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ICS 87.040

## **DRAFT EAST AFRICAN STANDARD**

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**Hot applied thermoplastic road marking paint — Specification, Part 1:  
Constituent material and mixtures**

## **EAST AFRICAN COMMUNITY**

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## Foreword

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The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 070, *Paints, varnishes and related products*.

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

During the preparation of this Standard, reference was made to the following document:

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Acknowledgement is hereby made for the assistance derived from this source.



# Hot applied thermoplastic road marking paint — Specification, Part 1: Constituent material and mixtures

## 1 Scope

This Draft East African Standard prescribes the requirements, methods of sampling and test for hot applied thermoplastic road marking paint and constituents that are melted and applied by spray, screed or extruded.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

DEAS 927:2018, *Road marking paints— Specification*

ISO 4618, *Paints and varnishes — Terms and definitions*

ISO 591-1, *Titanium dioxide pigments for paints part 1: Specification and Method of test*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

BS 598-2, *Sampling and examination of bituminous mixtures for roads and other paved areas/Methods for analytical testing*

BS 812-103, *Testing aggregates*

BS 1994, *Specification for dichloromethane (methylene chloride)*

EN 1423, *Road marking materials. Drop on materials. Glass beads, antiskid aggregates and mixtures of the two*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **aggregate**

a granular material of mineral composition, such as calcite, quartz or flint, used to provide bulk of thermoplastic road marking material

### 3.2

#### **binder**

a thermoplastic resinous material which, with any included oils or other plasticers, provide adhesion to the road surface and cohesion between the other components.

**3.3**

**extender**

a powder added to assist the dispersion of the pigment and impart body to the mixture.

**3.4**

**luminance factor**

the ratio of the luminance of a reflecting surface in a given direction to that of the ideal white diffusing surface, when viewed in same direction and illuminated in the same way, expressed as a percentage

**3.5**

**retroreflectivity**

the property of some material such as solid glass beads, to reflect incident light in direction close to the direction from which it came

**3.6**

**thermoplastics**

a solvent-free marking substance supplied in block, granular or powder forms. It's heated to a molten state and then applied with appropriate hand or mechanical applicator. It forms cohesive films by cooling

**3.7**

**thermoplastic road marking material**

a material consisting of aggregate, pigment, binder, glass beads and extenders, capable of being softened by heating and hardened by cooling, which is used for road marking

**3.8**

**softening point**

is the temperature at which a given layer of thermoplastic material experiences a given deformation under the action of steel balls of 13.9 g

**3.9**

**no pick-up time**

the period, determined by the procedure described in Annex C of **CD/K/5:2018**, between application of a paint and the moment when the paint just ceases to be removed by a simulated tyre of a vehicle passing over the painted surface

## **4 Requirements**

### **4.1 General requirements**

#### **4.1.1 Aggregate**

**4.1.1.1** For white and yellow thermoplastic, the aggregate shall consist of light coloured sand, calcite, quartz or calcined flint.

**4.1.1.2** For black thermoplastic, calcined bauxite or other dark coloured aggregate may be used and pigment may be predisposed.

#### **4.1.2 Binder**

The binder shall comprise plasticised synthetic resin, plasticised natural resin or rosins.

### **4.2 Specific requirements**

**4.2.1** The Hot applied thermoplastic road marking paint shall comply with requirements in Table 1 below.

**Table 1 — Specific requirements for Hot applied thermoplastic road marking paint**

Sl. No.	characteristic	Requirement			Test method
		Yellow	White	Other colours	
i)	Luminance factor,%.	48 - 52	70, min	TBD	Annex A and B
ii)	Heat stability, min.	45	65	TBD	Annex A and B
iii)	Softening point, °C, min.	85			Annex C
iv)	Flow resistance at 40°C, %, max.	25			Annex D
v)	no pick-up time	Shall comply			Annex A and Annex E
vi)	Pigment, Titanium	Titanium dioxide (TiO2) of the anatase or the rutile crystal structure,			ISO 591-1,
vii)	Reflectorization	Class A incorporated into marking material prior to the application on the road surface			EN 1423
		Class B Solid glass beads for additional surface reflectorization			
viii)	Total Lead content, max.	90ppm			ISO 6503

**4.2.2 Composition of the marking material**

**4.2.2.1** When the sample of the marking material is tested in accordance with Annexes E and F, the proportion of the constituents of the mixture shall be in accordance with Table 2.

