



U I C CODE

Leaflet to be classified in Volumes :

V - TRANSPORT STOCK

VIII - TECHNICAL SPECIFICATIONS

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TECHNICAL SPECIFICATION
FOR THE PROTECTION AGAINST CORROSION
AND PAINTING OF COACHES
AND TRACTIVE UNITS

**NUMERISATION DANS
L'ETAT DU DOCUMENT**

(Reprint, 01-11-1989)

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1 - PURPOSE

1-1 - Nature of the work

This specification defines the paint products, systems and methods to be used for the protection against corrosion and painting of rolling stock other than wagons and containers.

These provisions shall apply to single components, sub-assemblies and assemblies used in the construction of a vehicle and also to complete vehicles.

This specification applies to the following vehicles :

- standard coaches,
- special coaches,
- luggage vans in passenger trains,
- electric locomotives,
- Diesel locomotives,
- light rail motor tractors,
- electric motor coaches, vehicles with reversible driving cabs, and trailers of electric motor train units,
- railcars, vehicles with driving cabs and trailers of thermal engine trainsets,
- service vehicles,

This specification defines the minimum requirements to ensure the protection of passenger coaches and motor units for a suitable length of time.

1-2 - Classification

The work of anti-corrosion protection and painting of rolling stock shall consist of :

- preparation of the surfaces before painting,
- application of the paints,
- lettering and markings.

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,
- 842-2 : Methods for testing for paint products,
- 842-3 : Surface preparation of metallic and non-metallic materials used in the construction of railway vehicles and containers,
- 842-6 : Quality inspection of paint systems for railway vehicles,
- 842-7 : Recommendations for the design, methods of assembly and selection of the materials for the construction of passenger rolling stock built of metal,
- ISO/R 1461 : Hot galvanizing on iron products,
- ISO/R 2085 : Treatment of metal surfaces -
Anodizing of aluminium and alloys,
Inspection of the continuity of thin coats,
copper sulphate test,

- ISO/R 2128 : Treatment of metal surfaces.
Anodizing of aluminium and its alloys.
Measuring of the thickness of oxide coatings.
Non-destructive method by optical section microscope.

2 - MATERIALS

2-1 - Paints

The products to be used for painting are given in Appendices 1 to 4. They must conform to the provisions of UIC Leaflet 842-1.

This conformity shall be checked by applying the test methods described in UIC Leaflet 842-2.

The system of protection of a vehicle or vehicle component may normally include only products from the same supplier. This clause may be waived only with the prior agreement of the purchasing Railway.

~~2-19~~ - Suitability of the products

Before use, the paints and auxiliary agents must have passed, not only checks and tests completed in accordance with the provisions of UIC Leaflets 842-1 and 842-2 at the manufacturer's works and by the laboratories, but also the test of suitability for application described in Appendix 5.

Materials which do not comply with the conditions of this final acceptance test must not be used.

2-13 - Compatibility of the products

For systems of protection where the top coat is a bituminous solution or a thermal and sound insulating product, the mutual compatibility of all the paints and insulating materials must be checked.

2-3 - Anodized light alloy parts

Anodized light alloy parts are not generally painted. The thickness of the anodized coats is measured in accordance with ISO Standard R 2128, and must be greater than 15 μ m.

In addition, its thickness must be verified in accordance with ISO Standard R 2085 and must be continuous.

2-4 - Galvanized parts

Galvanized parts must meet the requirements of ISO Recommendation R 1461.

3 - PROVISIONS RELATING TO PROTECTION AGAINST CORROSION AND THE APPLICATION OF THE PAINTS

3-1 - Preparation of the surfaces before application of a paint

3-11 - Preparation of surfaces before application of a first coat

Before application of the first coat of paint, the surface must be prepared in accordance with the provisions of UIC Leaflet 842-3.

3.12 - Preparation of surfaces during application

Those parts of surfaces already painted, which become soiled with grease, weld spatter, condensation, etc., should be cleaned and degreased, using a solvent compatible with the product already applied, before any fresh application of paint, in order to ensure that the following coats are applied under satisfactory conditions.

3-2 - Application of the paint systems

3-21 - Paint system, process and thickness of the coats

3.211 - Paint system and process

The products used and the process adopted to provide the system of protection of the various types of vehicles and their component parts, are given in Appendices 1 to 4.

Any modifications to these processes must be approved by the purchasing Railway.

3-212 - Thickness of the layers and drying time

The thickness of the dry film and the drying times of the various protective products are given in Appendix 5.

During application, the builder must check the thicknesses of the wet film, to avoid rejection when the vehicle is finished. The thicknesses of the wet film must be fixed by the purchasing Railway.

The limit values of the dry film, shown in the table in Appendix 5 for each coat of paint, must not be exceeded either above or below. The total thickness when dry of the complete system adopted by the purchasing Railway, must not be less than the values shown in Appendix 5 (see 6.1).

These total thicknesses when dry shall apply equally in the case of systems with one or more coats.

3-213 - Parts which have been given an anti-corrosion priming coat before transport and storage

When components made of sectional or sheet steel have been coated with anti-corrosion primer before transport and storage, this coat shall not be taken into consideration in the system of protection to be applied.

In the case of doubtful adherence or risk of incompatibility of the anti-corrosion priming coat with the following coats, the existing coat must be completely removed.

Temporary protective products must be removed, unless they are compatible with the other paints of the protective systems.

The same applies to the painting of other types of parts, irrespective of their origin.

