected three consecutive times to the cycle as described below, in order to stabilize the position of mechanical parts of the headlamp on a base representative of the correct installation on the vehicle:

Operation of the passing lamp for one hour (the voltage shall be adjusted as specified in paragraph 1.1.1.2. above).

Period of rest for one hour.

The headlamp type shall be considered as acceptable if the mean value of the absolute values $\Delta r_I$ measured on the first sample and $\Delta r_{II}$ measured on the second sample is not more than 1.0 mrad

$$\frac{(\Delta r_I + \Delta r_{II})}{2} \leq 1.0 \text{ mrad}$$

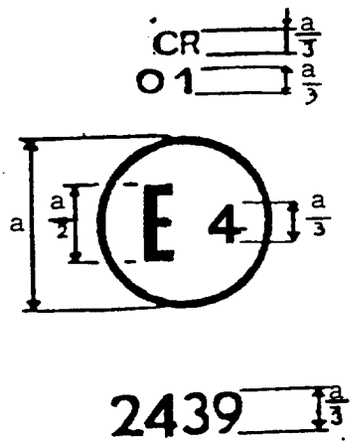
3. CONFORMITY OF PRODUCTION

One of the sampled headlamps shall be tested according to the procedure described in paragraph 2.1. above after being subjected three consecutive times to the cycle described in paragraph 2.2.2. above. The headlamp shall be considered as acceptable if $\Delta$ r does not exceed 1.5 mrad.

If this value exceeds 1.5 mrad, but is not more than 2.0 mrad, a second headlamp shall be subjected to the test after which the mean of the absolute values recorded on both samples shall not exceed 1.5 mrad.

Annex 5

EXAMPLES OF ARRANGEMENTS OF APPROVAL MARKS
(See paragraph 4 of this Regulation)




a = 12 mm min.

Figure 1

The headlamp bearing the approval marking shown above is a headlamp meeting the requirements of this Regulation in respect of both the driving beam and the passing beam, and which is designed for right-hand traffic only.

Note:

The approval number and the additional symbols shall be placed close to the circle and either above or below the letter "E", or to the right or left of that letter. The digits of the approval number shall be on the same side of the letter "E" and face the same direction.

The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

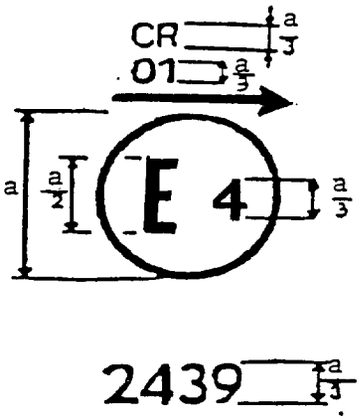



Figure 2


Figure 3a


Figure 3b

The headlamp bearing the approval mark shown above is a headlamp meeting the requirements of this Regulation with respect to both the passing beam and the driving beam, and designed:

For left-hand traffic only.

For both traffic systems, by means of an adjustment as desired of the optical unit or the lamp.

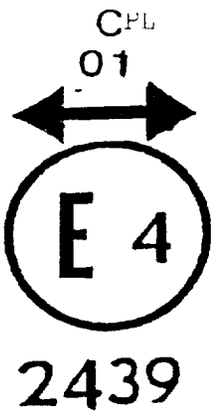



Figure 4

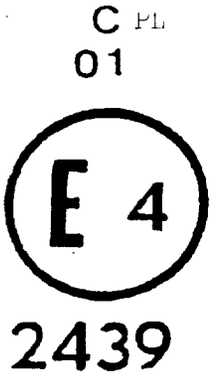



Figure 5

The headlamp bearing the approval mark shown above is a headlamp incorporating the lens of plastic material meeting the requirements of this Regulation with respect to the passing beam only, and designed:

For both traffic systems. | For right-hand traffic only.

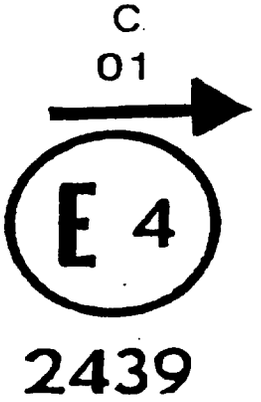



Figure 6

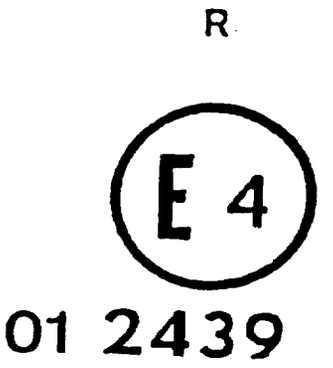



Figure 7

The headlamp bearing the approval mark shown above is a headlamp meeting the requirements of this Regulation:

With respect to the passing beam only, and designed for left-hand traffic only.

With respect to the driving beam only.

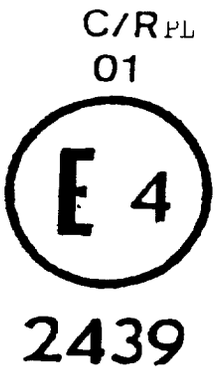



Figure 8

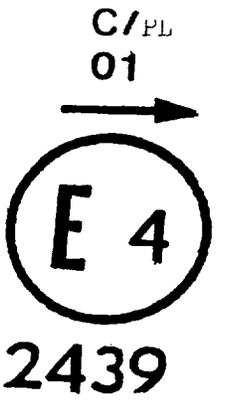



Figure 9

Identification of a headlamp incorporating the lens of plastic material meeting the requirements of Regulation No. 1:

For both the passing beam and the driving beam and designed for right-hand traffic only.

