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Laroflex® MP grades

chlorinated binders, resistant to hydrolysis, for the manufacture of physically drying coatings on iron and steel, non-ferrous metals, mineral substrates as well as for printing inks and road marking paints

Nature copolymers based on vinyl chloride and vinyl isobutyl ether

Range

Laroflex® MP 15
Laroflex® MP 25
Laroflex® MP 35
Laroflex® MP 45
Laroflex® MP 60

Properties

Physical form fine white powder

Storage Laroflex® MP grades can be stored for 2 years if kept away from heat and moisture.

Product specification		Laroflex®				
		MP 15	MP 25	MP 35	MP 45	MP 60
viscosity of a 20 % solution in toluene at 23 °C (73 °F) (ISO 3219, DIN 53019/53214, shear rate D = 500 s^{-1})	mPa·s	12–18	20–26	30–40	40–50	≥ 50
Other properties						
K value according to Fikentscher (ISO 174, DIN 53726)		~ 30	~ 35	~ 35	~ 35	~ 35
density at 20 °C (68 °F) (ISO 2811, DIN 53217)	g/cm³	1.25	1.24	1.24	1.24	1.24
Vicat softening temperature (ISO 306, DIN 53460)	°C °F	46–48 115–118	48–52 118–126	48–52 118–126	48–52 118–126	48–52 118–126
chlorine mass fraction	%	40	44	44	44	44

Application

Laroflex® MP grades are binders resistant to hydrolysis. They can be used for anti-corrosion coatings, for coatings on galvanized steel, other non-ferrous metals, concrete, fiber cement, for road marking paints, flame-retardant coatings on non-flammable building materials, printing inks, marine and container paints. They are compatible with most alkyd resins, dry oils, polyacrylic resins, liquid epoxy resins, tars and bitumens.

Overview

Laroflex® MP grades offer advantages to both manufacturers and users of coatings:

- broad choice of solvents, particularly budget-priced blends of aromatic and aliphatic hydrocarbons
- good compatibility with other coatings raw materials
- good pigment binding capacity even at high solids
- unrestricted choice of pigments and extenders
- easy application by all common techniques, no cob-webbing even at high solids
- thermal stability allows force drying
- good adhesion on iron, steel and many unrelated coatings systems, good intercoat adhesion
- good resistance of properly formulated coatings to aqueous alkalis and acids, salt solutions, to stress from water, humidity changes, low and cyclic temperatures as well as to chalking and yellowing
- long lasting corrosion protection even under extreme outdoor conditions

Differences in properties

Laroflex® MP grades mainly differ in their viscosities and the rheology of their solutions. Viscosity ranges given in the table relate to 20 % solutions in toluene at 23 °C (73 °F). The less polar the solvent, the greater the differences in viscosity.

The low-viscous solutions of Laroflex® MP 15 and Laroflex® MP 25 are diluted easiest with aliphatic hydrocarbons, their viscosity changes the least during storage and they produce highest gloss. The high-viscous solutions of Laroflex® MP 60 tend to gel, particularly in non-polar solvents.

Choosing the right solvent

Suitable solvents are aromatic hydrocarbons or their blends with esters and glycolether acetates. Aliphatic hydrocarbons and/or alcohols are used as diluents.

Ketones, in general, are less suited since they are retained by vinyl chloride polymers longer than other solvents with equal volatility, resulting in slower drying coatings.

The diluent fraction of the solvent blend mainly depends on the solvency of the true solvent. Depending on the type of solvent and when Laroflex® MP 45 or Laroflex® MP 60 are used, the diluent proportion must be reduced by up to 40 % as compared with Laroflex® MP 35.

The diluent proportion can be increased if other raw materials in the formulation are readily compatible with Laroflex® MP grades and soluble in aliphatic hydrocarbons or alcohols. Examples are hard resins such as Laropal® K 80, many alkyd resins, high-aromatic grades of tar, soft resins and plasticizers present in greater proportions.

Aromatic hydrocarbons or blends of aromatic and aliphatic hydrocarbons are best suitable for coatings that are to be exposed to water very soon after application.