3-22 - Colours

3-221 - Colours of products forming the system of protection

Unless otherwise stipulated, the products forming the system of protection must be of different colours.

3-222 - Colours of top coats

The colours of top coats must conform to those indicated by the purchasing Railway.

Components not included specially in the order or its appended documents, except those mentioned in 3.251, must be painted in the same colour as the surrounding area when they are painted.

3-23 - Technical conditions of application

3-231 - Atmospheric conditions of the painting premises

The application and drying of the various coats of paint must be completed in a dust-free atmosphere, and the ambient temperature and that of the object to be painted must not be less than + 12°C. When two-component paints are used, this temperature must not be less than + 18°C.

In all cases, the relative humidity in the paint shop must not be greater than 75%.

The vehicle must not be taken outside while the successive coats of the system of protection are being applied. However, when this working procedure is not possible, and if the purchasing Railway so authorises, vehicles may be placed outside between the application of two successive coats of paint, but provided that the paint has reached the point where it is "dry to the touch" defined in 3-242 of UIC Leaflet 842-2.

3-232 - Stirring and straining of the paint

The paint must be stirred before being decanted. If mechanical agitators are used, the formation of air pockets must be avoided.

In cases where the purchasing Railway accepts products with a flash point of less than + 21°C, as a concession, the builder must take all the necessary safety measures.

After stirring and after making up the mixture in the case of two-component paints, the materials must be strained to ensure smooth working and a good quality of application.

3-233 - Application processes

One or more of the processes listed below must be used to apply the coats of paint. These processes must be approved by the purchasing Railway :

- spraying by air gun, if necessary with heating of the paint or one of its components,
- electrostatic spray,
- spraying with high pressure equipment without air (Airless system), if necessary with heating of the paint or one of its components.

When two-component products are used, account must be taken of the prior reaction times and the "pot life" indicated by the paint supplier.

Any prior reaction time, any inaccuracy in the proportion of the mixture and any air infiltration can be avoided by using a device enabling the mixing of the two components to take place directly as soon as the spray leaves the gun.

Small parts can also be treated by a dip process, provided that the paint to be applied consists of one component only.

3-24 - Details relating to paint products in general

3-241 - Reactive priming paints (wash primer)

Reactive priming paints (wash primer) are delivered as materials in either one or two separate components. Except for the special indications in Appendices 1 to 4, two-component reactive priming paints (wash primer) should be used.

Generally speaking, reactive priming paints (wash primer) consist of a polyvinylbutyral based binder, zinc chromate based pigments, and free phosphoric acid in organic solution. In the case of reactive priming paints delivered as two separate components, the dissolved free phosphoric acid constituting one of the components is added to the other component in the proportion prescribed, just before application. The chemical reaction of the mixture begins immediately after addition of the catalyst. (Even the metal object to be painted participates in the reaction, thus giving very good adhesion).

One-component reactive priming paint (wash primer) must be delivered ready for use.

Two-component reactive priming paint (wash primer) must be used in accordance with the instructions supplied by the manufacturer.

3.242 - Zinc powder paint

Zinc powder paint is an anticorrosion priming paint for steel structures. It can be applied in one or two coats, without a finishing paint. It is also used for assemblies (steel/steel) where spot welding is employed, but which are not sealed. The prescribed thinner must be used to obtain the correct spraying consistency.

3-243 - Zinc chromate anticorrosion priming paint.

Zinc chromate anticorrosion primer is the standard anticorrosion priming paint. It exists in the form of one or two components. To obtain the correct consistency for use, the specific thinners prescribed for the respective binders (alkyd resin, epoxy resin, polyurethane resin) must be used. With regard to the two-component paint, see also 3-247 (two-component paint). Unless otherwise agreed beforehand by the purchasing Railway, two-component paints may not be applied to anticorrosion priming paints with an alkyd resin base.

3-244 - Alkyd resin paints

Alkyd resin paints are delivered ready for use. For painting by spraying, white spirit or another suitable solvent is generally used to obtain correct consistency for application. The same applies for obtaining the correct application consistency for painting by other methods.

3-245 - Bituminous paints

Bituminous solutions are delivered ready for use and must not be diluted. In the case of thickening of the product due to storage at low temperature or for a prolonged period, the paint should be heated in a water-bath before application, at a temperature of + 30 to 35°C.

Bituminous emulsion is delivered ready for use. The paint may only be diluted with water in a maximum proportion of 2%, in the event of thickening due to prolonged storage.

3-246 - Dispersion paints

Dispersion paints, intended for the painting of the insides of vehicle bodies and for separation purposes when inscriptions are to be placed on bituminous paints, are applied

as delivered. In the event of thickening due to prolonged storage, they can be diluted with water in a maximum proportion of 2%. Dispersion paints intended for the painting of the outsides of vehicle bodies are delivered ready for use. To obtain the correct spray, the paint is diluted, if necessary, with water in a maximum proportion of 2%.

3-247 - Epoxy or polyurethane resin based two-component paints

Epoxy or polyurethane resin based two-component paints are products which are generally not delivered ready for use. They consist of a basic component and a hardening agent which must be mixed before use in a prescribed proportion. The instructions of the manufacturer must be observed when mixing and using these products.

To obtain the correct consistency for use, a special thinner must be used.

The chemical reaction of the mixture begins immediately after the addition of the hardening agent. The service life in the paint pot - i.e., the time elapsing between suitability for application of the base-hardening mixture until thickening occurs - varies according to the composition of the product and the manufacturer's. Application must cease as soon as the "pot life" indicated by the manufacturer is exceeded.