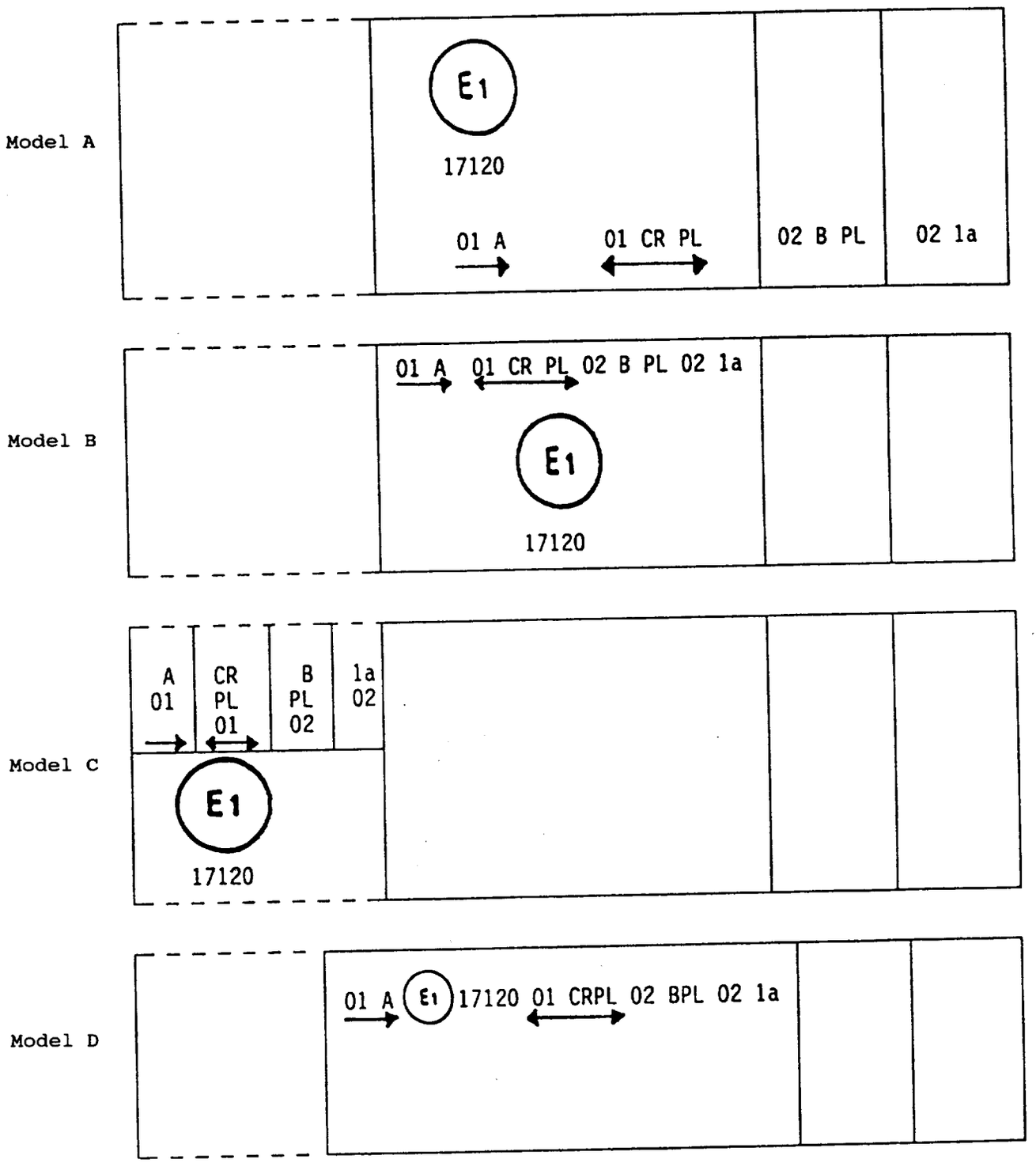
For the passing beam only and designed for left-hand traffic only.

the passing lamp filament shall not be lit simultaneously with the driving lamp filament and/or any other headlamp with which it is reciprocally incorporated.

Simplified marking of grouped, combined or reciprocally incorporated lamps

Figure 10

(The vertical and horizontal lines schematize the shape of the light-signalling device. They are not part of the approval mark).



Note: The four examples shown above correspond to a lighting device bearing an approval mark relating to:

A front position lamp approved in accordance with the 01 series of amendments to Regulation No. 7,

A headlamp with a passing beam designed for right-hand and left-hand traffic and a driving beam, approved in accordance with the 01 series of amendments to Regulation No. 1 and incorporating a lens of plastic material,

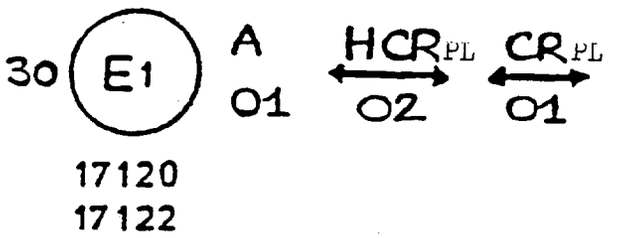
A front fog lamp approved in accordance with the 02 series of amendments to Regulation No. 19 and incorporating a lens of plastic material,

A front direction indicator lamp of category 1a approved in accordance with the 02 series of amendments to Regulation No. 6.

