



## U I C CODE

Leaflet to be classified in Volumes :

V - TRANSPORT STOCK

VIII - TECHNICAL SPECIFICATIONS

# 842-2

# R

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Brought up-to-date on

TECHNICAL SPECIFICATION  
FOR METHODS FOR TESTING  
PAINT PRODUCTS

**NUMERISATION DANS  
L'ETAT DU DOCUMENT**

(Reprint, 01-04-1989)

## 1 - PURPOSE

## 1.1 - Nature of the products.

This specification defines the methods for testing paint products and paint systems intended for the protection of railway vehicles and containers. Generally speaking, these methods are simplified forms of the methods stipulated by ISO Standards.

## 1.2 - Classification

Series of tests are carried out to check the characteristics of paint products :

- in delivery condition,
- when ready for application,
- as a dry film.

## 1.3 - Reference documents

Reference is made to the following documents in the text of this specification :

UIC Leaflets 842-1 ; Supply of paint products for the protection of railway vehicles and containers.

842-3 ; Surface preparation of metallic and non-metallic materials used in the construction of railway vehicles and containers.

UIC Leaflets 842-4 : Protection against corrosion and painting of wagons and containers.

842-5 : Protection against corrosion and painting of coaches and tractive units.

ISO Recommendations :

ISO/R 1512 : Paints and varnishes. Sampling.

ISO/R 1514 : Paints and varnishes. Standardised panels for testing.

ISO/R 1515 : Paints and varnishes. Determination of volatile and non-volatile matter.

ISO/R 1516 : Paints and varnishes. Determination of the danger classification by flash point (Closed cup method).

ISO/R 1519 : Paints and varnishes. Bend test (cylindrical mandrel).

ISO/R 1520 : Paints and varnishes. Cupping test.

ISO/R 1522 : Paints and varnishes. Pendulum damping test.

ISO/R 1524 : Paints and varnishes. Determination of the fineness of grind.

ISO Standard :

ISO 2409 : Paints and varnishes. Cross-cut test.

ISO 2808 : Determination of dry film thickness.

Euronorm :

Euronorm :

Fe 32-66 : Thin steel plates for cold bending or pressing. Quality standard.

1-4 - Details to be shown in orders.

The purchasing Railway must specify in its order which tests it has adopted for the approval and acceptance of the paints.

It must also specify the results to be obtained for the tests in paragraphs :

2-11, 2-215, 3-132, 3-15, 3-25, 3-261, 3-3111, 3-3112, 3-312, 3-313, 3-3141, 3-3142, 3-31431-3-315, 3-31523, 3-316, 3-318, 3-331, 3-332, 3-333, 3-3352, 3-3353, 3-33532, 3-3371, 3-338.

2 - SAMPLING

2-1 - Sample taking and preparation

2-11 - Sample taking

In principle, samples are taken in the producing factory by a representative of the purchasing Railway. The manufacturer shall supply the staff and paint necessary for correct rapid sampling of the paints submitted for acceptance at his own expense.

Products shall be submitted in batches, which must only include those of the same kind from the same manufacturing batch.

The representative of the purchasing Railway shall select the containers he wishes to sample at random from each batch submitted. However, the number of samples may not exceed that laid down in the table in § 6.21 of Recommendation ISO/R 1512.

Should the purchasing Railway decide to carry out tests that require larger quantities of products, the representative of the purchasing Railway shall select the additional quantity of product, the volume of which must be fixed in the order.

#### 2-12 - Preparation of samples

The containers selected shall be opened and their contents examined for the presence of skin and sediment.

The batch must be refused and no samples taken for analysis and testing, if it is impossible to obtain a uniform sample by stirring because of abnormal sedimentation or the presence of skin or foreign matter.

After stirring to obtain uniformity of the product in each container selected, the representative of the purchasing Railway shall take about 10% of the contents in each case, up to a maximum of 2 litres, and mix all the samples together until they are of uniform texture. The average sample thus obtained shall be used to fill four tins with an average capacity of 1 litre to 95% of that amount in each case. If the sampling is carried out in the producing factory, each of the 4 tins shall be sealed and stamped by the representative of the purchasing Railway and by the manufacturer.

The 4 identical samples thus obtained are used as follows:

- one is retained by the supplier,
- two are intended for analysis and testing,
- a fourth is retained with its seals intact for the possibility of arbitration as provided for in paragraph 6 of UIC Leaflet 842 - 1.

#### 2-2 - Test panels

##### 2-21 - Preparation of the test panels

Unless otherwise stipulated, test panels must be prepared as follows:

##### 2-211 - Steel panels

The panels shall be made of mild steel of the special grade defined in EURONORM 32-66 (special deep pressed steel) and must be free from rust and carbon deposits. Their dimensions and thickness are laid down in the paragraphs relating to the various tests.

Before application of the coatings of the various paint products, the panels must be degreased and rubbed down either mechanically in accordance with the provisions of 2-11, 2-12 and 2-3 of UIC Leaflet 842-3, or manually in accordance with the provisions of 2-4 of ISO/Recommendation 1514. In both cases, the average roughness must be  $12 \mu m < Ra < 13,5 \mu m$  corresponding to:  $40 \mu m < Rt < 45 \mu m$ .

##### 2-212 - Aluminium panels

Aluminium panels must be of the same grade as that used for the construction of the vehicles or containers. Their dimensions and thickness are laid down in the paragraphs relating to the various tests.

Before applying the coatings of the various paint products, the panels must be prepared, in accordance with the provisions of paragraph 4 of UIC Leaflet 842-3, either by rubbing down mechanically, or by degreasing or scouring with a sulphochromic mixture, in accordance with the method of preparation of plates used for the construction of the vehicles or containers.

2-213 - *Wooden panels*

Wooden panels must be made of the same sort of wood as that used for the construction of the vehicles or containers. These panels must have regular annual growth rings, and a minimum thickness of 15 mm. The humidity of the wood must be between 12% and 15%. Before painting, the panels must be rubbed down with abrasive paper and the dust removed.

2-214 - *Glass panels*

Glass panels must be cleaned with a suitable solvent and dried.

2-215 - *Panels of synthetic material*

Panels of synthetic material must be made of the material used in practice. The method of preparing these panels must be covered by a preliminary agreement between the purchasing Railway and the manufacturer.

2-22 - *Conditions for drying test panels*

For drying purposes, the test panels shall be placed vertically, in a well ventilated area maintained at a temperature of  $\pm 23^{\circ}\text{C}$   $\pm 2^{\circ}\text{C}$ , where the atmosphere has a relative humidity of  $50\% \pm 5\%$ .

Unless otherwise stipulated, each coat of paint must have reached the drying stage 3 defined in 3-243 within the time laid down, before the next coat of paint can be applied.

3 - TESTING METHODS

3-1 - *Methods of testing materials in delivery condition*

3-11 - *Determination of the weight per volume*

3-111 - *Apparatus*

For determining the weight per volume, the following equipment is used :

- a 50 cm<sup>3</sup> measuring flask graduated and cut level with the gauge indication,
- a balance accurate to the nearest mg.

3-112 - *Method*

The weight per volume is determined at a temperature between  $15^{\circ}\text{C}$  and  $25^{\circ}\text{C}$ , as follows :

After washing, the empty flask is weighed and dried, its weight being termed as  $m_1$ .

The flask is filled with distilled water until a convex meniscus is obtained. The overall weight ( $m_2$ ) is then determined.

The flask is then emptied and dried and filled with the carefully homogenised paint sample until a convex meniscus is obtained. Care should be taken to prevent air bubbles from forming during filling. The overall weight ( $m_3$ ) is then determined.

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The weight per volume "d" of the paint at the testing temperature is given by the following formula :

$$d = \frac{m_3 - m_1}{m_2 - m_1}$$

**3-12 - Determination of the volatile and non-volatile matter content**

The volatile and non-volatile matter content is determined in accordance with the provisions of ISO/Recommendation 1515, subject to the fact that the test value of  $2g \pm 0.2g$  must be maintained for 3 hours in an oven kept at a temperature of  $+ 105 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ .

**3-13 - Determination of the consistency**

**3-131 - Apparatus**

The consistency of a paint is determined by means of a consistometric section of standard dimensions. The consistometric sections described in ISO Standard 2431 and national standards can be used within their particular limits of consistency.

**3-132 - Method of testing**

Unless otherwise stipulated, the temperature of the paint to be tested and of the consistometric section, must be  $+ 23 \text{ }^\circ\text{C} \pm 0.5 \text{ }^\circ\text{C}$  before and during the test.

The consistometric section is placed on a support so that its upper edge is horizontal, with the nozzle placed beneath the section stopped. The latter is filled with the paint to be tested until a slightly curved meniscus is obtained : during this operation, care must be taken not to trap air bubbles in the paint.