The paint prepared in this way may only be applied after elimination of air introduced when mixing the two components. Generally speaking, a waiting time of 30 minutes is sufficient. This waiting time is eliminated when the paint is mixed away from the air (gun with two heads, equipment with a premixing chamber).

3-248 - Aluminium paint

Aluminium paint is delivered ready for application. When the paint is to be applied by spraying, it is brought to the required spraying consistency by using a suitable thinner. Due to

its tendency to settle, it must be stirred continually even during use.

3-249 - Coverings applied as a thick coat

Thick coverings consist of two-component products with a polyester, epoxy resin or polyurethane base, used to fill the largest hollows.

They are in the form of a base and a hardener, which when mixed, give a coating ready for use without adding any thinner.

These thick coatings must be prepared and used in accordance with the instructions of the manufacturer.

3-2410 - Smoothing coatings

To correct defects in the surface smoothness in the paint on the outside of vehicle bodies, only two-component smoothing coverings with a base of polyester resin, epoxy resin or polyurethane are allowed.

When preparing the smoothing covering, the proportions of components fixed by the manufacturer and the pot life must be observed.

Depending on the particular provisions of the purchasing Railway, the smoothing coating shall be applied in successive coats with a knife or gun as indicated in Appendix 5. The builder must ensure, before applying a coat, that the previous coat is "hard" dry.

After rubbing down the smoothing coverings, the water used for rubbing down and rinsing must be removed from uneven points where it has accumulated, by means of dry oil-free compressed air.

Following coats may not be applied until after complete evaporation of the water used for rubbing down and total drying of the surface.

Coverings with an alkyd resin base can also be used for interior painting work.

These coverings are delivered ready for use. The conditions of application, drying and rubbing down of these coverings are identical to those of the coverings used for exterior painting.

3-2411 - Varnish

Varnishes with a base of polyester resins or acid-hardening polyurethane resins are not generally delivered ready for use.

The rulings applicable to them are the same as those contained in 3-247.

3-2412 - Products for thermal and acoustic insulation

Liquid products for thermal and acoustic insulation must be prepared and used by observing the instructions of the manufacturer. These products may only be applied to a complete paint system which is absolutely dry, consisting of a coat of anti-corrosion priming paint, where applicable an intermediate coat and a top coat.

Direct application to a coat of anti-corrosion priming paint is tolerated when the insulation characteristics and the finishing qualities of the product are verified by tests of long duration.

Insulating products with a dispersion base must not be applied to bitumens, or to mist-type sprays.

These products are delivered ready for use. In the event of thickening due to prolonged storage, depending on their nature they may be thinned in a maximum proportion of 2%, with water or a suitable solvent.

The thickness of the wet coats must allow a thickness of 10 mm of the dry coats to be obtained.

The insulating coat must be completely dry before facings or top coats are applied.

Solid products for thermal and acoustic insulation must be applied to a complete paint system which is absolutely dry.

When dispersion-based soundproof products are applied to the underframe, a protective paint must be applied after drying is complete.

Any zones of application, and the thickness of the insulating products, must be specified in the order or its appended documents by the purchasing Railway.

3-25 - Provisions to be observed during construction

3-251 - Surfaces and parts not to be painted

The following surfaces and parts must not be painted :

- sides of tyres or rims of solid wheels,
- running surfaces of wheels,
- brake-blocks, shoes and brake discs,
- rigging components requiring greasing,
- front faces of buffers,
- functional components which are threaded, sliding or telescopic,
- parts made of elastomers,

and, at the request of the purchasing Railway :

- axles,
- centres of solid wheels,

These surfaces and parts must be protected against any splashes of paint.

3-252 - Painting of parts in contact in overlapping zones of assemblies

The painting of parts in contact in overlapping zones of assemblies :

- steel/steel,
- steel/stainless steel,

- stainless steel/stainless steel,
- light alloy/light alloy,
- light alloy/steel (see 3-254).

spot welded or not continuously welded, shall be carried out in accordance with the provisions of UIC Leaflet 842-3.

In order to prevent the penetration of dampness, gaps existing between superimposed components and two consecutive spot welds must be filled with paint or with an insulating spray product approved by the purchasing Railway, the whole then being covered with the prescribed coats of paint, applied to ensure perfect sealing of the joint.

When this process cannot be used, sealing of the assembly must be ensured by means of a suitable product approved by the purchasing Railway.

3-253 - Painting of sealed welded assemblies

In the case of sealed welded assemblies, the coat of anti-corrosion priming paint must only be applied after welding is completed.

3-254 - Painting of mixed steel/light alloy assemblies

In the case of mixed steel/light alloy assemblies, the contact surfaces, previously covered with a coat of reactive priming paint (wash primer), shall be given a coat of anti-corrosion priming paint and waterproof insulating compound.

Light alloy rivets must only be given the coat of reactive priming paint (wash primer).

3-255 - Painting of galvanized parts

Generally speaking, galvanized parts are not painted. Otherwise, they must first be given a coat of epoxy resin priming paint or reactive priming paint (wash primer).

After welding of galvanized parts, damaged sections must be shot-blasted or brushed mechanically and covered with a coat of zinc powder paint. The minimum thickness of the dry coat is 40 μ m.

3-256 - Painting of monocoque parts, hollow sections and tubing

Monocoque parts, hollow sections and tubing, except those for compressed air piping systems and electric cables, must, unless otherwise stipulated in Appendices 1 to 4, and if they have not been sealed by welding, be given a coat of anti-corrosion priming paint inside. In addition, sealing of the joints must be ensured by application of a suitable sealing product approved by the purchasing Railway.

