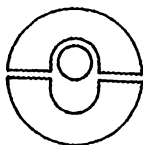


INTERNATIONAL



UNION OF RAILWAYS

U I C CODE

Leaflet to be classified in Volumes :

V - TRANSPORT STOCK

VIII - TECHNICAL SPECIFICATIONS

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**TECHNICAL SPECIFICATION
FOR METHODS FOR TESTING
PAINT PRODUCTS**

(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.

R**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 $12 \mu\text{m} < Ra < 13,5 \mu\text{m}$ corresponding to: $40 \mu\text{m} < Rt < 45 \mu\text{m}$.

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 $+ 23^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 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 cm³ 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 °C and 25 °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 $+ 105^{\circ}C \pm 2^{\circ}C$.

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 $+ 23^{\circ}C \pm 0,5^{\circ}C$ 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 100µm are permissible.

3-15 - Determination of stability during storage

Original containers intended for testing, kept closed, are stored at a temperature between + 5 °C and + 30 °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 $- 20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

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

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:

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

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

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 m/sec² 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 °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. etherophthalic 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,

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

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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 $t^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ 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 $t^{\circ}\text{C}$ - in relation to the water at 4°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 $+7^{\circ}\text{C}$ to its value at $+4^{\circ}\text{C}$.

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