High-volatile solvents and/or diluents produce faster drying coatings. Coatings containing a blend of xylene and butanol instead of xylene alone will dry faster. Polymers release esters more easily than ketones and aromatic hydrocarbons of the same volatility. The most favorable low-volatile solvent is ethoxypropyl acetate. Note that the solvent retention also depends on the other constituents of the formulation.

Gloss and flow of coatings can be improved by adding high-boiling solvents, e.g., ethoxypropyl acetate. High proportions of low-volatile diluents, however, may result in precipitating of binder constituents, impairing both gloss and mechanical properties of the coatings.

Greater proportions (20–25 %) of high-boiling solvents, e.g., ethoxypropyl acetate or blends of aromatic hydrocarbons with a boiling range of 150 °C (302 °F) to 190 °C (374 °F) reduce blistering which may occur in airless-sprayed coatings, particularly those with a low pigment content.

High proportions of diluent in the solvent blend reduce the risk of previous coats pulling up.

Clear or almost clear solutions can be obtained in aromatic hydrocarbons such as toluene, xylene or Solvesso®[1] 100 as well as in chlorinated hydrocarbons, anone and tetrahydrofuran. Solutions with other solvents may be somewhat cloudy but will not adversely influence hardness and homogeneity of the film, provided the solution dries to form a clear film.

Viscosity behavior of the solution

The viscosity of solutions of Laroflex® MP grades not only depends on the concentration, the composition of the solvent blend and its temperature, but also on the conditions under which they are prepared.

[1] registered trademark of Exxon Mobil Corporation

The higher the temperature as well as duration and extent of shear forces, the lower the viscosity of the solution will be after cooling down to room temperature. After extended storage, the viscosity may increase again, an effect that is more pronounced the less the solvating power and the affinity between solvents and polymer.

Unpigmented concentrated solutions of Laroflex® MP grades in xylene may tend to gel – often only months after they have been prepared and without undergoing a gradual increase in viscosity. Adding ketones and esters reduces the tendency to gel, in particular if the binder concentration is high. By adding 10–20 % of an alcohol to the solvent blend, gelling generally can be suppressed completely. Likewise, no gelling has been observed yet in formulations containing blends of high-boiling aromatics such as Solvesso®[1] 100 or Shellsol®[2] A. The gel structure can be removed by intensive stirring, heating or by milling with pigments.

This rheological behavior is quite pronounced in Laroflex® MP 60. It is scarcely noticed in Laroflex® MP 35 and not at all in Laroflex® MP 15 and Laroflex® MP 25.

Typical solvent blends

1. Coatings based on Laroflex® MP grades without significant amounts of cobinders:

   Flash point above 21 °C (70 °F)

a)	100 %	xylene
b)	75 %	xylene
	25 %	aromatics 145–185 °C (293–365 °F)
c)	85 %	xylene
	15 %	white spirit 155–185 °C (311–365 °F)
d)	50 %	xylene
	20 %	aromatics 145–185 °C (293–365 °F)
	30 %	white spirit 155–185 °C (311–365 °F)
e)	80 %	xylene
	10 %	isobutanol
	10 %	white spirit 155–185 °C (311–365 °F)
f)	70 %	xylene
	4 %	isobutanol
	13 %	aromatics 145–185 °C (293–365 °F)
	13 %	white spirit 155–185 °C (311–365 °F)
g)	70 %	xylene
	10 %	isobutanol
	5 %	ethoxypropyl acetate
	15 %	white spirit 155–185 °C (311–365 °F)
h)	65 %	xylene
	5 %	aromatics 145–185 °C (293–365 °F)
	5 %	ethoxypropyl acetate
	25 %	white spirit 155–185 °C (311–365 °F)

[2] registered trademark of Shell Chemicals Group

i)	50 %	xylene
	35 %	n-butylacetat
	15 %	Isobutanol
		(schnell trocknende körperreiche Lacke)

2. Coatings based on 1:1 blends of Laroflex® MP grades and alkyd resins:

   Flash point over 21 °C

a)	70 %	xylene
	30 %	white spirit 155–185 °C (311–365 °F)
b)	70 %	xylene
	10 %	Isobutanol
	20 %	white spirit 155–185 °C (311–365 °F)
c)	50 %	xylene
	15 %	aromatics 145–185 °C (293–365 °F)
	35 %	white spirit 155–185 °C (311–365 °F)
d)	60 %	xylene
	5 %	ethoxypropyl acetate
	35 %	white spirit 155–185 °C (311–365 °F)
e)	60 %	xylene
	5 %	isobutanol
	5 %	aromatics 145–185 °C (293–365 °F)
	30 %	white spirit 155–185 °C (311–365 °F)
f)	40 %	xylene
	10 %	isobutanol
	10 %	ethoxypropyl acetate
	40 %	white spirit 155–185 °C (311–365 °F)