**Table 2 — Proportion of constituents of marking material**

Sl. No.	Constituents	Percentage (%)
i)	Binder ( Resin and oil)	20 ± 2
ii)	Solid glass beads	20 minimum
iii)	Aggregate together with pigments extender and solid glass beads	—

Note: At least 20 % by mass, may be maintained even in case the material to which solid glass beads are surface applied by pressure or gravity. Black material to be non-reflectorized and the binder to be 19 ± 3 by mass of the total mixture.



## **5 Packaging and Labelling**

### **5.1 Packaging**

The thermoplastic road marking paint and mixture shall be packaged in a suitable container that prevents it from deterioration during storage, transportation and normal handling

### **5.2 Labelling**

The labelling shall be either in English, Kiswahili or French or in combination as agreed between the manufacturer and / or the supplier. Any other language is optional.

Each package shall be legibly and indelibly marked with the following information.

- i) the words “hot applied thermoplastic road marking paint”;
- ii) name and address of the manufacturer;
- iii) net contents by mass in kilograms;
- iv) date of manufacture
- v) best before date ;
- vi) colour of the material;
- vii) instructions for use, disposal and safety requirements.
- viii) maximum safe heating temperature;
- ix) batch number.

## **6 Sampling**

Sampling shall be done in accordance to ISO 15528.

## Annex A (normative)

### Determination of heat stability of thermoplastic material

#### A.1 Principle

Heat stability for the thermoplastic material is determined by measuring the luminance factor after heating the material for extended period. The material is heated at 200 °C for 6 h; the luminance factor is then measured.

#### A.2 Apparatus

**A.2.1 Heating device**, an oil bath or suitable recessed aluminium block on a hotplate capable of maintaining the sample at 200 °C  $\pm$  3 °C.

**A.2.2 Paddle stirrer**, electrically driven capable of continuously stirring the molten sample at 150  $\pm$  10 r/minute. The shaft of the stirrer shall have a 6.5 mm diameter rod of suitable length to fit stirrer motor which is fitted with a single blade paddle of 40  $\pm$  0.5 length and 1.5 mm  $\pm$  0.5 mm thickness.

**A.2.3 Beaker**, of heat resistant glass with capacity of 250 mL and having nominal dimensions 110 mm high  $\times$  65 mm diameter.

**A.2.4 Light source**, a tungsten lamp operating at a correlated colour temperature of 2 854 K.

**A.2.5 Photoelectric cell**, having a spectral sensitivity closely matched to CIE photopic luminous efficiency function V (X) when two curves are normalized at 555 nm.

**A.2.6 Magnesium carbonate block**, calibrated against magnesium oxide. A new surface should be prepared before use.

**A.2.7 Mould of silicon rubber**, approximately 100 mm in diameter to cast sample discs.

**A.2.8 Balance**, capable of weighing up to 300 g to an accuracy of 1 g.

#### A.3 Procedure for preparation of test material

##### A.3.1 General

Test material shall be prepared in accordance with A.2.2, for powdered material or A.2.3 for block or performed material.

##### A.3.2 Powdered material

A minimum of 2.5 kg of sampled material shall be prepared in an oven or on hot plate.

##### A.3.2.1 Oven heating

Preheat the oven to a temperature of 200 °C and place the sample in the oven. After 20 min, subsequently at 10 to 15 min intervals, remove the sample from the oven and place in the fume cupboard, quickly stir thoroughly with a spatula, measure the temperature, and replace the sample in the oven. When the temperature of the sample reaches 185 °C  $\pm$  5 °C and its homogeneous, pour the material onto the mould or surface such as test panel, pour a test specimen in accordance with A.3.4. The time from commencement of heating to pouring shall not exceed 2 h.

If the sample is not homogeneous at  $185\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ , raise the oven temperature to  $220\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ . Continue heating, remove the sample at 10 to 15 min intervals and stir and measure the temperature as in step (a). When the sample is homogeneous pour onto the mould or surface such as test panel, pour the sample in accordance with A.3.4.