Figure 11

Lamp reciprocally incorporated with a headlamp

Example 1




The above example corresponds to the marking of a lens of plastic material intended to be used in different types of headlamps, namely:

either: a headlamp with a passing beam designed for right-hand and left-hand traffic and a driving beam with a maximum intensity comprised between 86,250 and 101,250 candelas, approved in Germany (E1) in accordance with the requirements of Regulation No. 20 as amended by the 02 series of amendments,

which is reciprocally incorporated with

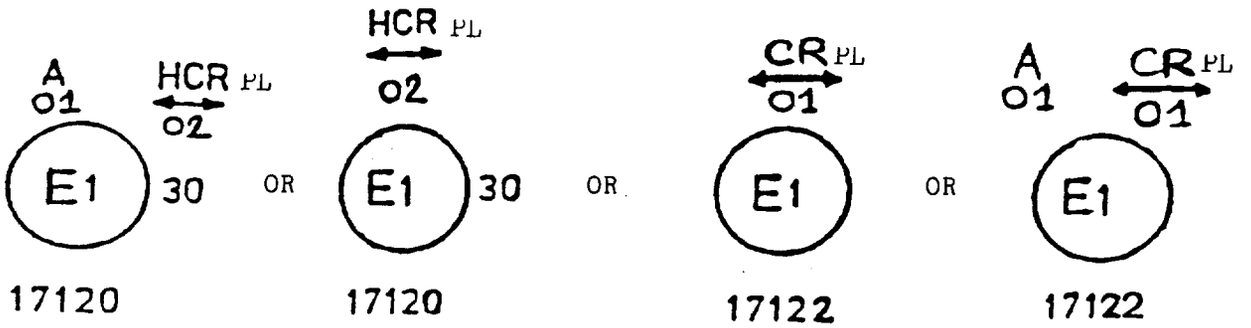
a front position lamp approved in accordance with the 01 series of amendments to Regulation No. 7;

or: a headlamp with a passing beam designed for right-hand and left-hand traffic and a driving beam, approved in Germany (E1) in accordance with the requirements of Regulation No. 1 as amended by the 01 series of amendments,

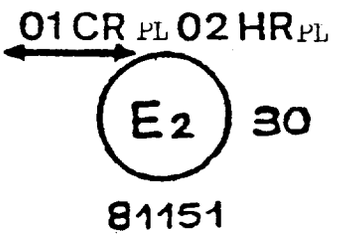
which is reciprocally incorporated with the same front position lamp as above;

or even: either of the above-mentioned headlamps approved as a single lamp.

The main body of the headlamp shall bear the only valid approval number, for instance:




Example 2

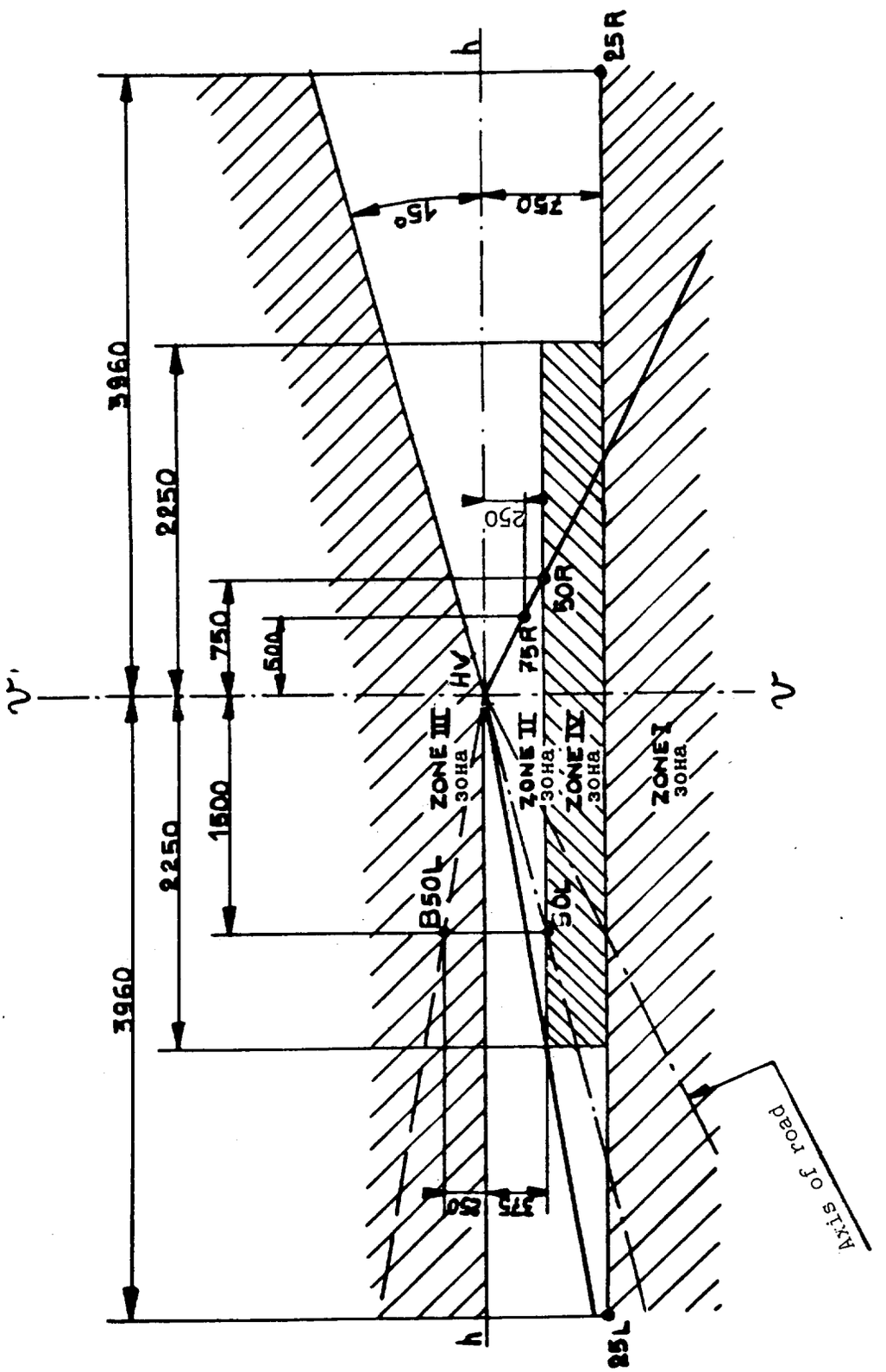



The above example corresponds to the marking of a lens of plastic material used in an assembly of two headlamps approved in France (E2), consisting of a headlamp emitting a passing beam designed for both traffic systems and of a driving beam with a maximum intensity comprised between x and y candelas, meeting the requirements of Regulation No. 1, as amended by the 01 series of amendments and of a headlamp emitting a driving beam with a maximum intensity comprised between w and z candelas, meeting the requirements of Regulation No. 20, as amended by the 02 series of amendments the maximum intensity of all the driving beams being comprised between 86,250 and 101,250 candelas.

## Annex 6

**MEASURING SCREENS**
**Standard European Beam**

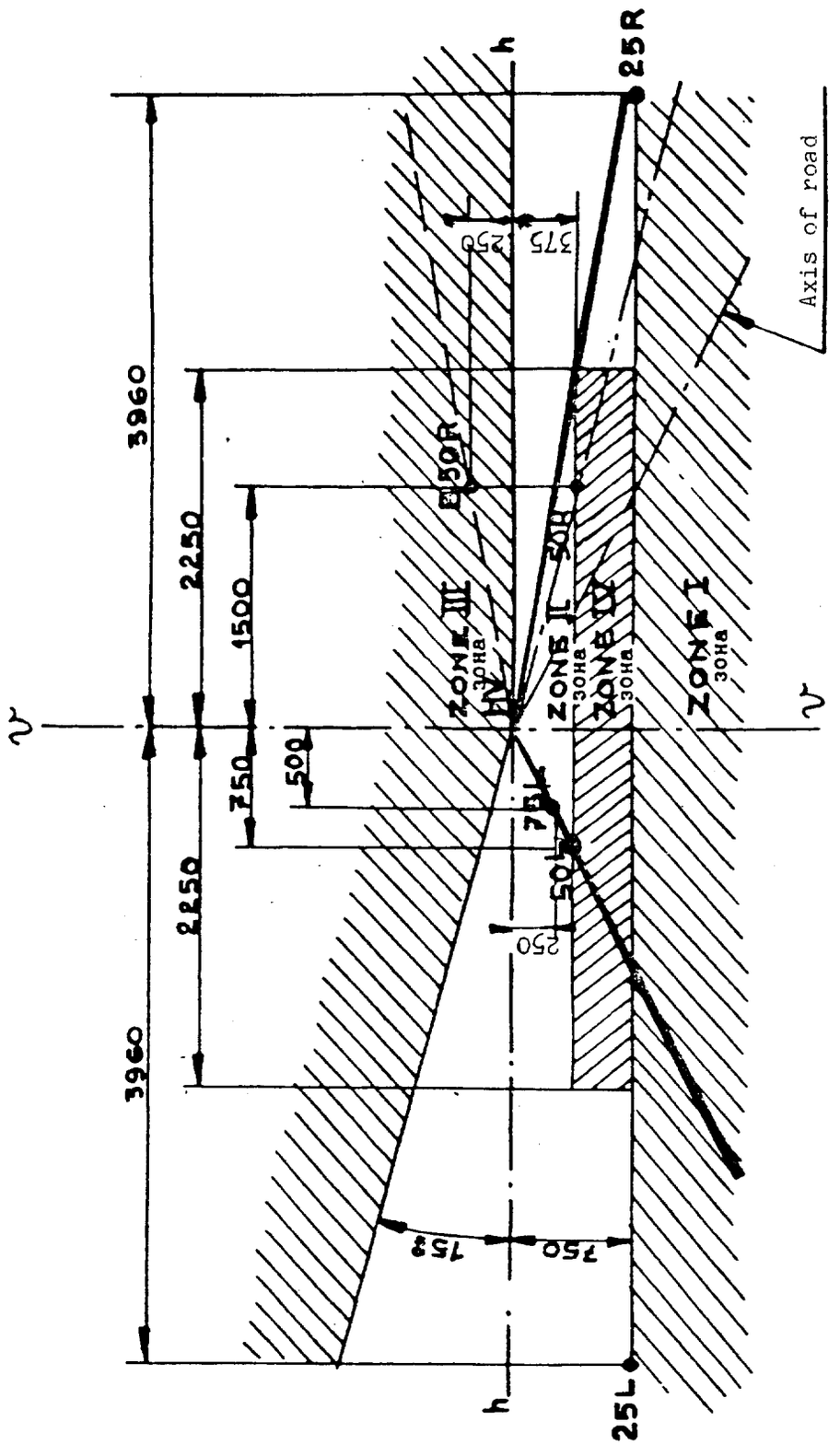
A. Headlamp for right-hand traffic
(Dimensions in mm)




h-h : horizontal plane ) passing through
v-v : vertical plane ) focus of headlamp