Plasticizing

Laroflex® MP grades are internally plasticized. Coatings based on them are flexible and adhere well. Proportions of additional plasticizers can be kept comparatively low. In general, mass proportions of 10–25 % are sufficient. Plasticizers – mostly low-viscous – with good solvating power (such as Palatinol® 911 or Plastomoll® DOA) can be added in low proportions of 5–15 %, soft resins (such as Acronal® 4 F) or polyester resins in larger proportions of 15–30 %.

In formulations based on Laroflex® MP 15, the plasticizer proportion should be kept some 10–15 % lower than in those based on the other Laroflex® grades.

Too much plasticizer will adversely affect the hardness and thermostability of the dried coatings and can promote shrinkage, alligatoring and soiling of outdoor coatings.

Coatings that have to withstand chemicals and salt water are formulated with plasticizers resistant to saponification, e. g., chlorinated paraffin waxes. Saponifiable plasticizers (phthalates, adulates or phosphates) can be used when resistance to chemicals is less important. Plastigen® G is the plasticizer of choice for coatings on alkaline substrates (e. g., concrete) and for top coats extraordinarily resistant to yellowing and chalking.

Acronal® 4 F and its mixtures with phthalates are particularly suitable to increase adhesion to aluminum and its alloys and other difficult substrates. The flexibility and adhesion of films based on Laroflex® MP grades at low temperatures can be increased by using low-viscosity, high-efficiency plasticizers (Palatinol® 911 and Plastomoll® DOA). Plasticizers which are insoluble in aliphatic hydrocarbons (Palamoll® 646) least impair the resistance of films based on Laroflex® MP grades to lubricants and fuel oil.

Modification by other coatings raw materials

Hard resins

Solids content, gloss and adhesion can be increased by adding hard resins.

Non-saponifiable hard resins such as Laropal® K 80 are recommended for coatings resistant to chemicals and water. For non-pale coatings or when less emphasis is put on resistance to light and weathering, coumarone, indene or hydrocarbon resins can be used. Saponifiable hard resins (e. g., maleate or modified phenolic resins) can be used if good resistance to chemicals is not required.

Hard resins which are compatible with Laroflex® MP grades (e. g., Laropal® K 80 or Laropal® A 81) are often able to overcome any slight incompatibility on the part of other materials present in the formulation. Laropal® K 80 and Laropal® A 81 increase the diluent tolerance of coatings based on Laroflex® MP grades for aliphatic hydrocarbons.

Air-drying binders

Air-drying binders reduce the thermoplasticity of Laroflex® MP grades.

Combined with a predominant proportion of air-drying binder, Laroflex® MP grades improve the coating's

- surface drying and thus its initial hardness,
- resistance to chemicals and water,
- outdoor performance, particularly in industrial environments.

If resistance to chemicals and water is essential, the proportion of Laroflex® MP should be at least the same as that of the air-drying binder.

The lower acid value and average molecular mass of an alkyd resin, the better its compatibility – which should be checked in each case.

The most compatible alkyd resins are those containing about 45–55 % drying or 25–50 % semidrying oils.

Other compatible binders are bodied oils with modified phenolic resins, various urethane/alkyd resins and some epoxy resins modified by oil fatty acids.

In many cases, air-drying binders can be made perfectly compatible with Laroflex® MP grades by including other compatible components, e. g., Laropal® K 80, Laropal® A 81 or plasticizers.

In combinations of Laroflex® MP grades with alkyd resins, the amount of white spirit in the solvent blend can often be increased well above the proportion normally used in coatings solely containing Laroflex® MP grades (see *Typical solvent blends* earlier in this chapter).