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Excess paint is removed by placing a glass plate on the top of the section, taking care not to trap air bubbles. The plate is then slid out horizontally. With a container placed beneath the section, the nozzle is unstopped and a stop watch started.

The stop watch is stopped as soon as the flow of liquid ceases, and the time recorded.

The consistency of the paint is expressed by the arithmetical average of two successive readings not differing by more than 5%.

This method does not apply to thixotropic or viscous materials, the consistency of which can be determined with a viscosimeter with a high shearing speed, or assessed by means of a test application.

**3-14 - Determination of the fineness of grind**

The fineness of grind is determined in accordance with the provisions of ISO/Recommendation 1524 with the following accuracy; only gauges graduated in units of 0 to  $100 \mu\text{m}$  are permissible.

**3-15 - Determination of stability during storage**

Original containers intended for testing, kept closed, are stored at a temperature between  $+ 5 \text{ }^\circ\text{C}$  and  $+ 30 \text{ }^\circ\text{C}$  for a period corresponding to the guarantee period laid down by the purchasing Railway.

At the end of this period, the containers are opened and the state of their contents examined. The uniformity - texture, skin, dry deposit, etc. - is checked by stirring and straining.

The consistency is also checked in accordance with the provisions of 3-13. In addition, the various properties listed in UIC Leaflet 842-1 can be checked if the purchasing Railway so desires.

**3-16 - Determination of the resistance to freezing of water-based paint products:**

The resistance to freezing is determined by placing a closed container containing about 100 ml of the paint sample to be examined for 2 hours in a refrigerator with a temperature of  $- 20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

At the end of this period, the container is placed in a room kept at a temperature of  $+ 23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

The paint is examined when it has reached this temperature.

**3-17 - Determination of the danger classification according to the flash point**

The danger classification according to the flash point is determined in accordance with the provisions of ISO Recommendation 1516, subject to the following conditions:

The limits of the danger classification are:

$< + 21^{\circ}\text{C}$ , between  $+ 21^{\circ}\text{C}$  and  $+ 55^{\circ}\text{C}$ , above  $+ 55^{\circ}\text{C}$ .

The method can be used within a range between  $+ 5^{\circ}\text{C}$  and  $+ 65^{\circ}\text{C}$ .

The cup used is of the ABEL-PENSKY type.

**3-2 - Methods of testing products ready for application**

**3-21 - Determination of the volume of pigment concentration**

**3-211 - Definition**

The volume of pigment concentration is the ratio of the volume of the materials in powder form - TVMP -, contained in a sample of the product to the conventional dry volume output RVSC, which is the ratio expressed in % of the total volume of the dry film to the volume of product used and assumed to be in the "ready for use" condition.

**3-212 - Apparatus**

The following equipment is used :

- a laboratory centrifugal machine capable of an acceleration of  $55\ 000\ \text{m}/\text{sec}^2$  at the end of the tube,
- a 50 ml pycnometer with a capillary rod, the diameter of the tube being about 1 mm,
- a drier fitted with two-way valve enabling the pressure to be varied,
- a vacuum pump for reducing the pressure to a value of about 4 m bar,
- a water tank controlled thermostatically, able to maintain any temperature to within  $0.1^{\circ}\text{C}$ ,
- a balance accurate to 0.001 g,
- a water horn fitted with an overflow bottle,
- a mercury pressure gauge, fitted with a stop valve enabling it to be isolated,
- a thermometer giving readings to a tenth of a degree,

- stainless steel discs 60 mm in diameter and 0,7 mm in thickness, with an opening of 1,5 mm at 2 or 3 mm from the edge.

Discs made of lighter materials, including plastic - e.g. etherophtalic polyethylene - can also be used, provided they do not alter the volume of the solvent in the paint at the time of application, or during the heating and drying process.

- hooks for hanging up the test sample,
- an immersion bath,
- a calibration device - see Appendix 1 - Figure 1,
- a laboratory analytical balance of the single-plate type giving an accuracy of 1/10 mg,
- a device for draining the test samples, fitted with an electric motor capable of 500 r.p.m. - see Appendix 1, Figure 2.

3-213 - Test method

To calculate the volume of pigment concentration it is necessary to determine the volume of the materials in powder form TVMP and the conventional dry volumic output RVSC.

3-2131 - Determination of the volume of matter in powder form TVMP.

The following operations are involved:

- determination of the weight per volume  $d_1$  of the sample of the product to be tested,

- determination of the weight content P % of materials in powder form,
- determination of the weight per volume  $d_2$ , in relation to water at  $\pm 4^\circ\text{C}$  of the matter in powder form.

3-21311 - Determination of the mass  $d_1$  of the sample of the product for testing

This is done in accordance with the provisions of 3-11.

3-21312 - Determination of the weight content P% of matter in powder form

The amount of matter in powder form is determined by the centrifugal process on a test sample of 5 to 10g.

The weight  $M_1$  of the empty tube for the centrifugal process is determined.

The test sample is placed in the tube for the centrifugal process and the combined mass  $M_2$  determined.

An extraction liquid, chosen in relation to the chemical nature of the binding agent and the polarity of the dispersion phase, is inserted in the tube for the centrifugal process, and the volume of this liquid must be approximately equivalent to the volume of the test sample.

After the centrifugal process, elimination of the dispersion phase, and drying, the weight  $M_3$  of the tubes for the centrifugal process containing the matter in powder form is determined.

The content of matter in powder form P % of the test sample is equivalent to:

$$P \% = \frac{M_3 - M_1}{M_2 - M_1} \times 100$$

The content of matter in powder form of the sample corresponds to the arithmetical average of two readings.

3-21313 - Determination of the weight per volume  $d_2$  of the matter in powder form.

The weight per volume  $d_2$  is determined as follows:

The weight  $M_1$  of the pycnometer, previously cleaned and dried, is determined to the nearest 0,001 g.

A test sample is taken from the sample of matter in powder form obtained in 3-21312, the weight of this test sample being between 2 g and 20 g and its volume less than half that of the pycnometer. The test sample is inserted in the pycnometer, and the combined weight  $M_2$  determined.

The test sample is then covered with a displacement liquid consisting of kerosene, and the whole is stirred to wet the pigment thoroughly.

The pycnometer is placed in a drier, to which the following circuits are connected, previously assembled in parallel by means of T - connections:

- Vacuum circuits from the water horn,
- Vacuum circuits from the vacuum pump,
- An earthed mercury pressure gauge inserted on a by-pass circuit between the drier and the common vacuum circuit.

A partial vacuum is established by means of the water horn, and this only increases when the bubbling caused as the gas is given off gradually comes to a halt.

The vacuum is maintained in the water horn until there is a clear drop in the rate at which the gas is given off; the water horn is then stopped, and the vacuum circuit connected to the vacuum pump, until the pressure gauge indicates a constant pressure of 4 m bar.

The vacuum pump is then stopped and the constancy of the vacuum watched, leaving the pycnometer at reduced pressure - about 4 m bar - until finally no more gas is given off.

The drier is then closed, and the vacuum circuits disconnected. The two-way valve of the drier is opened to allow air to enter, until the pressure is the same as that outside in the laboratory. The pycnometer is removed from the drier and filled completely with the displacement liquid, the capillary being arranged carefully so that it be-



comes filled with the excess liquid; the pycnometer is then placed in a container of water, maintained at a temperature of  $t \text{ } ^\circ\text{C} \pm 0.1 \text{ } ^\circ\text{C}$  for a period of 1 hour, the excess liquid being absorbed by means of a twist of filter paper. The pycnometer is removed from the container, wiped carefully and its weight  $M_3$  determined after a period of 15 minutes.

The complete weight of the pycnometer is determined under the same conditions of time and temperature :

- filled with the displacement liquid, the weight being termed  $M_4$ ,
- filled with distilled water, the weight being termed  $M_5$ .

The density of the displacement liquid at a temperature of  $t \text{ } ^\circ\text{C}$  - in relation to the water at  $4 \text{ } ^\circ\text{C}$  - is given by the following formula :

$$d_3 = \frac{M_4 - M_1}{f(M_5 - M_1)}$$

where  $f$  is the coefficient of correction for bringing the density of the water at  $+7 \text{ } ^\circ\text{C}$  to its value at  $+4 \text{ } ^\circ\text{C}$ .

The values of  $f$  for various temperatures are given in the following table :

Temperature of the water in $^\circ\text{C}$	$f$
15	1.002
20	1.003
25	1.004
30	1.006

The density of the matter in powder form  $d_2$  in relation to the water at  $+4 \text{ } ^\circ\text{C}$  is given by the following formula:

$$d_2 = \frac{d_3(M_2 - M_1)}{(M_4 - M_1) + (M_3 - M_2)}$$

The density  $d_2$  is obtained from the arithmetical average of three readings.