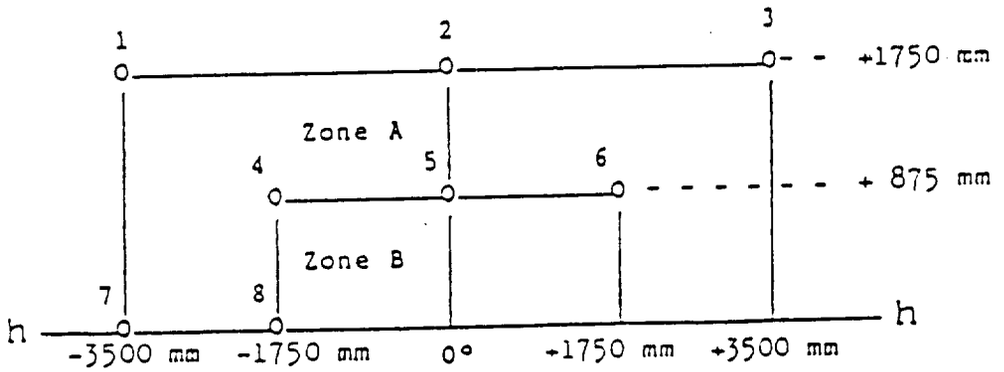
## Standard European Beam

B. Headlamp for left-hand traffic
(Dimensions in mm)




h-h : horizontal plane )
v-v : vertical plane ) passing through focus of headlamp

C. Measuring points of illumination values




Note: Figure shows the measuring points for right-hand traffic. Points 7 and 8 move to their corresponding location at the right-hand side of the picture for left-hand traffic.

Annex 7

REQUIREMENTS FOR LAMPS INCORPORATING LENSES OF PLASTIC MATERIAL - TESTING OF LENS OR MATERIAL SAMPLES AND OF COMPLETE LAMPS

1. GENERAL SPECIFICATIONS

1.1. The samples supplied pursuant to paragraph 2.2.4 of Regulations Nos. 1, 8, 19, 20 or paragraph 3.2.4 of Regulations Nos. 5, 31, 57, 72 shall satisfy the specifications indicated in paragraphs 2.1 to 2.5 below.

1.2. The two samples of complete lamps supplied pursuant to paragraph 2.2.3 of Regulations Nos. 1, 8, 19, 20 or paragraph 3.2.3 of Regulations Nos. 5, 31, 57, 72 and incorporating lenses of plastic material shall, with regard to the lens material, satisfy the specifications indicated in paragraph 2.6 below.

1.3. The samples of lenses of plastic material or samples of material shall be subjected, with the reflector to which they are intended to be fitted (where applicable), to approval tests in the chronological order indicated in table A reproduced in appendix 1 to this annex.

1.4. However, if the lamp manufacturer can prove that the product has already passed the tests prescribed in paragraphs 2.1-2.5 below, or the equivalent tests pursuant to another Regulation, those tests need not be repeated; only the tests prescribed in appendix 1, table B, shall be mandatory.

2. TESTS

2.1. Resistance to temperature changes

2.1.1. Tests

Three new samples (lenses) shall be subjected to five cycles of temperature and humidity (RH = relative humidity) change in accordance with the following programme:

3 hours at 40° C ± 2° C and 85-95% RH;

1 hour at 23° C ± 5° C and 60-75% RH;

15 hours at -30° C ± 2° C;

1 hour at 23° C ± 5° C and 60-75% RH;

3 hours at 80° C ± 2° C;

1 hour at 23° C ± 5° C and 60-75% RH;

Before this test, the samples shall be kept at 23° C ± 5° C and 60-75% RH for at least four hours.

Note: The periods of one hour at 23° C ± 5° C shall include the periods of transition from one temperature to another which are needed in order to avoid thermal shock effects.

2.1.2. Photometric measurements

2.1.2.1. Method

Photometric measurements shall be carried out on the samples before and after the test.

These measurements shall be made using a standard lamp, at the following points:

B 50 L and 50 R for the passing beam of a passing lamp or a passing/driving lamp (B 50 R and 50 L in the case of headlamps intended for left-hand traffic);

$E_{max}$ route for the driving beam of a driving lamp or a passing/driving lamp;

HV and $E_{max}$ zone D for a front fog lamp.

2.1.2.2. Results

The variation between the photometric values measured on each sample before and after the test shall not exceed 10% including the tolerances of the photometric procedure.

2.2. Resistance to atmospheric and chemical agents

2.2.1. Resistance to atmospheric agents

Three new samples (lenses or samples of material) shall be exposed to radiation from a source having a spectral energy distribution similar to that of a black body at a temperature between 5,500K and 6,000K. Appropriate filters shall be placed between the source and the samples so as to reduce as far as possible radiations with wave lengths smaller than 295 nm and greater than 2,500 nm. The samples shall be exposed to an energetic illumination of 1,200 $W/m^2$ ± 200 $W/m^2$ for a period such that the luminous energy that they receive is equal to 4,500 $MJ/m^2$ ± 200 $MJ/m^2$. Within the enclosure, the temperature measured on the black panel placed on a level with the samples shall be 50° C ± 5° C. In order to ensure a regular exposure, the samples shall revolve around the source of radiation at a speed between 1 and 5 1/min.