If these "hybrid binder" coatings are to be overcoated, care must be taken to ensure that oxidative drying has progressed so far that there is no risk of "pulling up" caused by excessive softening of the first coat by the solvent phase of the second coat. The tendency of pulling up can be reduced by increasing the proportion of Laroflex® MP grades. Equally, the solvent can be diluted with more white spirit. Solvent blends whose proportion of diluents increases gradually and only to a limited extent perform best. An example is a blend consisting of equal parts of xylene and white spirit.

Pigmentation

Any conventional anti-corrosion pigment can be used in primers based on Laroflex® MP grades as chemical reactions between the two are unlikely. Based on our current experience, the binder – if stored under normal conditions – does not need to be stabilized against attack by active metal powders such as aluminum bronze. If there are any doubts, small proportions of zinc oxide or epoxy compounds may be added.

[3] registered trademark of Resolution Nederland B. V.

Higher proportions of flake extenders or pigments in the pigment blend (e. g., talc, micaceous iron oxide or aluminum bronze) improve the coatings' adhesion and impermeability to water vapor, they also facilitate airless spraying of thick coats.

Pigments and extenders resistant to weathering should be preferred for topcoats. Some extenders – including a few natural magnesium, aluminum or potassium-aluminum silicates as well as barytes – contain impurities, which may cause yellowing of white topcoats. A small amount of zinc white generally prevents such discoloration.

Pigments resistant to acids and alkalis must be used for coatings resistant to chemicals.

Effective corrosion protection is achieved with coatings having a pigment volume concentration (PVC) of 16–35 %. For coatings particularly resistant to chemicals, a lower PVC range of 16–22 % should be preferred. Well-formulated high-build finishes, on the other hand, can be pigmented up to about 35 %. In general, the pigmentation level should be limited to 90 % of the critical PVC.

Stabilizers

Laroflex® MP grades are sufficiently stable to dehydrochlorination. Thus no stabilizers are normally needed. Exceptions are coatings that are either exposed to heat or unpigmented or – in some cases of coatings based on transparent pigments – exposed to UV radiation for extended periods.

Note that chlorinated binders are less stable if moisture or some chemicals are present.

Generally, coatings systems based on Laroflex® MP grades should not be exposed to heat above 70–80 °C (158–176 °F) for prolonged periods.

Heat stabilizers should be added for force drying at temperatures of up to 130 °C (266 °F). Adding 2 % Mark®[4] 17 M and 3 % Drapex®[4] 39 (respective to Laroflex® MP) provides adequate stabilization.

Dispersants, antisettling agents, thixotropes

Some dispersants or antisettling agents, particularly in higher proportions, may act with chlorinated binders to cause corrosion of metal containers and thus reduce the coating's anticorrosion protection. Trials are recommended.

Thixotropes derived from hydrogenated castor oil (e. g., Luvotix®[5] or Thixatrol®[6] ST) can be used for high-build coatings. Manufacturer's instructions on their use should be observed.

[4] registered trademark of Crompton Vinyl Additives
[5] registered trademark of Lehmann & Voss & Co.
[6] registered trademark of Elementis plc

Further, suitable thickeners and antisettling agents consist of an approximately 10 % gel paste made from Bentone®[6] 38 or Bentone®[6] 39 and Anti-Terra®[7] U in aromatic solvents.

Processing

Production of coatings

Laroflex® MP grades dissolve very rapidly even without heating. Caking is avoided by immediately and uniformly distributing the powder: thoroughly stirring, it is slowly added to the diluent (aliphatic hydrocarbons, alcohols). Proportions of Laroflex® MP powder and diluent should be approximately equal. Then, solvent(s) and other diluents are added while stirring. Subsequently, plasticizers and combination resins may be added.

Solutions of Laroflex® MP grades that contain plasticizers and possibly other binder components are used to paste and mill pigments. If alkyd resin cobinders are present in the formulation, these can be used to prepare the pigment paste.

Application techniques

Coatings based on Laroflex® MP grades are suitable for all common application techniques such as high-pressure spraying, airless spraying, hot spraying, brushing, dipping, curtain or roller coating or paint roller.

No cob webbing occurs during the application of coatings based on Laroflex® MP grades even at high solids or if they contain highly volatile solvents.