3-21314 - Expression of the volumic rate of matter in powder form

The volumic rate of matter in powder form TVMP is given by the following formula :

$$\text{TVMP} : \frac{P \times d_1}{d_2}$$

3-2132 - Determination of the conventional dry volumic output RVSC.

This comprises the following operations :

- determination of the total volume of the dry film,
- determination of the corresponding volume of the product used.

3-21321 - Determination of the total volume of the dry film,

The volume  $V_1$  of the test sample is determined before applying the covering, by weighing it after having dried it at  $105 \text{ } ^\circ\text{C}$  for 10 minutes and cooling in the drier first in the air, the weight in

grams being  $M_1$ , then immersing it in a displacement liquid, the mass in grams being  $M_2$ , the volumic mass  $d_1$  of the displacement liquid at the testing temperature of  $+23\text{ }^\circ\text{C} \pm 1\text{ }^\circ\text{C}$  is determined by the method indicated in 3-11 of this specification, taking into account, where applicable, the pressure of the air on the liquid contained in the pycnometer; the volume  $V_1$  of the test sample is then :

$$V_1 = \frac{M_1 - M_2}{d_1}$$

The test pieces are then immersed completely in the immersion bath containing about 500 cm<sup>3</sup> of the product suitably homogenised.

The test samples are then taken from the container at a regular speed, drained at a speed of 550 revolutions per minute for 20 to 30 seconds, dried at  $105\text{ }^\circ\text{C} \pm 1\text{ }^\circ\text{C}$  for three hours, and then cooled in a drier.

The volume  $V_2$  of the test sample after painting is determined, first by weighing it in the air, its weight in grams being  $M_3$ , then immersing it in a displacement liquid of volumic weight  $d_1$ , its weight in grams being  $M_4$ , when the volume  $V_2$  of the painted test sample is :

$$V_2 = \frac{M_3 - M_4}{d_1}$$

The volume  $V_3$  in cm<sup>3</sup> of the dry paint film is :

$$V_3 = V_2 - V_1$$

$V_3$  must be between 0,150 and 0,300 cm<sup>3</sup>.

3-21322 - Determination of the volume of products used

The weight per volume  $d_2$  of the product is determined in accordance with the provisions of 3-11.

The content of non-volatile matter NV is determined in accordance with the provisions of ISO / Recommendation 1515.

If  $M_1$  and  $M_3$  are the weights in grams of the test sample before and after painting, the volume  $V_4$  of the test sample corresponding to the volume  $V_3$  of the dry film of paint is given by the following formula :

$$V_4 = \frac{M_3 - M_1}{NV \times d_2}$$

3-21323 - Expression of the conventional dry volumic output

The conventional dry volumic output RVSC is given by the following formula :

$$RVSC = \frac{V_3}{V_4} \times 100$$

3-214 - Expression of the volume of pigment concentration CPV

The volume of pigment concentration is given by the following formula :

$$CPV = \frac{TVMP}{RVSC}$$

The result of the calculation - a number between 0 and 1 - should be expressed to three decimal places.

**3-22 - Determination of the pot life (two-component paints)**

The pot life is determined as follows : a quantity of more than 200 grams of the paint comprising component No. 1 previously homogeneously mixed with component No. 2 in the prescribed proportions, and adjusted where applicable to the application consistency with a suitable solvent, is placed in a tin container 100 mm in diameter and 45 mm in height, maintained at a temperature of  $+ 20^{\circ}\text{C} (1) \pm 2^{\circ}\text{C}$  with a relative air humidity of  $65\% (1) \pm 5\%$ .

The time elapsing between the mixing of the two components and the appearance of the first clots or traces of setting is recorded.

**3-23 - Determination of dilution**

The dilution is determined as follows : the paint to be tested is applied to a panel of steel sheeting with minimum surface dimensions of 30 cm X 30 cm, prepared in accordance with the provisions of 2-211.

After drying under the conditions prescribed in 2-22, and for the times indicated in 3-21 of UIC Leaflet 842-4 and 3-212 of Leaflet 842-5, a coat of the next paint to be applied in the system of protection used, is applied to this film by spraying or with a brush.

(1) Because of the special properties of two-component paints, it is recommended that this test should be carried out at a temperature of  $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$  instead of the standard temperature of  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , and with a relative humidity of  $65\% \pm 5\%$ .

The conditions of application and the appearance of the dry film of this latter coat of paint are examined and recorded.

**3-24 - Determination of drying time**

Drying time is determined as follows :

The paint is applied uniformly with a paint applicator to a glass plate with surface dimensions of 8 cm X 17 cm, prepared in accordance with the provisions of 2-214, so that the thickness of the paint deposited corresponds to the thickness of the dry coat generally prescribed.

The time H<sub>0</sub> of application is noted, and the sample is left to dry under the conditions prescribed in 2-22.

The test should be carried out in diffused daylight, at a temperature of  $+ 23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and with a relative humidity of  $50\% \pm 5\%$ .

**3-241 - Degree of drying 1 : away from dust**

Degree of drying 1 corresponds to a state of dryness where patches of glass measuring about 0,2 mm, spread over the paint film, are completely removed with a fine brush leaving no traces.

The time H<sub>1</sub> corresponding to this condition is recorded.

**3-242 - Degree of drying 2 : dry to the touch**

Degree of drying 2 is determined as follows : a disc of 64 g/m<sup>2</sup> pure cellulose typing paper measuring 22 mm in diameter, with a porosity index of 1 to 5, writing adhesion solution 3 or 4 and a Beck.

smoothness of 20 to 80 seconds, is placed on the paint film; it is covered with an elastomer disc measuring 22 mm in diameter, 5 mm in thickness, and with a Shore hardness of  $50 \pm 3$ . A load of 200 grams is applied to this elastomer disc for 30 seconds.

After this period, the load is removed and the test panel allowed to fall vertically from a height of 50 mm, so that one of its edges strikes perpendicularly against a wooden support. If the paper becomes completely detached under the impact, degree of drying 2 is achieved.

The corresponding time  $H_2$  is recorded.

3-243 - *Degree of drying 3 : apparently completely dry*

Degree of drying 3 corresponds to a state of dryness where the paper disc defined in 3-242 above, applied under the same conditions with a load of 2000 grams for 30 seconds, becomes detached noiselessly.

The corresponding time  $H_3$  is recorded.

3-244 - *Expression of the results*

The differences  $H_1 - H_0$ ,  $H_2 - H_0$ ,  $H_3 - H_0$ , expressed in hours, represent the drying times for the corresponding degrees of dryness.

3-25 - *Determination of the covering capacity on a contrasting surface*

The covering capacity on a contrasting surface is determined by one of the following two methods.

- Method of testing with three coats.
- Method of testing with a tapering coat.

3-251 - *Method of testing with three coats*

The paint is applied with a wet film applicator having a cut-away section about 7 cm in width and 60  $\mu$ m in depth, to a glass panel with minimum surface dimensions of 10 cm  $\times$  30 cm, and prepared in accordance with the provisions of 2-214 in a horizontal position.

When the coat of paint has attained degree of drying 3 defined in 3-243, the painted surface is divided into three equal parts, two of which are given a second coat of paint. When this latter attains degree of dryness 3, one of the two parts is given a third coat. The last two applications are carried out under the same conditions as the first.

When the paint film has reached degree of drying 3, the panel is placed paint downwards on a contrasting card and lit with diffused light.

The thickness of the dry coat needed to make the contrast on the card completely disappear is determined.

3-252 - *Method of testing with a tapering coat*

The paint is applied with a tapering coat to a glass panel with surface dimensions of 8 cm  $\times$  17 cm, prepared in accordance with the provisions of 2-214.

When the paint film has attained the degree of drying 3, the thickness of the coats is measured in accordance with 3-261. The panel is then placed paint downwards on a contrasting black and white card, with a thin film of oil with a high boiling point between, and the minimum thickness of coat needed to cause the contrast to disappear completely is determined.

**3-26 - Determination of the thickness of the coats of paint**

**3-261 - Determination of the thickness of the dry coats of paint**

The methods for determining the thickness of the dry coats of paint are carried out in accordance with the provisions of ISO Standard 2808. They can be mechanical, optical, magnetic, electromagnetic or by eddy currents, depending on the nature of the object; the accuracy of the measuring instruments must be about  $\pm 10\%$ . The roughness of the object must be taken into account, both in choosing the measuring instrument and when making the measurement itself.

If the thickness of the coats of paint is determined for the purpose of a subsequent test, this must be done just before the test is carried out, and as near as possible to where it is to take place. The number of measurements to be made should be adequate, so that the thickness of the dry coat of paint on the surface tested is determined accurately.

The thickness of the dry coat of paint is indicated in  $\mu\text{m}$ .

**3-262 - Determination of the thickness of the wet coats of paint**

The thickness of the wet coats of paint is measured immediately after application.