The samples shall be sprayed with distilled water of conductivity lower than 1 mS/m at a temperature of 23° C ± 5° C, in accordance with the following cycle:

spraying: 5 minutes;
drying: 25 minutes.

2.2.2. Resistance to chemical agents

After the test described in paragraph 2.2.1. above and the measurement described in paragraph 2.2.3.1. below have been carried out, the outer face of the said three samples shall be treated as described in paragraph 2.2.2.2. with the mixture defined in paragraph 2.2.2.1 below.

2.2.2.1. Test mixture

The test mixture shall be composed of 61.5% n-heptane, 12.5% toluene, 7.5% ethyl tetrachloride, 12.5% trichlorethylene and 6% xylene (volume %).

2.2.2.2. Application of the test mixture

Soak a piece of cotton cloth (as per ISO 105) until saturation with the mixture defined in paragraph 2.2.2.1. above and, within 10 seconds, apply it for 10 minutes to the outer face of the sample at a pressure of 50 N/cm$^2$, corresponding to an effort of 100 N applied on a test surface of 14 x 14 mm.

During this 10-minute period, the cloth pad shall be soaked again with the mixture so that the composition of the liquid applied is continuously identical with that of the test mixture prescribed.

During the period of application, it is permissible to compensate the pressure applied to the sample in order to prevent it from causing cracks.

2.2.2.3. Cleaning

At the end of the application of the test mixture, the samples shall be dried in the open air and then washed with the solution described in paragraph 2.3. (Resistance to detergents) at 23° C ± 5° C.

Afterwards the samples shall be carefully rinsed with distilled water containing not more than 0.2% impurities at 23° C ± 5° C and then wiped off with a soft cloth.

2.2.3. Results

2.2.3.1. After the test of resistance to atmospheric agents, the outer face of the samples shall be free from cracks, scratches, chipping and deformation, and the mean variation in transmission

$\Delta t = \frac{T2 - T3}{T_2}$, measured on the three samples according to the procedure described in appendix 2 to this annex shall not exceed 0.020

($\Delta t_m \leq 0.020$).

2.2.3.2. After the test of resistance to chemical agents, the samples shall not bear any traces of chemical staining likely to cause a variation of flux diffusion, whose mean variation

$\Delta d = \frac{T5 - T4}{T_2}$, measured on the three samples according to the procedure described in appendix 2 to this annex shall not exceed 0.020

($\Delta d_m \leq 0.020$).

2.3. Resistance to detergents and hydrocarbons

2.3.1. Resistance to detergents

The outer face of three samples (lenses or samples of material) shall be heated to 50° C ± 5° C and then immersed for five minutes in a mixture maintained at 23° C ± 5° C and composed of 99 parts distilled water containing not more than 0.02% impurities and one part alkylaryl sulphonate.

At the end of the test, the samples shall be dried at 50° C ± 5° C. The surface of the samples shall be cleaned with a moist cloth.

2.3.2. Resistance to hydrocarbons

The outer face of these three samples shall then be lightly rubbed for one minute with a cotton cloth soaked in a mixture composed of 70% n-heptane and 30% toluene (volume%), and shall then be dried in the open air.

2.3.3. Results

After the above two tests have been performed successively, the mean value of the variation in transmission

$\Delta t = \frac{T2 - T3}{T_2}$, measured on the three samples according to the procedure described in appendix 2 to this annex shall not exceed 0.010

($\Delta t_m \leq 0.010$).

2.4. Resistance to mechanical deterioration

2.4.1. Mechanical deterioration method

The outer face of the three new samples (lenses) shall be subjected to the uniform mechanical deterioration test by the method described in appendix 3 to this annex.

2.4.2. Results

After this test, the variations:

in transmission: $\Delta t = \frac{T2 - T3}{T_2}$

and in diffusion: $\Delta d = \frac{T5 - T4}{T_2}$

shall be measured according to the procedure described in appendix 2 in the area specified in paragraph 2.2.4 above. The mean value of the three samples shall be such that: $\Delta t_m \leq 0.100$;

$\Delta d_m \leq 0.050$.

2.5. Test of adherence of coatings, if any

2.5.1. Preparation of the sample

A surface of 20 mm x 20 mm in area of the coating of a lens shall be cut with a razor blade or a needle into a grid of squares approximately 2 mm x 2 mm. The pressure on the blade or needle shall be sufficient to cut at least the coating.

2.5.2. Description of the test

Use an adhesive tape with a force of adhesion of 2 N/(cm of width) ± 20% measured under the standardized conditions specified in appendix 4 to this annex. This adhesive tape, which shall be at

least 25 mm wide, shall be pressed for at least five minutes to the surface prepared as prescribed in paragraph 2.5.1.

Then the end of the adhesive tape shall be loaded in such a way that the force of adhesion to the surface considered is balanced by a force perpendicular to that surface. At this stage, the tape shall be torn off at a constant speed of 1.5 m/s ± 0.2 m/s.

2.5.3. Results

There shall be no appreciable impairment of the gridded area. Impairments at the intersections between squares or at the edges of the cuts shall be permitted, provided that the impaired area does not exceed 15% of the gridded surface.

2.6. Tests of the complete lamp incorporating a lens of plastic material

2.6.1. Resistance to mechanical deterioration of the lens surface

2.6.1.1. Tests

The lens of lamp sample No. 1 shall be subjected to the test described in paragraph 2.4.1. above.