3-257 - Painting of timber parts, veneering and plywood and hardboard panels

Concealed surfaces, contact surfaces and sectional surfaces of timber parts, veneering and plywood and hardboard panels shall, after preparation of the surface in accordance with the provisions of UIC Leaflet 842-3, be painted with a waterproof fungicide product approved by the purchasing Railway.

3-258 - Painting of inaccessible parts

When parts are inaccessible after assembly, the complete painting system must be applied beforehand.

*3-259 - Painting before assembly of window frames,
entrance doors and accessories*

Window frames, entrance doors, accessories and locks must only be fitted to the body of the vehicle after application and total drying of the complete external protection system, including the top coat of paint.

Exceptions to this ruling must have the prior agreement of the purchasing Railway.

3-2510 - Painting of entrance doors and window frames

Access doors when not anodized must be given the same protection system on the inside and outside surfaces as the corresponding walls of the vehicle body.

If the surface of the window frames has to be protected, the protection system chosen must have a service life equivalent to that of the outside paint of the vehicle body.

Contact surfaces between the window frames and the entrance door frames on the one hand, and the body on the other, must be made damp-proof by a suitable sealing product approved by the purchasing Railway.

*3-26 - Painting of the parts of mechanical and electrical
equipment*

3-261 - Painting of brake rigging

The system of protection and the thicknesses of the coats laid down for brake rigging are specified in Appendices 1 to 4.

Triple valves, brake distributors, brake-rod adjusters and changeover devices shall be left with the original paint applied by the manufacturer, provided they have received a complete system of paint and that it is not damaged.

These parts must be protected during painting. When these parts are delivered with an intermediate coat of paint only, the paint system shall be supplemented as prescribed in Appendices 1 to 4.

The builder must ensure compatibility between the intermediate coat and the top coat.

*3-262 - Painting of the components of mechanical
equipment*

In all cases, the preparation of the components before painting takes place shall be carried out in accordance with the provisions of DfC Leaflet 842-3.

The system of protection and the thicknesses of the coats laid down for internal combustion engines, transmissions, cooling installations of internal combustion engines, steam heating installations and heat exchangers and joint components are specified in Appendix 4.

3.263 - Painting of electrical fittings

Unless otherwise stipulated in Appendices 1 to 4, cables, plugs, current sockets, switches, etc. must not be painted. Should these parts already be fitted, they must be protected against any paint splashes.

Battery cases must be protected externally and internally by a covering resistant to chemical products, with a minimum thickness of 130 μ m and approved by the purchasing Railway.

The surfaces of pantographs, transformer tanks, motors, transmissions, control devices and other electrical components, must be prepared before painting in accordance with the provisions of UIC Leaflet 842-3. If no specific provision is laid down in Appendices 1 to 4, the parts shall be left with their original paint insofar as this conforms to the required conditions (see also 3-12) with regard to its composition and the thickness of the coat.

3-27 - *Drying of the products*

3-271 - *Drying time in the workshop*

The minimum drying time to be observed for the various products applied in normal thickness are specified in Appendix 5.

For two-component reactive priming paints, the maximum permissible drying time must be observed ; otherwise, the paint must be rubbed down before application of the following coat.

3-272 - *Drying of the top coat*

After completion of the painting operations, the minimum drying times indicated in Appendix 5 having been complied with, the vehicle must be stabled, for a minimum period of 48 hours, in dry premises where the temperature is constantly above + 18 °C, to obtain complete drying of the top coat.

3-28 - *Touching up paintwork during construction*

If surfaces already painted are damaged during construction, the prescribed system of protection must be reconstituted.

Coats of paint already completely dry shall be roughened before retouching.

When the damage is more serious, particularly if the surface of the material is affected, the latter must be prepared in accordance with the provisions of UIC Leaflet 842-3. The system of protection prescribed is then reconstituted in full.

3-29 - *Inscriptions*

3-291 - *Marks and inscriptions to be applied*

The marks and inscriptions to be applied on each vehicle shall be shown in the working drawings.

3-292 - *Method of applying the marks and inscriptions*

The marks and inscriptions shall normally be applied with lettering paints, by means of transfers, or by any other method approved by the purchasing Railway.

3-293 - *Paints to be used for marking*

With polyurethane resin paint, the marking must be carried out with ;

- polyurethane resin inscription paints when stencils are used ;
- self-adhesive stickers, the adhesion of which is checked when transfers are used.

In the case of dispersion finishing paints, the marking may be applied with :

- epoxy ester lettering paints or alkyd resins when stencils are used,
- serigraphy processes using alkyd resin paint,
- varnish transfer stickers.

Bituminous paint must, if necessary, be given a coat of dispersion paint for the outside of vehicle bodies, to cover it before marking.

The procedure provided for polyurethane resin paints and for dispersion finishing paints shall then be applied.

4 - QUALITY INSPECTION OF THE WORK

The representative of the purchasing Railway must be able to inspect the quality of the anticorrosion protection work and the painting of vehicles and their accessories.

These inspections shall be carried out in accordance with the directives of UIC Leaflet 842-6.

5 - GUARANTEE

The vehicles shall be guaranteed for a period of two years with regard to the efficiency of the system of protection. Different periods may be chosen by agreement between the purchasing Railway and the rolling stock manufacturer.

The guarantee shall take effect from the date the vehicle is placed in service.