The measuring apparatus consists of a disc of hardened polished steel 50 mm in diameter, with two external centred and polished working surfaces, and an off-centre polished median surface for measuring the thicknesses of wet coats of paint from 0 to 300  $\mu\text{m}$ . The apparatus is graduated from 0 to 30 on each side. When working on the freshly painted surface, the median surface is wetted with the paint up to the graduation corresponding to the thickness of the wet coat of paint.

The thickness of the wet coat is obtained from the arithmetical average of two measurements.

Other previously graduated pieces of apparatus can also be used for this purpose, such as a measuring card, or any other similar measuring device.

**3-27 - Determination of the tendency to run**

The tendency to run is determined as follows: the paint to be tested is prepared to the necessary consistency of application, and applied under the conditions of normal practice to a test panel with minimum surface dimensions of 70 cm  $\times$  70 cm arranged vertically. This panel consists of the material normally used, and is prepared in accordance with the provisions of 2-21.

The first primer coat is applied immediately to the surface for which it is intended, and dried under the conditions prescribed in 2-22 of this specification. All the other paints are applied directly on their preceding coat immediately in accordance with the approved paint system, after the drying periods laid down in 3-21 of UIC Leaflet 842-4 and 3-212 of UIC Leaflet 842-5 have been observed. Each paint is applied to half the test panel with a paint coat thickness equal to 1.5 times that prescribed in 3-21 of UIC Leaflet 842-4 and 3-212 of UIC Leaflet 842-5.

The behaviour of the paint is then examined.

**3-3 - Methods of testing products in the dry film state.**

**3-31 - Mechanical methods of testing**

**3-311 - Determination of flexibility**

**3-3111 - Determination of the flexibility of the paints**

The flexibility of the paints is deter-

mined in accordance with the provisions of ISO/Recommendation 1519, subject to the following conditions.

The method is applied as an "all or nothing" test

Only type 1 apparatus must be used.

The test panels of polished steel sheeting, measuring 100 mm x 50 mm x 0.3 mm, are prepared in accordance with the provisions of ISO Recommendation 1514.

The paint is applied to the steel panel by means of a film applicator, or after a drying time corresponding to that used in practice for the preceding coats in the paint system in question. These coats must have been applied to the sample panel by the procedure actually used for application to the parts, so that the thickness of the dry paint coat corresponds to the coat thickness prescribed.

The atmospheric conditions during drying are:

temperature: + 23 °C ± 2 °C, relative humidity 50% ± 5%,

and the drying time is 14 days.

The thickness of the various coats is determined in accordance with the provisions of 3-261.

The atmospheric conditions for the tests are:

temperature +23 °C ± 2 °C and 0 °C ± 2 °C, relative humidity 50% ± 5%.

The examination is carried out with a lens that magnifies by x 10.

By agreement between the purchasing Railways and the supplier, a tapering mandrel can be used instead of the cylindrical mandrel.

3-3112 - Determination of the flexibility of the filler coats.

The flexibility of the coatings can be determined by two different methods.

3-31121 - First method

A coat of anticorrosion primer is applied according to current practice to a test panel of steel sheeting measuring 170 mm x 85 mm x 0.5 mm, prepared in accordance with the provisions of 2-211. After a drying time of 24 hours under the conditions prescribed in 2-22, the filler to be tested is applied in a single operation, using an applicator, with a thickness so that, when it has been rubbed down with water with abrasive paper of grain size 150, the remaining thickness is 0.5 mm. The test panel is dried for a period of 14 days under the conditions prescribed in 2-22, and is then placed in the tenons of the bending apparatus, as shown in Appendix 2, where it is secured with a catch. By slowly moving the stirrup, the test sheet is bent over a circular segment 100 mm in diameter. The duration of the bending movement should be about 12 seconds.

The panel is examined with a lens that magnifies by x 10.

3-31122 - Second method

A coat of anticorrosion primer ( surface 1, see Appendix 3) is applied to a test panel of steel sheeting measuring 400 mm × 120 mm × 2 mm, previously shot-blasted and dusted under the conditions prescribed in 2-211, in accordance with current practice over half the panel lengthwise.

After a drying time of 24 hours under the conditions prescribed in 2-22, a filler coat 0.5 mm in thickness is applied with an applicator, both on the painted part and on the unprotected part, with the coating to be tested in the damp state (surface 2, see Appendix 3).

After a drying time of 24 hours under the conditions prescribed in 2-22, another layer of the filler to be tested (surface 3, see Appendix 3) is applied with a thickness of more than 0.5 mm, in the wet state. After a drying time of 24 hours under the conditions prescribed in 2-22, the last coat is rubbed down over a width of about 120 mm (surface 4, see Appendix 3), with water and using abrasive paper with a grain size of 150, until a coat thickness of 0.5 mm is obtained.

After a drying time of 14 days under the conditions prescribed in 2-22, the test panel is placed in the tenons of the bending apparatus shown in Appendix 3, with the covered surface towards the outside. It is then bent for about 12 seconds through 180 degrees continuously round a cylindrical mandrel 100 mm in diameter. Examination is carried out with a lens that magnifies by × 10.

3-312 - Determination of behaviour during shaping

Behaviour during shaping is determined in accordance with the provisions of ISO Recommendation 1520, subject to the following conditions:

The test panel is made of polished steel sheeting, with minimum dimensions of 70 mm × 70 mm × 1 mm, prepared in accordance with the provisions of ISO Recommendation 1514.

The paint is applied with a film applicator to the steel panel or, after a drying time corresponding to current practice, to the previous coats in the paint system in question, which will have been applied to the panel according to the process used in current practice, so that the thickness of the dry paint coat corresponds to the coat thickness generally prescribed. The atmospheric conditions for drying and testing are: temperature + 23 °C ± 2 °C, relative humidity 50% ± 5%.

Drying time is 14 days.

The coat thickness is determined in accordance with the provisions of 3-261.

3-313 - Determination of adhesion

Adhesion is determined in accordance with the provisions of ISO Standard 2409, subject to the following conditions.

The test panel is made of polished steel sheeting measuring 150 mm × 95 mm if possible, and with a thickness of ≥ 0.25 mm, prepared in accordance with the provisions of ISO Recommendation 1514, subject to the following conditions.

The paint is applied with a film applicator to the steel panel or, after a drying time corresponding to current practice, to the previous layers in the paint system in question, which will have been applied to the panel in accordance with the procedure used in current practice, so that the thickness of the dry paint coat corresponds to the coat thickness generally prescribed.

The climatic conditions for the drying and testing are:

- temperature  $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ , relative humidity  $50\% \pm 5\%$ .

Drying time is 14 days.

The thickness of the coat is determined in accordance with the provisions of 3-261.

The apparatus, for cross-cutting is hand operated and consists of a hardened steel cutting tool with a cutting angle of  $30^{\circ}$ .

The gap between incisions is :

- 1 mm for coat thicknesses  $\leq 80\text{ }\mu\text{m}$ ,
- 2 mm for coat thicknesses between  $80\text{ }\mu\text{m}$  and  $120\text{ }\mu\text{m}$ ,
- 3 mm for coat thicknesses  $\geq 120\text{ }\mu\text{m}$ ,

The number of parallel incisions is 6.

### 3-314 - Determination of the impact strength

The impact strength is determined by allowing a given weight to fall from a certain height on to a test piece.

#### 3-3141 - Testing apparatus

The testing apparatus shall consist of :

- a steel base plate with a groove containing a matrix, the diameter of which shall be fixed by the purchasing Railway,

- an impact weight of 900 to 1000 g, with a spherical lower end whose diameter shall be fixed by the purchasing Railway,
- a tube 1 metre long, kept in a strictly perpendicular position in relation to the plane of the matrix, the diameter of which is adapted to guide the falling weight without restraining it. This tube is graduated in centimetres, and its centre line passes through the centre of the matrix.

#### 3-3142 - Preparation of the test piece

The paint system is applied in accordance with the actual conditions of application, to a test panel of 1 mm steel sheeting, prepared in accordance with the provisions of 2-211. This panel is dried for 14 days under the conditions prescribed in 2-22.

The coat thickness of the paint is measured at the point where the test is to be carried out, or as near as possible to it in accordance with the provisions of 3-261.

#### 3-3143 - Carrying out of the tests

The tests are effected with indirect and direct impacts, at a temperature of  $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  and a relative humidity of  $50\% \pm 5\%$ .

##### 3-31431- Tests of resistance to indirect impact

With the test panel placed on the base plate, with the painted side downwards, the weight is allowed to drop on to the test panel from the height prescribed by the purchasing Railway for the paint in question.



The panel is then examined with a lens that magnifies by  $\times 10$ .

3-31432 - Tests of resistance to direct impact

The test panel is placed on the base plate, with the painted side upwards, and the test carried out in accordance with the instructions in 3-31431.

3-315 - Determination of scratch resistance

Scratch resistance can be determined either by the steel point method (Clemen method) or by the pencil scratch method.