If the sample is not homogeneous at  $220\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ , reject the batch.

Report the temperature at pouring and at the time from first commencement of heating to pouring.

#### **A.3.2.2 Hot plate heating**

Preheat the hot plate to a surface temperature of  $250\text{ }^{\circ}\text{C}$  to  $270\text{ }^{\circ}\text{C}$  and place at least 2.5 kg of the test sample in a suitable container on the hot plate. Stir continuously to ensure homogeneity and even heating and measure the temperature at 5 min interval. When the temperature of the sample reaches  $185\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  and the sample is homogeneous, pour the material onto the mould or surface such as test panel, pour the sample in accordance with A.3.4.

If the sample is not homogeneous at  $185\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ , continue heating, remove the sample at 5 min intervals and stir and measure the temperature as in A.3.2.2. When the sample is homogeneous, pour into mould or surface such as test panel, pour test specimen in accordance with A.3.4

#### **A.3.3 Block material or preformed material**

A minimum of 2.5 kg of sample material shall be prepared in a oven or hot plate as below.

**A.3.3.1** Take the block sample and without the application of heat, prepare a subsample by breaking up a sufficient number of pieces of material, each weighing not more than 50 g.

**A.3.3.2** Follow the procedure described in A.3.2, except that the time from commencement of heating to pouring shall not exceed 1 h. Stir thoroughly before pouring the appropriate specimens for testing.

#### **A.3.4 Preparation of test specimen**

**A.3.4.1** If not already at pouring temperature, heat thermoplastic material prepared to a temperature of  $185\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  and mix to an even consistency.

**A.3.4.2** Pour the thermoplastic material onto a test panel until a disk of approximately 100 mm diameter and thickness of 2 mm is formed. Determine the luminance factor in accordance to Annex C of CD/K/O5:2018.

## Annex B (normative)

### Determination of luminance factor

#### B1 Principle

The principle of the method is photoelectric comparison of the luminance of the test paint relative to that of a perfect reflecting diffuser. In this standard, magnesium carbonate or a white tile, calibrated against a perfect reflecting diffuser, is used as the reference surface.

#### B2. Apparatus and materials

**B2.1 Light source**, a tungsten lamp operating at a correlated colour temperature of 2 854 K in a photometer.

**B2.2 Photoelectric cell**, having a spectral sensitivity closely matched to the CIE photopic luminous efficiency function  $V(\lambda)$ .

**B2.3 Magnesium carbonate block**, calibrated against a perfect reflecting diffuser. Prepare a new surface immediately before use.

**B2.4 Calibrated white reference tile**, having a CIE value in the range 70 to 95, and a calibration against a perfect reflecting diffuser traceable to a national accredited laboratory.

**B2.5 Glass test pannel**, as described in Annex A (for Method 1 only).

#### B3. Procedure

##### B3.1 Method 1: Test panels

**B3.1.1** Prepare the glass test panel (B2.5) and apply the paint by the method described in Annex A.

**B3.1.2** Calibrate the apparatus with the light source (B2.1), with the axis of the incident beam at  $45^\circ \pm 1^\circ$  to the reference surface (B2.3 or B2.4). Locate the photoelectric cell (B2.2) such that the axis of the cell is at  $90^\circ \pm 1^\circ$  to the illuminated reference surface. If using a magnesium carbonate block, calibrate on the mean of readings from three different areas.

Calculate the absolute value  $M$  by use of the appropriate calibration factor.

**B3.1.3** Measure the luminance of three different areas of the paint film using the same geometry as in B3.1.2. Calculate the mean luminance  $L$ .

##### B3.2 Method 2: Road trials

**B3.2.1** Clean an area of each non-reflectorized paint stripe (prepared as described in H2.6) at a distance of 500 mm  $\pm$  75 mm from the near side kerb, by the method described in J2.1, and allow to dry.

**B3.2.2** Taking precautions to shield the photoelectric cell from stray incident light, carry out the procedure described in B3.1.2 and B3.1.3, but measure the luminance at only one location on the paint stripe. Measure the luminance five times, rotating the cell through approximately  $90^\circ$  with minimal lateral displacement between each measurement.