For each vehicle, the manufacturer must record in a register the origin of the paint products subject to guarantee and their conditions of use. This register may be consulted at any time by the representative of the purchasing Railway and by the paint suppliers.

Any disputes between the purchasing Railway and the manufacturer shall be settled in accordance with the purchasing Railway's own regulations.

6 - PRELIMINARY REMARKS REGARDING APPENDICES | TO 5

6-1 - Painting system

Depending on the stresses to which the loose parts or an assembly of these parts are subjected, a painting system with 3, 2 or 1 coats, may be used.

The number of coats of the paint system adopted shall be fixed by the purchasing Railway.

Irrespective of the painting system adopted, with either 3, 2 or 1 coats, the total minimum thickness shown below must be obtained.

The conditions of application and drying of systems with 2 or 1 coats and the quality inspection regulations for a 1-coat system, must be observed.

The total thickness (e) of the dry film of the painting system must not be less than the values shown below :

- systems consisting of alkyd resin products, epoxy resins or polyurethane resins, also systems comprising dispersion paints utilized as intermediate and finishing coats e ≥ 130 μ m
- systems comprising a bituminous based finishing coat e ≥ 250 μ m
- systems with a finishing coat consisting of a bituminous mixed paint e ≥ 170 μ m

In assessing the thicknesses indicated above, the thickness of the following must not be taken into consideration :

- passivation coats with 1 or 2 components (wash primer)
- coats of welding paints,
- filler coats,
- insulation coats.

B-2 - Parts and surfaces not to be painted

The parts and surfaces which must not be painted are indicated in Paragraph B-251.

B-3 - Colours and nature of the binders

The colours and nature of the binders to be used shall be specified by the purchasing Railway.

B-4 - Drying of paints (Appendix 5)

When a paint is dried in a hot air chamber, it must be exposed to the ambient air for 15 to 30 minutes before placing in the chamber. This exposure time must not be taken into consideration when determining the drying time. The time necessary for the painted component to cool to ambient temperature must also not be taken into account.

The drying times shown correspond to the times which must elapse :

- in the case of fillers, before a coat of filler can be applied with a spray or a knife,
- with intermediate paints, before a finishing paint can be sprayed on,
- with the paints or products indicated elsewhere, before spraying on the following coat of the product normally used in the system adopted.

The minimum drying time for fillers before rubbing down must be 12 hours at + 20°C or 15 hours at + 18°C. Furthermore, after rubbing down with water, a minimum drying time of 12 hours at + 20°C must be observed before any fresh application of the product.

Before applying acoustic or thermal insulation products, it is necessary to ensure that the coats of products previously applied are completely dry.

APPENDICES

PAINT SYSTEM FOR THE BODIES OF VEHICLES MADE OF ORDINARY STEEL

Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	1. Underframe (infrastructure) including the inside surfaces of sheet steel flooring and items of equipment situated beneath the underframe.	3	4	5
1-1	Inside surfaces of the underframe (infrastructure) including inside surfaces of sheet steel flooring and items of equipment situated beneath the underframe, engine mounting, buffing and draw gear, electric and air pipes, brake equipment, outside and inside of battery containers and external and internal converter containers, sanders and the inside surfaces of skirts	zinc chromate 2-component or zinc chromate alkyd resins or (in the case of diesel locomotives) zinc chromate (1 component) epoxy resins	Bitumen based or alkyd resins	at the choice of the purchasing Railway
1-2	Passenger coaches as in Point 1 of the text			See Point 6-1. Preliminary remarks
	Tractive units as in Point 1 of the text		Two-component intermediate paint. 2-component finishing paint	For battery containers, the paint

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2	Upper surfaces of the underframe (infrastructure) including upper surfaces of sheet steel flooring and engine mountings.	zinc chromate 2-component or zinc chromate alkyd resin or (in the case of diesel locomotives) zinc chromate epoxy resin (1 component)	of alkyd resin intermediate paint alkyd resin finishing paint or (in the case of diesel locomotives), epoxy resin finishing paint (1 component)	must withstand chemical products
2-1	Passenger coaches as in Point 1 of the text			Sheet steel flooring of light alloy entrance vestibules are not painted on the walking surface.
2-11	Level with the bogies and beneath the entrance vestibules		Sound insulation product Bitumen base	at the choice of the purchasing Railway, taking into account 3-2412, also used, where applicable, on other parts.

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Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
2-12	Level with the lavatories, toilets and kitchens.		2-component intermediate paint, 2-component finishing paint or alkyd resin intermediate paint, Alkyd resin finishing paint.	
2-13	Other parts		Finishing paint, Thermal insulating products.	at the choice of the purchasing Railway, taking into account 3-2412.
2-2	Tractive units as in Point 1 of the text.			See 6-1 "Preliminary remarks".
2-21	Total surface		2-component intermediate paint, 2-component finishing paint or alkyd resin intermediate paint, Alkyd resin finishing paint (in the case of diesel locomotives).	

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2-22	Level with the bogies and entrance vestibules	Epoxy resin finishing paint (1 component)	at the choice of the purchasing Railway, taking into account 3-2412, also used, where applicable, on other parts
	Other parts		Thermal insulating product
3	2. Internal paints Internal surfaces of the superstructure of the body, including the framework, intermediate partitions and detachable steel components, also entrance doors and intercommunicating doors, the inside surface of the roof, the inside surfaces of the sides and ends.	Zinc chromate 2-component or zinc chromate alkyd resin	The window frames, inside fittings, are of anodized light alloy and are provided with a paint system similar to that of the adjacent visible surfaces. Burned or welded sections must be touched up after assembly and protected with the same paint system.