3-3151 - Steel point method (Clemen method)

3-31511 - Preparation of the test pieces

The paint to be tested is applied, by spraying or with a paint applicator, to a polished panel of steel sheeting 1 mm in thickness, 125 mm in length and 50 mm in width, prepared in accordance with the procedure indicated in 2-11, 2-12 and 2-3 of UIC Leaflet 842-3.

The thickness of the deposited paint film must be uniform and correspond to the dry coat thickness generally prescribed.

The panel is then dried in diffused daylight for 14 days under the conditions prescribed in 2-22.

3-31512 - Testing apparatus

The testing apparatus shall consist of:

- a horizontal carriage on which the test panel can be fixed,
- a moving lever arm, mounted on a base plate, with on one side the scratching point secured in a mandrel, and on the other side the corresponding counterweight,
- a weight, which can be fixed above the scratching point and capable of attaining at least 2000 grams.

The scratching point shall be of hardened steel with a hemispherical end 1 mm in diameter.

3-31513 - Carrying out of the tests

A razor blade is placed flat on the test panel previously secured to the carriage, and the weighted scratching point pressed on this razor blade under a given weight.

With the carriage moving at a speed of about 3 to 4 cm/second, if the scratching point leaves no trace of scratch on the paint film the test is recommenced, increasing the load by 50 grams each time.

Otherwise, the load is reduced until traces of scratching are no longer visible.

The test in which the paint film is scratched under the effect of the lightest load, is repeated three times on two test panels.

3-3152 - Pencil scratch test

3-31521 - Preparation of the test pieces

The paint to be tested is applied by spraying or with a paint applicator to a panel of steel sheeting 1 mm in thickness, prepared in accordance with the provisions of 2-11, 2-12 and 2-3 of UIC Leaflet 842-3.

The thickness of the deposited paint film must be uniform, as smooth as possible, and correspond to the dry coat thickness generally prescribed.

The panel is then dried for 14 days under the conditions prescribed in 2-22.

To ensure sufficient accuracy of measurement, the paint film must be as smooth as possible, since surface roughness such as that caused by specks of dust or impurities can distort the results. They interfere with the movement of the pencil and thus produce a mark although the force applied is not yet sufficient to cause scratching; these marks should be ignored.

3-31522 - Preparation of the pencils

The test is carried out with a series of "KOH-I-NOOR" pencils manufactured by "HARDMUTH", of hardnesses 6B to B, HB, F, H to 9H. Half a centimetre of the wood surrounding the lead is removed from each pencil. The appearance of the lead must not be affected, it must measure about 5 mm and have a clean-cut circular edge, obtained by rubbing vertically on abrasive paper No. 600.

3-31523 - Carrying out of the tests

A razor blade is laid flat on the test panel previously placed on the tray of a suitable balance. With the trays of the balance level, unless otherwise agreed, an additional weight of 750 grams is placed in the other tray.

The tester chooses a pencil and applies the lead to the razor blade under pressure, so that the trays of the balance are again level; he then moves this pencil over the paint film at a speed of about 10 cm/second, away from him, with the pencil at an angle of 45° to the paint surface and tracing a straight line. Throughout the period of movement of the pencil, the trays of the balance are maintained level to the nearest  $\pm 25$  grams, so that the pressure exerted by the pencil is constant.

When the first pencil has left a trace on the paint, the test is repeated with a pencil with the nearest degree of hardness. The new line traced must then be 5 mm away from the previous one.

The test is continued until two pencils are found with consecutive hardness numbers, one of which still traces a line on the film, while the harder one penetrates the paint film. This change is recognised by the sudden decrease in brilliance of the pencil lines, which can be observed by causing the panel to reflect. The result can be assessed more easily by eliminating the traces of lead with a damp cloth.

3-31524 - Expression of the results

The hardness of the paint film is expressed by the numbers of the two consecutive pencils.

For example, a pencil hardness of 2H - 3H signifies that the 2H pencil still traces a line on the paint film, while the 3H pencil begins to penetrate the film slightly.

### 3-316 - Determination of the hardness

The hardness is determined in accordance with the provisions of ISO Recommendation 1522, subject to the following conditions :

The test panel of polished glass measuring 100 mm  $\times$  100 mm  $\times$  5 mm is prepared in accordance with the provisions of ISO Recommendation 1514.

The paint is applied with a film applicator to the glass panel, after a drying time corresponding to current practice, on the previous coats in the paint system in question, which will have been applied to the panel also in accordance with the procedure used in current practice, so that the thickness of the dry paint coat corresponds to the coat thickness generally prescribed.

The atmospheric conditions for drying and testing are :

- temperature  $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ , relative humidity  $50\% \pm 5\%$ .

Drying time is 14 days.

The coat thickness is determined in accordance with the provisions of 3-261.

The purchasing Railway shall choose between the König pendulum and the Persoz pendulum.

### 3-317-Determination of the resistance to abrasion of paint with high zinc content

#### 3-3171 - Preparation of the test pieces

The test pieces of steel sheeting measuring 200 mm  $\times$  80 mm  $\times$  2 mm are prepared by degreasing and shot-blasting in accordance with the provisions of 2-211, and covered with the paint to be tested, in accordance with the usual application procedures.

Four test pieces covered in this way are then dried, under the conditions prescribed in 2-22, for a period of 14 days. Two of these test pieces are then subjected to the test for resistance to abrasion, while the other two are aged for a period of 6 months in accordance with the provisions of 3-334.

#### 3-3172- Apparatus

The test apparatus shall consist of a vertical cylinder 46 mm in diameter and 2.5 m in length, with an opening at each end.

#### 3-3173 - Carrying out of the tests

With the test panels arranged on a support sloping at  $45^{\circ}$  in relation to the vertical, and as near as possible to the lower opening of the cylinder, 5 kg of abrasive material, consisting of silicon gravel with a grain size of 10/16 mm are allowed to fall across the cylinder. The test is carried out at two different places on each test piece. The first two test pieces submitted to this test are then kept in a steam bath for 7 days. The other two test pieces, previously exposed to

bad weather for 6 months under the conditions prescribed in 3-334, are then subjected to the abrasion tests and steam bath under the same conditions.

3-3174 - Expression of the results

The result of the tests is obtained by examining the best three surfaces in each case.

*3-32 - Methods of testing the visual characteristics*

*3-321 - Determination of the tension, colour and brilliance*

The paint to be tested is applied to a square test panel of steel sheeting, with minimum dimensions of 70 cm x 70 cm, rubbed down and degreased in accordance with the provisions of 2-211.

The method of application and thickness of the paint film deposited must correspond to those for current use of the paint in question. After 96 hours of drying, under the conditions prescribed in 2-22, the panel is examined in diffused daylight to detect any surface defects, and compared to reference panels for tension, colour and brilliance.

*3-33 - Methods of testing the physical and chemical characteristics*

*3-331 - Determination of the resistance to artificial ageing*

The complete paint system or, where applicable, each of the coats making up this system, with coat thicknesses corresponding to those used in practice, is applied to a test panel of polished steel

sheeting prepared in accordance with the provisions of 2-11, 2-12 and 2-3 of UIC Leaflet 842-5, or to a test panel of the material to which the paint is to be applied, prepared in accordance with the provisions of 2-21. The individual coats are applied observing the drying times prescribed in 3-21 of UIC Leaflet 842-4 and 3-212 of UIC Leaflet 842-5.

The test panel is then dried again for 14 days under the conditions prescribed in 2-22, before being placed in accelerated ageing equipment approved by the purchasing Railway, where it is subjected to the number of cycles of exposure fixed by the purchasing Railway.

If the resistance to hair-line corrosion is to be determined at the same time as the resistance to artificial ageing, two incisions in the form of a cross, about 10 cm in length, through to the bare metal, are made just before the test panel is placed in the accelerated ageing equipment.

*3-332 - Determination of the resistance to salt mist*

A test panel of the same material as that used in practice, prepared, painted and dried in accordance with the provisions of 3-331, is placed in a glass container fitted with a cover, maintained at a temperature of  $\pm 35^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , into which a salt solution mist is sprayed uniformly with a concentration of  $5\% \pm 1\%$  unless otherwise stipulated by the purchasing Railway.

If the resistance to hair-line corrosion is to be determined at the same time as the resistance to salt mist, two incisions in the form of a cross are made, in accordance with the provisions of 3-331, just before the test panel is placed in the glazed container.

3-333 - *Determination of resistance to on-and-off cooling*

A test panel of the same material as that used in practice, prepared, painted and dried in accordance with the provisions of 3-331, is subjected on a weekday to a temperature of -20°C, for two periods of 3 hours, separated by an interval of at least 2 hours, during which the panel is placed in the water at ambient temperature.