Calculate the mean  $L$  of the five measurements.

**B4. Calculation**

Calculate the luminance factor as the ratio  $L/M$  and express it as a percentage.

**B5. Test report**

The test report shall state the luminance factor  $L/M$  to the nearest 1 %.

## Annex C (normative)

### Determination of the softening point

#### C.1 Principle

The principle of this method is to determine the softening point of the thermoplastic road materials in accordance with Wilhelmi.

#### C.2 Apparatus

**C.2.1 Ring**, in accordance with Wilhelmi (see Figure C.1), consisting of a bottom ring half and a top ring half with bayonet catch, retaining rod and prominently protruding nipples

**C.2.2 Beaker**, appropriate form for the equipment

**C.2.3 Steel ball mass**,  $13.9 \pm 0.1$  g (approximate diameter 15 mm)

**C.2.4 Thermometer**,  $+30$  °C  $+200$  °C graduated in 0.5 °C divisions

**C.2.5 Base plate of metal glass**

**C.2.6 Mould parting agent**, e.g. mixture of glycerine and dextrine in 1:1 ratio

**C.2.7 Knife**

**C.2.8 Tongs or tweezers**, for holding the ball

**C.2.9 Test liquids**, freshly boiled distilled water, glycerine

**C.2.10 Device for heating the beaker**, enabling the temperature of the test liquid to be raised uniformly from 5 °C to 180 °C at a rate of 5 °C per 60 s  $\pm$  5 s and with stirring if necessary to maintain a constant heating rate.

#### C.3 Samples

The sample mass shall amount to approximately 50 g. Two test specimens shall be tested.

#### C.4 Preparation of the ring

Heat the bottom half of the ring and base plate, thinly coated with the mould parting agent, together with the sample to the manufacturer's suggested softening point + 70 °C.

Fill the bottom half of the ring with the hot material. Place the top of the ring onto the bottom half so that the superfluous portion of the material is pressed out of that whole of the top half and leave standing for 30 min at room temperature (18 °C to 28 °C). The salient portion of the test specimen is trimmed off with the warmed knife so that the surface of the test specimen is smooth and flat.

Insert the bottom half of the ring into the top half and fasten with the bayonet catch. The test specimen is now firmly clamped between the halves of the ring, and is not capable of becoming deforming at the edges.

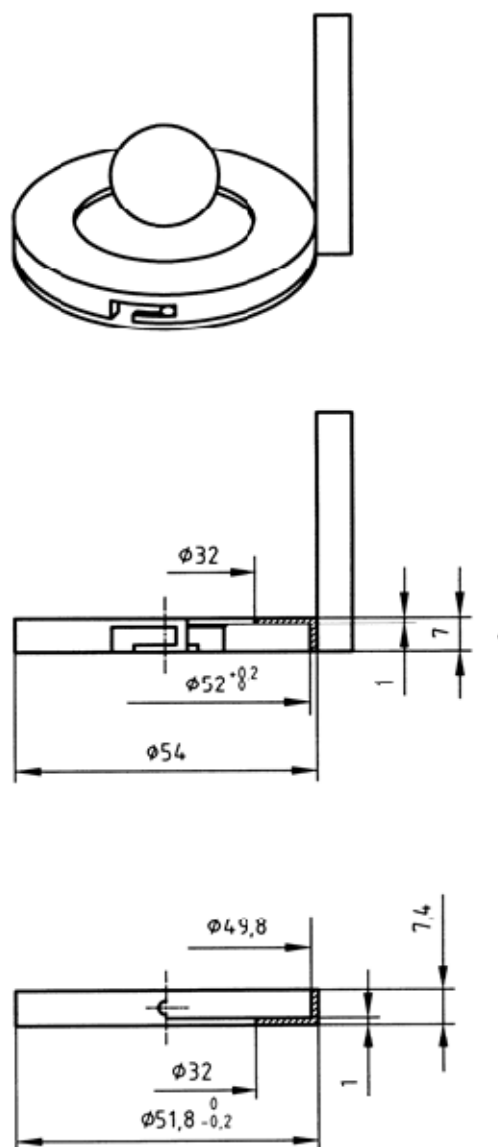


Figure C.1 — Ring in accordance with Wilhelmi

### C.5 Procedure

Suspend the ring, after preparation as in Clause C.4, the beaker in such a way that its bottom face is situated 50 mm above the bottom of the beaker. Pour the test liquid into the beaker up to a height of 50 mm above the top face of the ring a temperature of approximately 5 °C or 30 °C respectively according to the test liquid used (see Table C.1). Place the ball in the test liquid but not on the test specimen. Suspend the thermometer in the beaker in such a way that its bottom end lies flush with the bottom face of the ring, but does not touch either the ring or the beaker.