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Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
3-1	Non-visible parts		Intermediate paint. Finishing paint (in case of diesel locomotives resistant to diesel fuel). Thermal and sound insulating product.	At the choice of the purchasing Railway, taking into account 3-2412.
3-2	Visible sections - additional.		Smooth filler coat	Used, where applicable, except for tractive units. In the area subjected to high temperatures (near transformers, heating installations and cooling installations of thermal motors) the protection and insulating products must be stable at that temperature.
3-3	Floor of the corridor of motor compartments and the driving compartment.		Alkyd resin intermediate paint. Alkyd resin finishing paint (in the case of diesel locomotives, resistant to diesel fuel).	As indicated by the purchasing Railway.

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3 - <i>Wooden lining, inside walls and wooden battens</i>			
4	Hidden surfaces		
4.1	Linings, roof arches, plywood panels	Wooden protection product with fungicide properties.	2-component or alkyd resin with or without aluminium pigmentation.
4.2	Multiple planks for passenger compartments including edges and fixing holes.		Alkyd resin and bituminous solution.
5	Visible surfaces		
5.1	Internal walls and natural wood battens - varnishing.	2-component pore filler or 2-component fungicide varnish.	One or two coats of 2-component varnish.

The edges and inside surfaces of wooden panels are given a coat of waterproof paint.

In the case of fireproofing, bare wood shall be treated with the approved fireproof product plus two coats of chlorinated rubber based paint.
Battens for varnishing are given two coats of varnish.

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Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
	- painting	alkyd resins or 2-component	Smooth filler coat Alkyd resin or 2-component intermediate and top coats	The intermediate coat is not applied to the inside of kitchen cupboards and luggage compartments.
6	4 - Radiators and heating pipes Radiators, radiator covers and heating pipes		Radiator paint	at the choice of the purchasing Railway.
7	5 - <i>Luggage racks and decorative parts</i> Luggage racks, arm rest brackets, compartment sliding door frames, corridor walls, swing doors, water systems and other fittings.			at the choice of the purchasing Railway.
8	6 - <i>External paint</i> Upper surface of the roof including ventilators, projecting parts -		2-component thick filler or smooth filler coat	Only when specially indicated by the purchasing Railway.

	except pantographs - external surfaces of side and end walls, also sole-bars, fairing, and external surfaces of skirts.	zinc chromate 2-component or zinc chromate alkyd resin.	2-component intermediate paint. 2-component finishing paint or alkyd resin intermediate paint. Alkyd resin finishing paint or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint.	Window frames, ventilation grills and handrails are either made of anodized light alloy or painted with a paint system similar to that of the adjacent surfaces.
9	7 - Marks and inscriptions Inscription on the bodies of wagons, sole-bars and fairing.			at the choice of the purchasing Railway, taking into account 3-29.
10	Marks of lubrication devices, handles and valves, brake changeover valves, terminal boxes, earthing boxes, pipe systems.			As shown in the drawings of the purchasing Railway.
11	8 - Metal components made of a material other than ordinary steel These components must be treated in accordance with the special provisions for the type of material concerned when they are to be painted.			

PAINT SYSTEM FOR THE BODIES OF VEHICLES MADE OF STAINLESS STEEL
WITH A FRAMEWORK OF ORDINARY STEEL

Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
	1 - Underframe (infrastructure) including inside surfaces of sheet steel flooring and items of equipment situated beneath the underframe.			
	2 - Internal paint			As under serial Nos. 1 to 7.
	3 - Wooden lining, internal walls and battens			
	4 - Radiators and heating pipes			
	5 - Luggage racks and fittings			
8	6 - External paint The top of the roof including ventilation covers and additional components situated above the roof - except pantographs - side and end walls, also sole-bars, deck frameworks and fairing.	zinc chromate 2-component	2-component thick or smoothing covering. 2-component intermediate paint. 2-component finishing paint.	Only when specially indicated by the purchasing Railway.

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	or zinc chromate alkyd resin.	or dispersion paint or alkyd resin. Intermediate paint. Alkyd resin finishing paint. or alkyd resin intermediate paint. Dispersion paint.	Window frames, ventilation grills, and handrails are either of anodized light alloy or painted with a paint system similar to that of the adjacent surfaces.
7 -	Marks and inscriptions		As under Serial Nos. 9 and 10.
8 -	Metal components consisting of a material other than stainless and ordinary steels.		
	See under serial No. 11.		

PAINT SYSTEM FOR VEHICLE BODIES OF LIGHT ALLOY WITH A FRAMEWORK OF ORDINARY STEEL

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Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
	1 - Underframe (infrastructure) including internal surfaces of sheet steel flooring and items of equipment situated beneath the underframe.			As under serial Nos. 1, 2-23.
	2 - Internal paint	Reactive priming paint (wash primer)		at the choice of the purchasing Railway, otherwise as under serial Nos. 3, 3-3.
	3 - Wooden lining, internal walls and battens.			As under serial Nos. 4 and 5.
	4 - Radiators and pipes			As under No. 6.
	5 - Luggage racks and fittings			As under No. 7.