2.6.1.2. Results

After the test, the results of photometric measurements carried out on the lamp in accordance with this Regulation shall not exceed by more than 30% the maximum values prescribed at points B 50 L and HV and not be more than 10% below the minimum values prescribed at point 75 R (in the case of headlamps intended for left-hand traffic, the points to be considered are B 50 R, HV and 75 L), in the case of front fog lamps this requirement shall be applied to zones A and B only.

2.6.2. Test of adherence of coatings, if any

The lens of lamp sample No. 2 shall be subjected to the test described in paragraph 2.5. above.

3. VERIFICATION OF THE CONFORMITY OF PRODUCTION

3.1. With regard to the materials used for the manufacture of lenses, the lamps of a series shall be recognized as complying with this Regulation if:

3.1.1. After the test for resistance to chemical agents and the test for resistance to detergents and hydrocarbons, the outer face of the samples exhibits no cracks, chipping or deformation visible to the naked eye (see paragraphs 2.2.2, 2.3.1 and 2.3.2);

3.1.2. After the test described in paragraph 2.6.1.1, the photometric values at the points of measurement considered in paragraph 2.6.1.2 are within the limits prescribed for conformity of production by this Regulation.

3.2. If the test results fail to satisfy the requirements, the tests shall be repeated on another sample of headlamps selected at random.

Annex 7 - Appendix 1

CHRONOLOGICAL ORDER OF APPROVAL TESTS

A. Tests on plastic materials (lenses or samples of material supplied pursuant to paragraph 2.2.4 (Regulations Nos. 1, 8, 19, 20; paragraph 3.2.4 in Regulations Nos. 5, 31, 57, 72) of this Regulation)

| Samples / Tests | | Lenses or samples of material | | | | | | Lenses | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1.1. | Limited photometry (para. 2.1.2) | | | | | | | | | | X | X | X | |
| 1.1.1. | Temperature change (para. 2.1.1) | | | | | | | | | | X | X | X | |
| 1.2. | Limited photometry (para. 2.1.2) | | | | | | | | | | X | X | X | |
| 1.2.1. | Transmission measurement | X | X | X | X | X | X | X | X | X | | | | |
| 1.2.2. | Diffusion measurement | X | X | X | | | | X | X | X | | | | |
| 1.3. | Atmospheric agents (para. 2.2.1) | X | X | X | | | | | | | | | | |
| 1.3.1. | Transmission measurement | X | X | X | | | | | | | | | | |
| 1.4. | Chemicals agents (para. 2.2.2) | X | X | X | | | | | | | | | | |
| 1.4.1. | Diffusion measurement | X | X | X | | | | | | | | | | |
| 1.5. | Detergents (para. 2.3.1) | | | | X | X | X | | | | | | | |
| 1.6. | Hydrocarbons (para. 2.3.2) | | | | X | X | X | | | | | | | |
| 1.6.1. | Transmission measurement | | | | X | X | X | | | | | | | |
| 1.7. | Deterioration (para. 2.4.1.) | | | | | | | X | X | X | | | | |
| 1.7.1. | Transmission measurement | | | | | | | X | X | X | | | | |
| 1.7.2. | Diffusion measurement | | | | | | | X | X | X | | | | |
| 1.8. | Adherence (para. 2.5) | | | | | | | | | | | | | X |

B. Tests on complete lamps (supplied pursuant to paragraph 2.2.3 (Regulations Nos. 1, 8, 19, 20; paragraph 3.2.3 in Regulations Nos. 5, 31, 57, 72) of this Regulation)

| Tests | Complete lamp Sample No. 1 | 2 |
|---|---|---|
| 2.1. Deterioration (para. 2.6.1.1) | X | |
| 2.2. Photometry (para. 2.6.1.2) | X | |
| 2.3. Adherence (para. 2.6.2) | | X |

Annex 7 - Appendix 2

METHOD OF MEASUREMENT OF THE DIFFUSION AND TRANSMISSION OF LIGHT

1. EQUIPMENT (see figure)

The beam of a collimator K with a half divergence $\frac{\beta}{2} = 17.4 \times 10^{-4}$ rd is limited by a diaphragm $D_T$ with an opening of 6 mm against which the sample stand is placed.

A convergent achromatic lens $L_2$, corrected for spherical aberrations, links the diaphragm $D_T$ with the receiver R; the diameter of the lens $L_2$ shall be such that it does not diaphragm the light diffused by the sample in a cone with a half top angle of $\beta/2 = 14°$.

An annular diaphragm $D_D$ with angles $\frac{\alpha_o}{2} = 1°$ and $\frac{\alpha_{max}}{2} = 12°$ is placed in an image focal plane of the lens $L_2$.

The non-transparent central part of the diaphragm is necessary in order to eliminate the light arriving directly from the light source. It shall be possible to remove the central part of the diaphragm from the light beam in such a manner that it returns exactly to its original position.

The distance $L_2$ $D_T$ and the focal length $F_2$ 1/ of the lens $L_2$ shall be so chosen that the image of $D_T$ completely covers the receiver R.