The type of test liquid and the initial temperature will depend of the softening point of the sample and are listed in Table C.1.

Table C.1 — Test conditions

Softening point in accordance with Wilhelmi	Test liquid	Initial temperature
Up to 80 °C	Freshly boiled distilled water	5 °C
Over 80 °C	Glycerine	30 °C

NOTE Freshly boiled distilled water should be used otherwise the test results may be affected by air bubbles. Glycerine is so viscous at temperature below 50 °C that streaks are found during the heating process. However the prescribed uniform temperature rise ensures that no difficulties will occur at temperature above 60 °C.

**C.5.1** After immersion of the ball, leave the beaker standing for 10 min at room temperature (18 °C to 28 °C) on the beaker heating devise, which has not yet been switched on.

**C.5.2** After 10 min, place the ball on the test specimen in the middle of the ring, with aid of tongs or tweezers.

**C.5.3** Heat the beaker in such way that the temperature of the test liquid increases uniformly at a rate of 5 °C per minute without non-turbulent stirring. Use the first few minutes to adjust the rate of temperature rise.

**C.5.4** At temperature which is at least 15 °C below the softening point of the sample, adjust the rate of the temperature rise with sufficient accuracy to ensure that the further rate of temperature rise from this point onwards takes place at 5 °C per 60 s  $\pm$  5 s.

**C.5.5** Deviations shall only occur within the range of these  $\pm$  5 s and shall even not be compensated during the progress of test.

**C.5.6** As the temperature increases, the test specimen becomes more cambered in a downward direction under weight of the ball. At instant when either the test specimen or ball comes into contact with bottom of the beaker read of the temperature at nearest 0.5 °C.

**C.5.7** Test the specimen in the second heating process. If the temperatures measured differ from one another by more than the permissible 2 °C, the repeat the test on two new specimens. Carry out the test procedure within 48 h of test specimen preparation.

## C.6 Expression of results

Report the mean value of the two measurements rounded to the nearest 1 °C. This represents the softening point in accordance with Wilhelmi. Check for compliance with 4.3.



**Annex D**  
(normative)

**Determination of flow resistance**

**D.1 Principle**

Two conical test specimens are held at 40 °C for 48 h and the percentage reduction in height is calculated.

**D.2 Apparatus**

**D.2.1 Hot box**, a room, container or oven which may be controlled at 40 °C  $\pm$  2 °C for 48 h.

**D.2.2 Measuring devise**, capable of measuring the height of the test cones in mm.

**D.2.3 Metal cones**, two split or hinged conical metal moulds, of height 100  $\pm$  5 and with an included angle nominally 60 ° at the apex, open at the base.

**D.3 Procedure**

**D.3.1** Heat sufficiently the test material to 90 °C  $\pm$  5 °C above its softening point.

**D.3.2** Cast two conical specimens of the material so that each has an angle of nominally 60° at its apex and vertical height of 100 mm  $\pm$  5 mm.

**D.3.3** Measure and record the height of the cone to the nearest millimetre.

**D.3.4** After 24 h at the room temperature, remove each specimen from its mould and place upwards on a flat level surface in the hot box maintained at a temperature of 40 °C  $\pm$  5 °C.

**D.3.5** Measure and record the height of the cone after a period of 48 h conditioning in the hot box.

**D.4 Calculation**

Calculate the decrease in height of two specimens as a percentage, to the nearest 0.1 %, and calculate the average of the two results as the mean slump and check for compliance Table 1

## Annex E

### (normative)

### No pick-up time test

#### E.1 Principle

Two rubber rings, simulating the tyres of a vehicle, are rolled over a test panel 15 min after application of the paint. The surfaces of the rings are examined for pick-up of the paint.