The duration of this test shall be fixed by the purchasing Railway,

3-334 - *Determination of the resistance to natural ageing*

The complete paint system or, where applicable, each of the coats making up this system, with the coat thicknesses corresponding to that used in practice is applied to a test panel of steel sheeting at least 2 mm in thickness, prepared by shot-blasting in accordance with the provisions of 2-11, 2-12 and 2-3 of UIC Leaflet 842-3 to obtain a roughness Sa3, or to a test panel of the material to which the paint is to be applied, prepared in accordance with the provisions of 2-21.

The individual coats are applied keeping to the drying times prescribed in 3-21 of UIC Leaflet 842-4 and 3-212 of UIC Leaflet 842-5. The test panels must have a minimum surface area of 600 cm<sup>2</sup>, with their shortest edge not less than 15 cm.

The test panels are dried for 14 days under the conditions prescribed in 2-22, and are then placed, in the spring, on a support, and exposed to atmospheric influences, with their surface sloping at 45° towards the equator.

The test panels are examined at least every 6 months; to assess their resistance. The minimum duration of the test is one year.

If the resistance to hair-line corrosion is to be determined at the same time as the resistance to salt mist, two incisions in the form of a cross are made, in accordance with the provisions of 3-331, just before exposure to the atmospheric influences.

3-335 - *Determination of the resistance to chemicals*

3-3351 - *Preparation of the test panels*

The paint to be tested is applied to a steel test panel with a surface measuring 100 mm x 150 mm, observing all the conditions (thickness, method of application, etc.) usually prescribed. The test panel thus protected is dried for 14 days under the conditions prescribed in 2-22.

3-3352 - *Chemicals for testing*

The chemicals for testing are :

- acids - sulphuric acid with a concentration of 3%,  
acetic acid with a concentration of 5%,
- bases - caustic soda with a concentration of 1%,  
caustic soda with a concentration of 2%,

Other products may be stipulated by the purchasing Railway.

3-3353 - *Methods of testing*

3-33531 - *Method of testing with a check every quarter of an hour.*

0.15 ml of chemical is dripped on to the test panel that is arranged horizontally. After a quarter of an

hour, the residue is carefully eliminated and the surface wiped, the appearance and condition of the latter being examined in comparison with an untested reference surface.

3-33532 - Method of testing with a check after 24 hours

Glass rings with an inside diameter of 15 mm and 15 mm in height are placed on a test panel arranged horizontally and cotton wool soaked in the chemicals is placed in the rings, which are covered with plates of glass for 24 hours. At the end of this period, the whole device is removed and the wiped surface compared from the point of view of appearance and condition to an untested reference surface.

The purchasing Railway may stipulate test procedures and a different period of exposure.

3-336 - Determination of resistance to washing

The paint to be tested is applied to test panels, observing all the conditions normally prescribed, such as thickness, method of application, etc. These painted panels are then dried for 14 days under the conditions prescribed in 2-22, before being placed in a testing apparatus, in which the paint can be stressed mechanically with a natural sponge in good condition, weighing 10 to 12 grams per cm<sup>2</sup>, and wetted with a 1% solution of soft soap at a rate of 2 drops per second. This sponge makes 40 to 60 to and fro movements per minute, over a length of 18 to 20 cm. After 10 000 movements to and fro, i.e. about 3 hours of testing, the test piece is rinsed in water and dried.

The surface subjected to the test is compared to a reference surface, in order to determine any differences in appearance and structure.

3-337 - Determination of water resistance

3-3371 - Dispersion paints

The paint to be tested is applied to the test panel observing all the conditions generally prescribed in practice, such as thickness, method of application, etc.

After the drying time fixed by the purchasing Rail way and carried out under the conditions prescribed in 2-22, the test panels are sprayed with water for 2 hours, and dried with a pad of cotton wool with a surface area of about 10 cm<sup>2</sup>, weighted down with about 1 kg. When examined, the pad must show only slight trace of colour from the paint.

3-3372 - Fillers

A test panel of steel sheeting with minimum unit volume dimensions of 200 mm × 100 mm × 1 mm, is covered with a coat of suitable priming paint, followed by a filler coat 0.5 mm in thickness applied with a knife.

The panel is dried for 7 days under the conditions prescribed in 2-22, and its lower half immersed vertically for 24 hours in distilled water maintained at a temperature of  $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . When comparing the wet and dry parts by scratching with a finger-nail, it is possible to judge whether swelling or softening has occurred, and the height reached by the water inside the filler coat is determined in relation to the immersion level.

3-33721 - Expression of the results

The quality classification is as follows :

Very good : Water risen up to 1 mm above the surface of the water, without swelling or softening.

Good : Water risen up to 1 mm above the surface of the water, involving no appreciable loss of hardness; the nail mark under a pressure of 1 kg must only attain a depth on the wet surface about double that of the dry surface. When rubbed with a finger, the paint must not run.

Passable : Water risen to a height of 2 mm at the most, and/or slight softening when scratched with a finger-nail, with paint running slightly when rubbed with a finger.

Mediocre : Water risen to a height of more than 2 mm, and / or softening when scratched with a finger-nail, with the paint running when rubbed with a finger nail.

3-338 - Determination of heat resistance

Ten test panels of steel sheeting, measuring 3 cm X 10 cm, are covered with paint, observing all the conditions of application usually prescribed; they are then dried to degree of drying 3 prescribed in 3-243. The thickness of the dry paint coat is measured in accordance with the provisions of 3-261.

The test panels are heated to a temperature fixed by the purchasing Railway, and maintained to within  $\pm 2\%$ , in an electrically heated muffle furnace with 2 air inlets:

Every 100 hours, a test panel shall be taken out of the muffle furnace and its surface compared with that of an unheated reference panel. The time taken for the paint to deteriorate is recorded.

3-339 - Determination of the suitability for welding

3-3391 - Arc welding

The small plates of steel sheeting measuring 500 mm X 50 mm for fillet welding, and 250 mm X 125 mm for butt weld-

ing, of the same thickness as that prescribed for construction purposes, are covered with a paint coat suitable for welding, for testing; the thickness of the dry coat must conform to that prescribed in 3-21 of UIC Leaflet 842-4 and 3-212 of UIC Leaflet 842-5.

After a drying time of 48 hours under the conditions prescribed in 2-22, the small plates are assembled applying the methods of the welding process(es) prescribed for construction.

After assembly, the test pieces are dried for 14 days under the conditions prescribed in 2-22, and then subjected to a visual examination, and to a fracture test in the case of fillet welding, and to a fracture test or radiographic examination in the case of butt welding.

3-3392 - Spot welding

The small plates of steel sheeting measuring 250 mm X 8 W, where W is the weld run in mm prescribed in the construction, and the thickness of which is that prescribed for the construction (see Appendix 4) are covered with a coat of paint suitable for the welding to be tested; the thickness of the dry coat must conform to that prescribed in 3-21 of UIC Leaflet 842-4 and 3-212 of UIC Leaflet 842-5.

After a drying time of 48 hours under the conditions prescribed in 2-22, the test pieces are assembled by the spot welds. The welding parameters prescribed for the construction should be respected.

After assembly, the test pieces are dried for 14 days under the conditions prescribed in 2-22, and then subjected to a visual examination and a stripping test.

3-3310 - Checking of the continuity of the coating

The continuity of the paint system coating of a metal article is checked by means of a continuous electric current.

3-33101 - Apparatus

The apparatus shown in Appendix 5 consists of :

- an electric torch with a 4,5 volt battery and bulb,
- an electrical flex 1 connecting one of the terminals of the battery on an earth connection,
- an electrical flex 2 connecting the other terminal of the battery to a copper pulsator 3 through the bulb.

3-33102 - Modus operandi

The modus operandi consists of making a free contact between the flex 1 and the metal article by tightening the adjustment screw 4 of the earth connection, until it goes through the coating, and moving the pulsator 3 under slight pressure over the entire surface of the coating. When the paint does not completely cover the metal parts, the electric circuit is established and the bulb lights up.