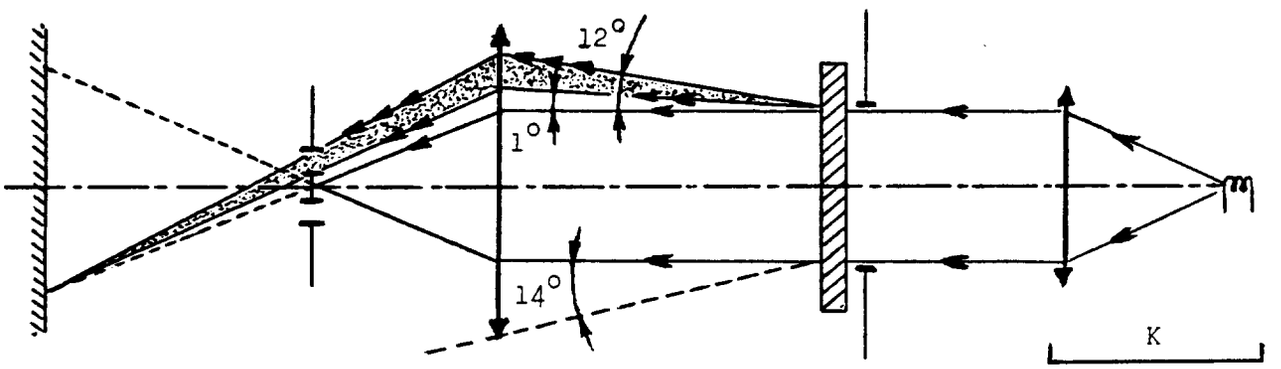
When the initial incident flux is referred to 1,000 units, the absolute precision of each reading shall be better than 1 unit.

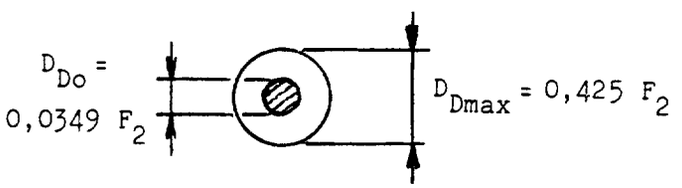
2. MEASUREMENTS

The following readings shall be taken:

| Reading | With sample | With central part of $D_D$ | Quantity represented |
|---|---|---|---|
| $T_1$ | no | no | Incident flux in initial reading |
| $T_2$ | yes (before test) | no | Flux transmitted by the new material in a field of 24° C |
| $T_3$ | yes (after test) | no | Flux transmitted by the tested material in a field of 24° C |
| $T_4$ | yes (before test) | yes | Flux diffused by the new material |
| $T_5$ | yes (after test) | yes | Flux diffused by the tested material |

1/ For $L_2$ it is recommended to use a focal distance of about 80 mm.


12°
1°
14°
K


$D_{Do}$ =
0,0349 $F_2$
$D_{Dmax}$ = 0,425 $F_2$


R
$F_2$
$L_2$
$L_1$
$D_D$
$D_T$

## Annex 7 - Appendix 3

## SPRAY TESTING METHOD

1. Test equipment

1.1. Spray gun

The spray gun used shall be equipped with a nozzle 1.3 mm in diameter allowing a liquid flow rate of 0.24 ± 0.02 1/minute at an operating pressure of 6.0 bars - 0, + 0.5 bar.

Under these operation conditions the fan pattern obtained shall be 170 mm ± 50 mm in diameter on the surface exposed to deterioration, at a distance of 380 mm ± 10 mm from the nozzle.

1.2. Test mixture

The test mixture shall be composed of:

Silica sand of hardness 7 on the Mohr scale, with a grain size between 0 and 0.2 mm and an almost normal distribution, with an angular factor of 1.8 to 2;

Water of hardness not exceeding 205 g/m$^3$ for a mixture comprising 25 g of sand per litre of water.

2. Test

The outer surface of the lamp lenses shall be subjected once or more than once to the action of the sand jet produced as described above. The jet shall be sprayed almost perpendicular to the surface to be tested.

The deterioration shall be checked by means of one or more samples of glass placed as a reference near the lenses to be tested. The mixture shall be sprayed until the variation in the diffusion of light on the sample or samples measured by the method described in appendix 2, is such that:

$$\Delta d = \frac{T5 - T4}{T_2} = 0.0250 \pm 0.0025$$

Several reference samples may be used to check that the whole surface to be tested has deteriorated homogeneously.

## Annex 7 - Appendix 4

## ADHESIVE TAPE ADHERENCE TEST

1. PURPOSE

This method allows to determine under standard conditions the linear force of adhesion of an adhesive tape to a glass plate.

2. PRINCIPLE

Measurement of the force necessary to unstick an adhesive tape from a glass plate at an angle of 90°.

3. SPECIFIED ATMOSPHERIC CONDITIONS

The ambient conditions shall be at 23° C ± 5° C and 65 ± 15% relative humidity (RH).

4. TEST PIECES

Before the test, the sample roll of adhesive tape shall be conditioned for 24 hours in the specified atmosphere (see para. 3 above).

Five test pieces each 400 mm long shall be tested from each roll. These test pieces shall be taken from the roll after the first three turns were discarded.

5. PROCEDURE

The test shall be under the ambient conditions specified in paragraph 3.

Take the five test pieces while unrolling the tape radially at a speed of approximately 300 mm/s, then apply them within 15 seconds in the following manner:

Apply the tape to the glass plate progressively with a slight lengthwise rubbing movement of the finger, without excessive pressure, in such a manner as to leave no air bubble between the tape and the glass plate.

Leave the assembly in the specified atmospheric conditions for 10 minutes.

Unstick about 25 mm of the test piece from the plate in a plane perpendicular to the axis of the test piece.