#### E.2 Apparatus and materials

**E2.1 Steel cylinder**, fitted with two replaceable O-rings (E2.2) and with a steel rod serving as an axle. The total mass of the assembly, complete with O-rings, shall be  $5.40 \pm 0.03$  kg. The dimensions of the steel cylinder shall be in accordance with Figure 1, subject to a tolerance of  $\pm 0.1$  mm.

**E2.2 O-rings**, made of synthetic rubber or rubber-like material. The dimensions of the O-rings shall be:

- a) Outside diameter: 104.8 mm;
- b) Inside diameter: 85.7 mm;
- c) Cross section: 9.5 mm.

**E2.3 Ramp**, having dimensions in accordance with Figure 1, subject to a tolerance of  $\pm 0.1$  mm.

**E2.4 Glass test panel**, 100 mm x 200 mm in area, and 3 mm in thickness, as described in Annex B.

#### E.3 Procedure

Carry out the test at a temperature of  $23 \pm 2$  °C and  $50 \pm 5$  % relative humidity. Prepare the glass test panel (E2.4) by the method described in Annex B to give a film of width not less than 75 mm. Record the time of application.

Put the painted glass panel against the ramp (E2.3) and 30 min after the application of the paint; allow the steel cylinder (E2.1) to roll freely down the inclined ramp and over the paint film. Examine the rubber O-rings on the cylinder and record whether any of the paint is adhering to them.

#### E.4 Test report

Both rings shall be free from adhering paint after 30 min of application.

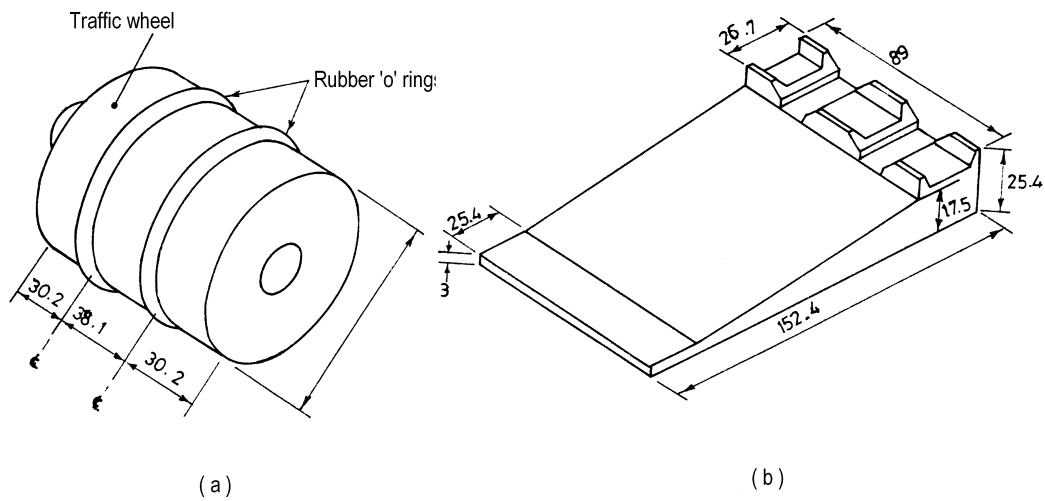


Fig.1 — Apparatus for no pick-Up Time Test

## Annex F (normative)

### Determination of binder content

#### F.1 Apparatus

**F.1.1 Metal bottle**, having a capacity of between 600 ml and 2000 ml with a wide mouth and suitable closures.

**F.1.2 Rotating machine**, which will rotate the bottle about its longitudinal axis at a speed of 20 r/min  $\pm$  10 r/min.

**F.1.3 Volumetric flasks**, of appropriate capacity, e.g. 250-ml, 500-ml and 1000-ml.

**F.1.4 Centrifuge or filtration apparatus**, the centrifuge capable of developing an acceleration of 25000 m/s<sup>2</sup>  $\pm$  100 m/s<sup>2</sup> calculated in accordance with the following equation:

$$a = 1.097 n^2 r \times 10^{-5}$$

where,

$n$  is the number of revolutions per min;

$r$  is the radius (in mm) to the inside base of the tube when rotating.