8	6 - External paint Upper surface of the roof including ventilators, projecting parts - except for pentagraphs - external surfaces of the side and end walls, also sole-bars, streamlining and external surfaces of fairing.	Reactive priming paint (wash primer) Zinc chromate 2-component or zinc chromate alkyd resin	2-component thick or smoothing covering. 2-component intermediate paint, finishing paint or alkyd resin Intermediate paint, Alkyd resin finishing paint or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint.	at the choice of the purchasing Railway. Window frames, ventilation grills and hand-rails are either of anodized light alloy, or painted with a paint system similar to that of the adjacent surfaces.
	7 - Marks and inscriptions			As under serial Nos. 9 and 10.
	8 - Metal components consisting of a material other than light alloy and ordinary steel See under serial No. 11.			

PAINT SYSTEM FOR VEHICLE BODIES OF LIGHT ALLOY

Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
	1 - Underframe (infrastructure) including internal surfaces of steel floorings and items of equipment situated beneath the underframe	Reactive priming paint (wash primer) (at the choice of the purchasing Railway)		As under serial Nos. 1, 2-23.
	2 - External paint	Reactive priming paint (wash primer) (at the choice of the purchasing Railway)		As under serial Nos. 3, 3-3.
	3 - Wooden lining, internal walls and battens			As under serial Nos. 4 and 5.
	4 - Radiators and heating pipes			As under serial No. 6.

				As under serial No. 7.
	5 - Luggage racks and fittings			
	6 - External paint			As under serial No. 8 for vehicle bodies of light alloy with framework of ordinary steel.
	7 - Marks and inscriptions			As under serial Nos. 9 and 10.
	8 - Metal components consisting of a material other than light alloy			
			See under serial No. 11.	

PAINT SYSTEM FOR BOGIES

Serial No.	Object	Paint			Observations
		Anti-corrosion priming	Intermediate and/or finishing		
1	2	2	4	5	
1	Motor bogie	zinc chromate 2-component or zinc chromate alkyd resin	2-component intermediate paint 2-component finishing paint or alkyd resin intermediate paint Alkyd resin fin- ishing paint.		Paint for parts added to the driving axles, see Appendix 3 or 4. See point 6.1 "Preliminary remarks".
1-1	Bogie frame with detachable parts, such as bogie bolster; equalizer, etc.				
1-2	Wheelsets and exterior of axle-box cases				Contact and friction surfaces, see 3-25.
2	Carrying bogies	zinc chromate 2-component or zinc chromate alkyd resin.	Bitumen base or 2-component intermediate paint 2-component fin- ishing paint or alkyd resin intermediate paint Alkyd resin fin- ishing paint.		at the choice of the purchasing Railway See point 6.1 "Preliminary remarks". Contact and friction surfaces: see 3-25.
2-1	Bogie frame with detachable parts.				

			or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint
2.2	Wheelsets with components added such as axle-box cases, guides, spring plates, etc...		
Remark: Bogies of light alloy must be protected in accordance with the special provisions for this material.			

PAINT SYSTEM FOR ITEMS OF EQUIPMENT OF ELECTRIC LOCOMOTIVES,
ELECTRIC RAILCARS, ELECTRIC VEHICLES WITH REVERSIBLE DRIVING CABS
AND TRAILERS OF ELECTRIC MOTOR TRAIN UNITS

Serial No.	Object	Paint			Observations
		Anti-corrosion priming	Intermediate and/or finishing		
1		3	4	5	
1-1	Item of electric equipment Pantograph and roof cable	zinc chromate 2-component or zinc chromate alkyd resin	2-component intermediate paint 2-component finishing paint, or alkyd resin intermediate paint, Alkyd resin finishing paint or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint.		see 6-1 "Preliminary remarks".
1-2	Transformer (external)	zinc chromate 2-component	2-component finishing paint		As a derogation from Appendix 5,

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	Transformer (internal)	of zinc chromate alkyd resin	or alkyd resin finishing paint	the minimum thickness of each coat must be 60 μ m when dry
1-3	Traction motor (internal)	zinc chromate 2-component or zinc chromate alkyd resin	2-component intermediate paint, 2-component finishing paint or alkyd resin intermediate paint. Alkyd resin finishing paint or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint.	Paint at the choice of the purchasing Railway
	Traction motor (internal)			Paint at the choice of the purchasing Railway.
2 2-1	Transmission Hollow shaft casing, large wheel centre, hollow shaft	zinc chromate 2-component or zinc chromate alkyd resin	2-component intermediate paint, 2-component finishing paint or alkyd resin intermediate paint	Contact and friction surfaces: see 3-25 see 6-1 "Preliminary remarks"

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Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
			Alkyd resin finishing paint or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint.	
2-1	Gear case (external)	zinc chromate 2-component or zinc chromate alkyd resin	2-component finishing paint or alkyd resin intermediate paint. Alkyd resin finishing paint or 2-component intermediate paint. Dispersion paint or alkyd resin intermediate paint. Dispersion paint.	As a derogation from Appendix 5, the minimum thickness of each coat must be 60 μ m when dry. see 6-1 "Preliminary remarks".
2-2	Oil or grease containers (internal) such as	zinc chromate 2-component	2-component finishing paint	As a derogation from Appendix 5,

	for instance, gear case, pivot bearing, median or diagonal coupling case, etc...			the minimum thickness of each coat must be 60 μ m when dry. Derogation only with the agreement of the purchasing Railway.
2-3	Cases of apparatus situated in the vehicle, auxiliary machines, fittings, electric equipment, control devices and protective grills.	zinc chromate alkyd resin	Alkyd resin intermediate paint. Alkyd resin finishing paint.	