Blistering and pore formation during airless spraying can be avoided by keeping the proportion of highly volatile esters (e. g., ethyl acetate and butyl acetate) in the solvent blend low. The inclusion of high-boiling aromatic hydrocarbons or ethoxypropyl acetate in advantageous. Good results are also obtained with defoamers, especially in paints with low PVC.

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[7] registered trademark of Byk-Chemie GmbH

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Drying

Coatings based on Laroflex® MP grades surface-dry rapidly but require some length of time to through-dry since Laroflex® MP grades, like all polymers, tend to hold back residual solvent. Consequently, a drying time of one or two days should be left between coats to prevent pulling up. Coatings to be exposed to water or liquid chemicals must be allowed to through-dry thoroughly. In this case, polar solvents should be avoided as any residual solvent could absorb large amounts of water and cause swelling.

Drying time can be reduced by choosing suitable solvent blends, reducing the plasticizer proportion, a higher PVC or adding voluminous extenders or diatomite. Excessive quantities of these extenders and inadequate pigment dispersion can easily lead to porous coatings with greater permeability to water vapor.

Fields of application

Industrial corrosion protection

Combinations of equal proportions of Laroflex® MP grades and air-drying binders have proven effective.

Two to three coats of thixotropic high-build coatings are needed to obtain the overall thickness of 200–250 µm necessary for effective corrosion protection. Depending on the make-up of the system and the quality of pigments and extenders, the PVC is 30–40 %. Lower-pigmented gloss coats may be used for top coats.

Marine coatings, underwater corrosion protection

Coatings having to withstand sea or river water can be formulated with Laroflex® MP grades and non-saponifiable hydrophobic plasticizers. Combinations with tar and/or hydrocarbon resins can also be used, some of the Laroflex® MP proportion may be replaced by a polyamine-cured epoxy resin. A PVC of 35–40 % is ideal for high-build coatings. These adhere extremely well to sandblasted steel, commercial shop primers and other unrelated coating systems. Laroflex® MP grades being resistant to alkalis allow formulating underwater coatings that give excellent performance in cathodic protection and on zinc/ethyl silicate primers. Since high-build coatings based on Laroflex® MP grades can be sprayed outstandingly well, only two or three spray coats are needed to achieve perfect corrosion protection.

Laroflex® MP grades can also be used as binders in antifouling paints. Hydrophylic cobinders like Lutonal® M 40 approx. 70 % in ethanol and/or rosin ensure that the antifouling agent is released at a uniform rate.

Machinery, automotive and container finishes

Suitable coatings can be formulated from Laroflex® MP grades and roughly equal amounts of air-drying binder.

Coatings on galvanized steel and aluminum

Air-drying binders should be avoided in primers and top coats on aluminum or, in particular, galvanized steel. Coatings based on such binders could flake or peel off after prolonged exposure to moisture and fluctuating temperature. Addition of special hard resins, talc and/or micaceous iron oxide allow coats with extremely good adhesion.

Coatings for mineral substrates

Laroflex® MP grades and alkali-resistant plasticizers are used to obtain coatings for mineral substrates. The pigmentation depends on the desired degree of gloss.

Architectural finishes with adequate permeability to water vapor should have a PVC of 50–60 %.

Combinations of Laroflex® MP grades, polyamine-cured epoxy resins and tar are used for underwater and underground mineral substrates.

The PVC for swimming pool coatings should be at least 50 % in order to avoid blisters forming from osmosis, even in high-build coats.

Since they are resistant to hydrolysis, Laroflex® MP grades are suitable binders for sealing and impregnating primers for stabilizing mineral substrates and reliably ensuring that subsequent coats of architectural finishes adhere well. Depending on the substrate's actual porosity, the binder concentration in these coatings should be 8–15 %.

Road marking paints

Road marking paints can be formulated from Laroflex® MP grades alone or combined with air-drying binders. Note, however, that air-drying binders will reduce the life of road markings.

Flame-retardant coatings

Laroflex® MP grades are suitable binders for flame-retardant coatings on non-flammable substrates.

Other fields of application:

- indoor and outdoor coatings on wood and duroplastics
- printing inks
- impregnating and coating of paper, cardboard and textiles
- effect paints such as wrinkle, hammer and crackle finishes

Safety

When handling these products, advice and information given in the safety data sheet must be complied with. Further, protective and workplace hygiene measures adequate for handling chemicals must be observed.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

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