The tubes shall be closed with caps to prevent loss of solvent during centrifuging.

NOTE 1 A typical centrifuge suitable for this method carries two or more buckets fitted with centrifuge tubes of between 50 ml and 100-ml capacity.

NOTE 2 It is strongly recommended that the speed of rotation should be verified regularly to ensure that the centrifuge maintains its performance at all times.

The filtration apparatus comprises a metal bottle as specified in F.1.1, a porous filter thimble, tubing and a 50 mL burette. The porous filter is of porcelain, alumina or similar material, 90 mm long by 20 mm diameter and of up to 4  $\mu$ m pore diameter. The filter is closed by sealing in, to within 5 mm of the bottom, a length of metal tubing, approximately 300 mm long by 5 mm bore, that passes through a supporting ring of cork or metal that is mounted just inside the open end of the filter. A cement paste composed of copper oxide powder, prepared by the direct oxidation of copper wire, of about 425  $\mu$ m particle size, and phosphoric acid is used to seal the joint. The joint is left to dry for a few hours. Alternatively, a rubber stopper may be used. Care has to be taken to ensure that the seal does not split the filter thimble.

**F.1.5 Recovery apparatus**, comprising a water bath with an electric heater capable of maintaining boiling water in the bath throughout the recovery procedure, a flat bottomed flask of 200 mL or 250 mL capacity, a vacuum gauge, a vacuum reservoir and a means of maintaining reduced pressure, e.g. a filter pump.

**F.1.6 Balance**, capable of weighing to within an accuracy of 0.005 g.

**F.1.7 Solvent**, Use dichloromethane (methylene chloride), complying with BS 1994.

#### F.2 Procedure

**F.2.1** Take a sub sample of 100 g to 150 g as described in Annex B break it into small pieces, and weigh to an accuracy of 0.05 % of the total mass taken.

**F.2.2** Insert the pieces into the bottle and add dichloromethane, measured by means of volumetric flasks, to give a solution of the binder having a concentration of about 3 %.

**F.2.3** Close the bottle and rotate it on the rotary mixer for a minimum of 15 min, until a complete solution of the binder is obtained.

**F.2.4** Separate a portion of the binder solution from insoluble matter either by centrifuging for 20 min to 30 min in completely closed tubes, or by means of the filtration apparatus using a dry, binder free filter. Take care to minimize loss of solvent during this separation.

**NOTE 1** If filtration is prolonged, owing to fine mineral matter being present in the binder solution, inaccurate results may be obtained and in this case centrifuging is essential.

**NOTE 2** When the amount of binder in the sample is unknown, it is advisable to recover the binder from one aliquot portion of solution before proceeding with the duplicate recovery.

**F.2.5** Weigh two flat-bottomed flasks (see F.1.5) to the nearest 0.01 g.

**F.2.6** Measure from the burette a sufficient amount of the centrifuged or filtered solution into each flask to give a residue of 0.75 g to 1.25 g of binder after evaporation of the solvent.

**NOTE** An estimate of the volume of solution (aliquot portion, A (in mL)) required is given by the following equation:

$$8 \times 100 A = C \times D$$

where,

8 is the total volume of solvent (in mL);

C is the mass of sample (in g);

D is the estimated percentage of soluble binder in the specimen.

**F.2.7** Remove the solvent from the binder solution by connecting each flask to the recovery apparatus. Immerse the flasks to approximately half their depth in the boiling water, and distil off the solvent at atmospheric pressure or at a reduced pressure of not less than 600 mbar (1 mbar = 0.1 Kpa =  $10^2$  N/m<sup>2</sup>). While the distillation is proceeding shake the flasks with a rotary motion so that the binder is deposited in a thin layer on the walls of the flasks. Do not allow pressure above atmospheric to develop in the flask during the evaporation of the solvent.

**F.2.8** At the stage that relatively rapid reduction in pressure occurs, usually accompanied by frothing, when the bulk of the solvent has been removed, reduce the pressure to 200 mbar in 1.5 min and maintain the pressure at 200 mbar for a further 3.5 min.