**4 - TEST REPORT**

The test report must specify :

- the method of testing applied, and, where applicable, the apparatus used for the tests,

- a complete description of the paint,
  - the method of application of the paint,
  - waivers allowed by the purchasing Railway as an exception as regards the methods of testing,
  - specific details specifying the test methods applied,
  - the test results,
  - the date of the test,
-



DETERMINATION OF THE VOLUME OF THE DRY COAT  
FROM A GIVEN VOLUME OF LIQUID PAINT

CALIBRATION DEVICE

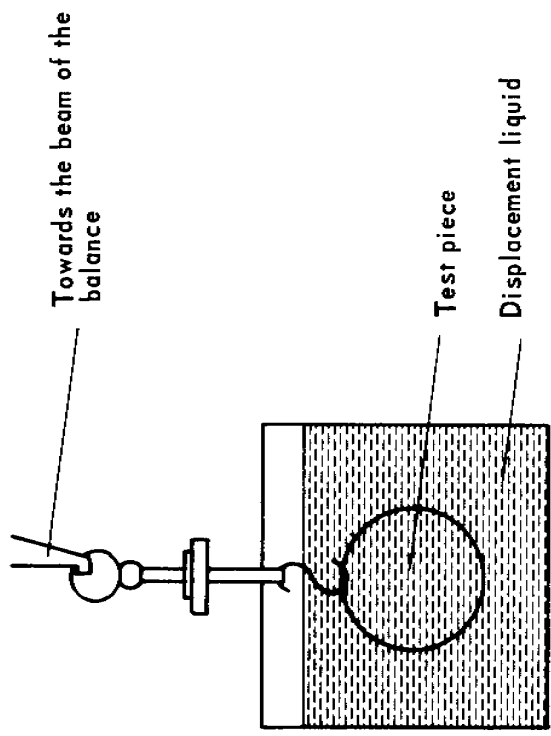


Fig. 1

DRAINING DEVICE

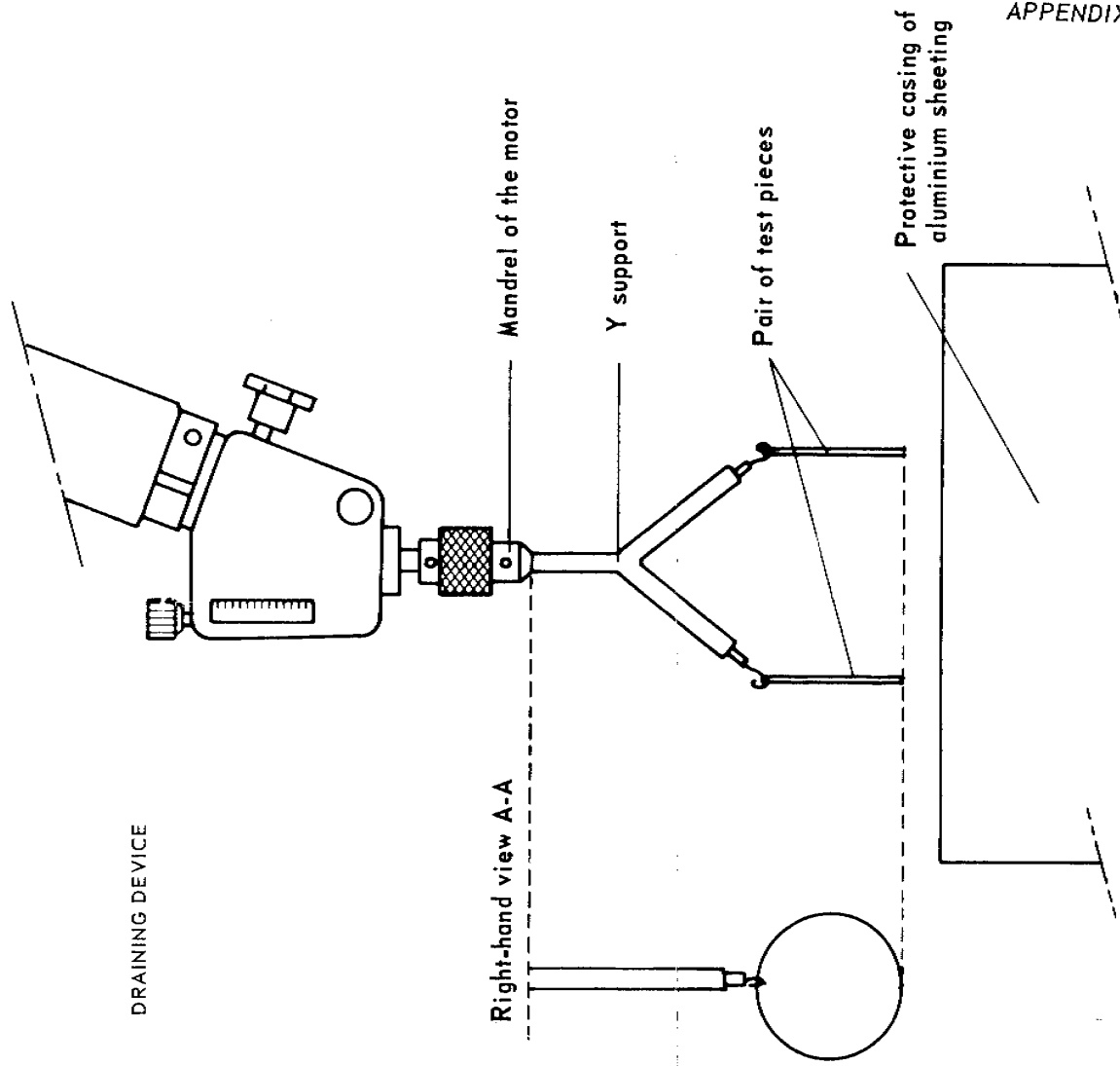
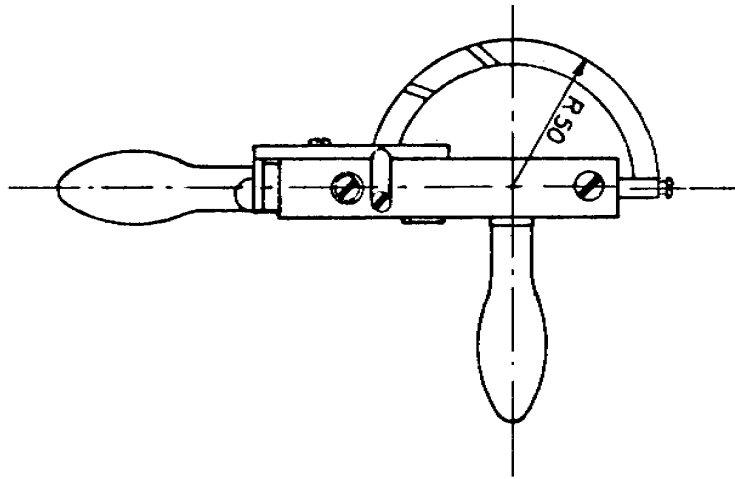


Fig. 2

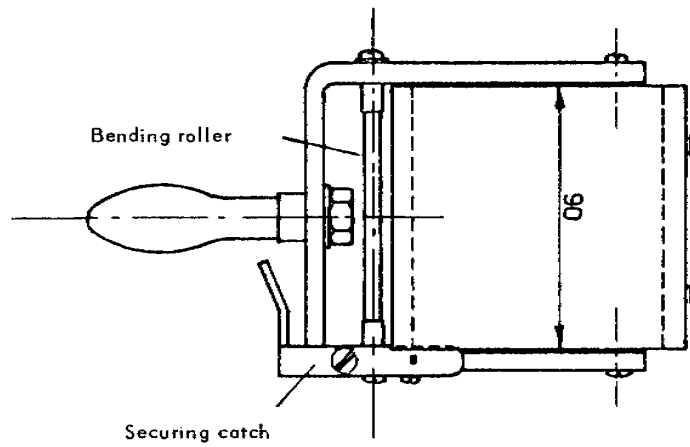
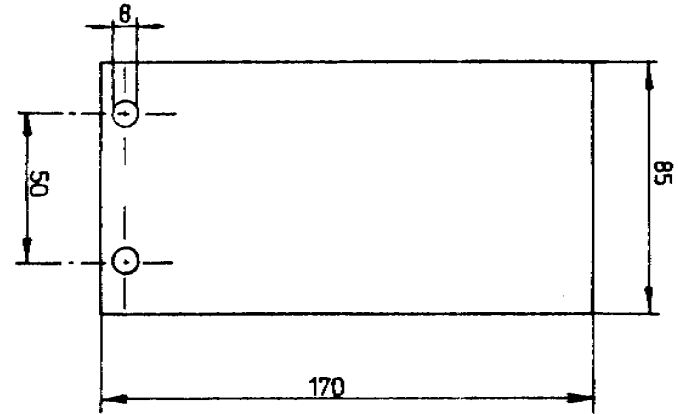
FLEXIBILITY TEST FOR FILLER COATS