PAINT SYSTEM FOR ITEMS OF EQUIPMENT OF DIESEL LOCOMOTIVES,
DIESEL RAILCARS, DIESEL VEHICLES WITH REVERSIBLE DRIVING CAB
AND TRAILERS OF DIESEL MOTOR TRAIN UNITS

Serial No.	Object	Paint			Observations
		Anti-corrosion priming	Intermediate and/or finishing		
1	2	3	4	5	
1	1- Internal combustion engine (external)	Zinc chromate 2-component or zinc chromate alkyd resin.	2-component finishing paint or alkyd resin finishing paint		
2	Internal combustion engine - case	Zinc chromate 2-component or zinc chromate alkyd resin.	2-component finishing paint or alkyd resin finishing paint		
	- other internal surfaces	no paint			
3	Exhaust pipes				The paints must withstand high temperatures and be at the choice of the purchasing Railway.

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4	2 - Gear Gear, motor axle (external)	Zinc chromate 2-component or zinc chromate alkyd resin	2-component finishing paint of alkyd resin finishing paint	Contact and connection surfaces : see 3-25
5	Gear (internal) - case - other internal surfaces	no paint		Paint at the choice of the purchasing Railway
6	3 - Cooling devices (including added parts) Installations with added parts	Zinc chromate 2-component or zinc chromate alkyd resin	2-component intermediate paint, 2-component finishing paint or alkyd resin intermediate paint, Alkyd resin finishing paint	
7	4 - Steam boiler installations Parts not subjected to high temperatures	Zinc chromate 2-component or zinc chromate alkyd resins	Paint for radiators	See 6-1 : "Preliminary remarks".
8	Parts subjected to high temperatures			Paints and thermal insulation at the choice of the pur- chasing Railway

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Serial No.	Object	Paint		Observations
		Anti-corrosion priming	Intermediate and/or finishing	
1	2	3	4	5
9	5 - Heat exchangers All metallic surfaces (external)	Zinc chromate 2-component	Paint for radiators	See 6-1 : "Preliminary remarks".
10	6 - Tanks Heating water tanks and fuel tanks (internal and external)			Paints at the choice of the pur- chasing Railway.
11	7 - Cardan shafts, equipment, auxiliary machines Cardan shafts, internal equipment, auxiliary machines, pipes, clothes cupboards and tool- boxes	Zinc chromate 2-component or zinc chromate alkyd resin	2-component finishing paint or alkyd resin finishing paint	Contact and connection surfaces : see 3-25
12	8 - Marks and inscriptions Lubrication device, filling and emptying apertures of internal combustion engines, gear and other added parts.		Epoxy-ester resin lettering paint	

THICKNESSES OF COATS AND DRYING TIMES

(the preliminary remarks are to be observed)

Serial No.	Products	Thickness of the coats per application		Drying time in hours at temperatures of					
		dry μ m	wet μ m	20° C h	40° C h	60° C h	80° C h	for special uses	
1	Reactive priming paints (wash primers) one component two components	10-20	1	1					
		max. 10	1						In the case of continuation with materials with 1 component. In the case of continuation with materials with 2 components.
2	Welding paint - zinc powder - intermittent arc welding - spot welding - aluminium - intermittent arc welding - spot welding	15-20	1	1					
		10-15	1						
3	Anti-corrosion priming paints alkyd resin base (1) epoxy resin base polyurethane base	15-20	1	1					
		10-15	1						
4	Thick coatings with 2 components	50		12	6				
		50-70		12	6	3	1		
		50-70		12	6	3	1		
		50-70		12	6	3	1		

(1) Remark:

For certain anticorrosion priming paints with an alkyd resin base, the drying times can be reduced. The products and the reduction in drying times must be approved by the purchasing Railway.

Serial No.	Products	Thickness of the coats per application		Drying time in hours at temperatures of					
		dry μ m	wet μ m	20° C h	40° C h	60° C h	80° C h	for special uses	
4	Thick coatings with 2 components			The drying time is to be fixed in relation to the binder, the coating and the thickness of the film					
5	Smooth primer coatings with 2 components: with a knife - with a spray-gun - primer with a spray-gun with 1 component: with a knife - with a spray-gun - primer with a spray-gun - with a knife for internal surfaces	250-350		3	1½				
		150-200		5	3				
		50-70		12	6				
		150-250		12	6				
		100-150		12	6				
6	Intermediate paints alkyd resins dispersion paints for external surfaces of vehicle bodies epoxy resins polyurethane resins	150-200		12	6				
		min. 45		6	2-4	1			
		min. 40		2	1				
		min. 40		10	5½	2½	1		
7	Finishing paints alkyd resin base for interior alkyd resin paints for radiators dispersion paint for outside surfaces of vehicle bodies dispersion paint for other applications	min. 40		8	4-6	1½			
		30-40		2	1				
		min. 40		2	1				
		min. 80		2	1½				

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8	epoxy resin base polyurethane base bituminous solution bituminous emulsion bituminous combination paint	min. 40	12	4	7	1
		min. 40	12	3	1 1/2	-
		min. 200	12	12	-	-
		min. 200 min. 120	24 12	12 -	-	-
9	<i>Soundproof and fireproof products</i> bituminous emulsion for insulation PVA acoustic insulation	min. 2000	48	24	-	-
		min. 2500	48	24	-	-
10	<i>One-coat paints</i> 2-coat system anticorrosion priming paint finishing paint	min. 130	12	8	3	-
		min. 60-70 min. 60-70	12 8	6 4-6	1 1 1/2	- -

APPLICATION

All Railways in the Union.

RECORD REFERENCES

Heading under which the question has been dealt with :

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