**F.2.9** Remove the flasks from the bath and admit air to the apparatus to increase the pressure to atmospheric. Wipe each flask dry and disconnect it, taking care to prevent the entry into the flasks of any water that may have collected where the rubber stopper joins the flask. Remove the last traces of solvent that remain in the flasks by a gentle current of clean, oil and water free air.

**F.2.10** Cool the flasks in a desiccator and weigh them to the nearest 0.01 g. If the quantity of soluble binder recovered in either flask lies outside the limits 0.75 g and 1.25 g, repeat the recovery with another portion of the solution having the volume suitably adjusted.

**F.2.11** If the difference between the duplicate recoveries is greater than 0.02 g, reject these results and repeat the recovery of the binder in duplicate on further aliquot portions.

**F.2.12** Note the results of the duplicate determinations in which the mass of binder recovered lies within the required limits.

**F.2.13** When the aggregate is required for a grading test or for analysis, filter the whole of the solution remaining after determination of the binder content. Use the funnel method described in BS 598 : Part 2, but with a No. 40 Whatman filter paper or equivalent or using a sintered glass Buchner funnel (porosity No.4) or a pressure filter.

### F.3 Calculation of results

**F.3.1** Calculate the mean of the results obtained in F.2.11.

**F.3.2** Calculate the binder content  $C$  (% by mass) of the sample from the following equation:

$$C = \frac{100 zV}{wm} \left( 1 + \frac{z}{dw} \right)$$

where,

$m$  is the mass of sample (in g);

$z$  is the average mass of binder recovered from the two aliquot portions (in g);

$V$  is the total volume of solvent (in ml);

$V$  is the volume of each aliquot portion (in ml);

$d$  is the relative density of the binder.

**NOTE** The density of resin/oil binders containing between 20 % and 30 % of oil lies between 1.03 and 1.08, hence a figure of 1.05 may be assumed when the exact nature of the binder is not known.

### F.4 Test report

Report the binder content of the sample.

## **Annex G** (normative)

### **Determination of the grading of constituents and glass bead content**

#### **F.1 General**

This Annex describes the methods for determining the grading of the constituents and the glass bead content of marking materials sampled in accordance with Annex B for the whole of the material obtained as described in Clause C.2.

#### **F.2 Apparatus**

2.80 mm, 600  $\mu$ m and 425  $\mu$ m test sieves complying with BS 410 shall be used.

#### **F.3 Determination of grading of constituents**

**F.3.1** Ignite the filter paper and thoroughly mix the ash with the main bulk of the aggregate.

**F.3.2** Carry out the grading test using 2.80 mm and 600  $\mu$ m test sieves in accordance with the method specified in BS 812 Part 103. If the glass bead content is to be determined use a 425  $\mu$ m test sieve also.

**F.3.3** Report the mass passing each sieve as a percentage of the combined mass of the aggregate, pigment and extender and (where present) glass beads.

#### **F.4 Determination of glass bead content**

##### **F.4.1 Apparatus**

**F.4.1.1 Metal tray**, of approximate dimensions 150 mm x 355 mm inclined at an angle of  $5^\circ \pm 1^\circ$  to the horizontal.

**F.4.1.2 Brush**, small and soft.

##### **F.4.2 Method**

Take all the material obtained in F.3.2, place increments of 5 g to 10 g on the upper end of the tray and gently brush the material until all the glass beads have been moved to the bottom of the tray.

##### **F.4.3 Calculation and expression of results**

Report the total mass of the round glass beads collected as a percentage of the mass of the original sample of thermoplastic material  $\times 100/70$ .

NOTE 1 The accurate determination of the proportion of glass beads in the mixture can be complicated by the chemical composition and relative density of the materials in it. The method given above is the simplest and although rather tedious does give quite accurate results.

NOTE 2 The intention of this standard is that a minimum of 20 % glass beads complying with as EN 1423 should be incorporated in the mix at the time of manufacture.

NOTE 3 An alternative method for determining glass bead content is to use a round meter as described in EN 1423

### **Bibliography**

- [1] KS 2157-1:2018, Hot applied thermoplastic road marking paint — Specification Part 1: Constituent material and mixtures