TEST APPARATUS

Bending apparatus for testing fillers



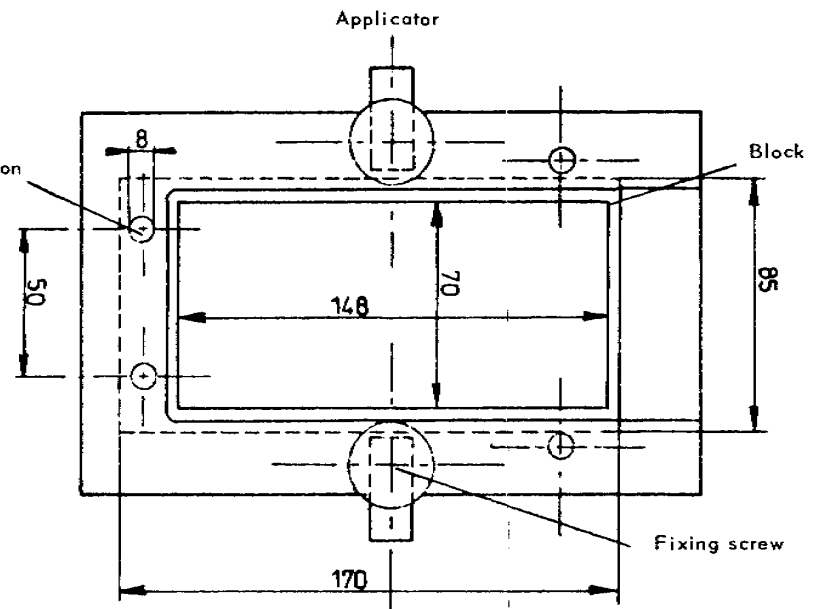
Test plate



Retaining tenon

Bending roller

Securing catch



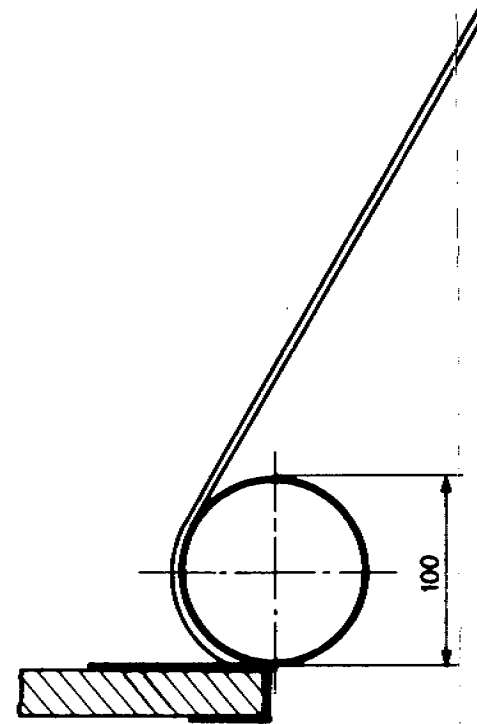
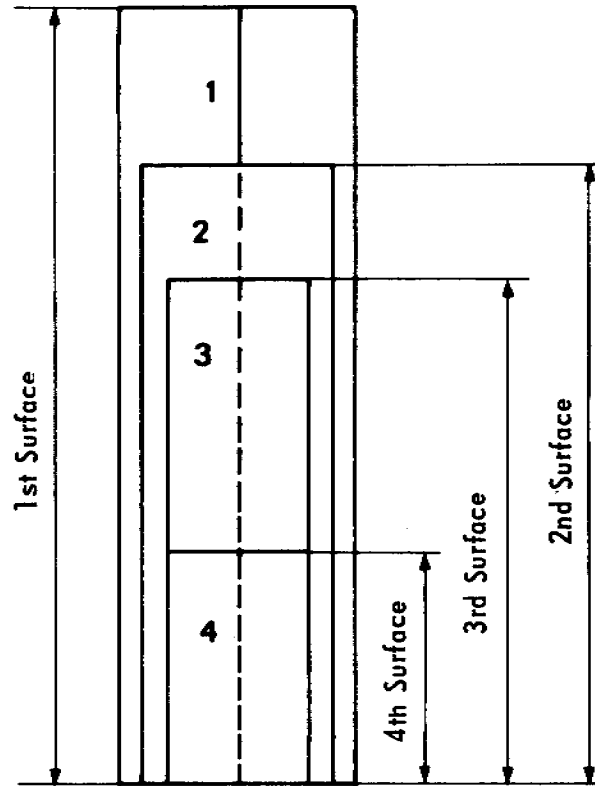
Applicator

Block

Fixing screw

FLEXIBILITY TEST FOR FILLER COATS  
TEST APPARATUS

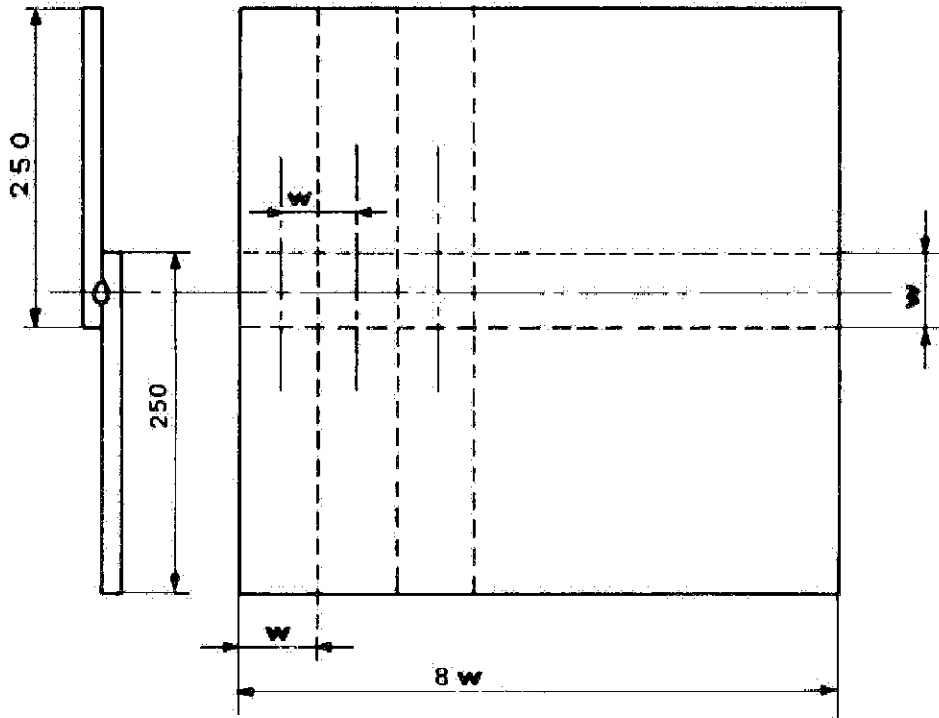
842-2  
R  
APPENDIX 3



DETERMINATION OF SUITABILITY FOR WELDING

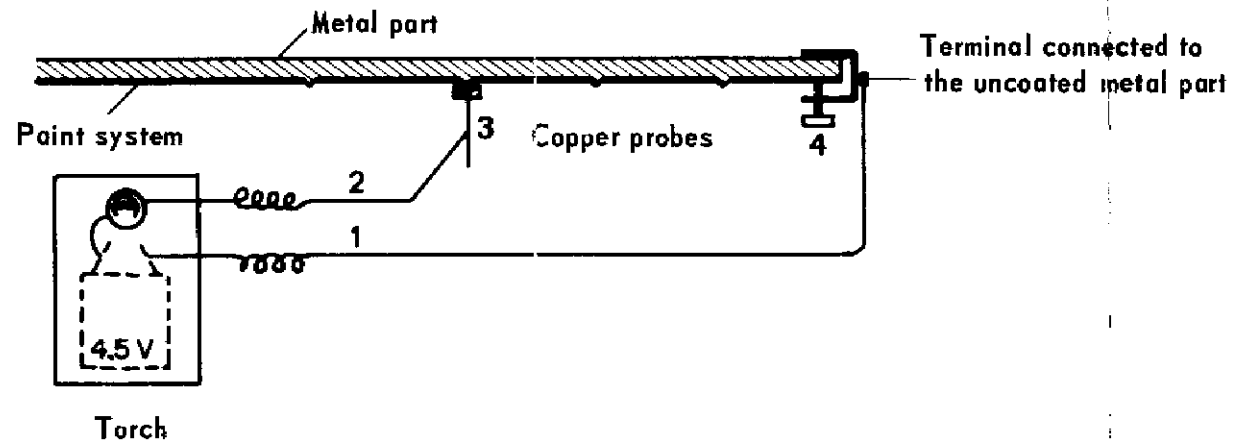
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Test panel for spot welding



CHECKING OF THE CONTINUITY OF THE COATING

TEST APPARATUS



APPLICATION

All Railways in the Union.

RECORD REFERENCES

*Headings under which the question has been dealt with :*

- Preparation of specifications for paints for wagons,  
(5th Committee, R.S. : Paris, June, 1957).

- Preparation, in relation to the results of tests and bases for study obtained elsewhere, of specifications for :

a) Paints for coaches (after updating of documents Nos. 1 and 2 of the ORE E- 17 Committee of Experts);

b) ..... c) ..... d) ..... e) .....

(5th Committee, Traction and Rolling Stock ; Budapest, June 1958).

- Preparation of specifications for paints for vehicles,  
(5th Committee, J.Q. : Portsmouth, May, 1962).

- Preparation of specifications for paints for vehicles,  
(Sub-Committee for Specifications : Paris, January, 1975).