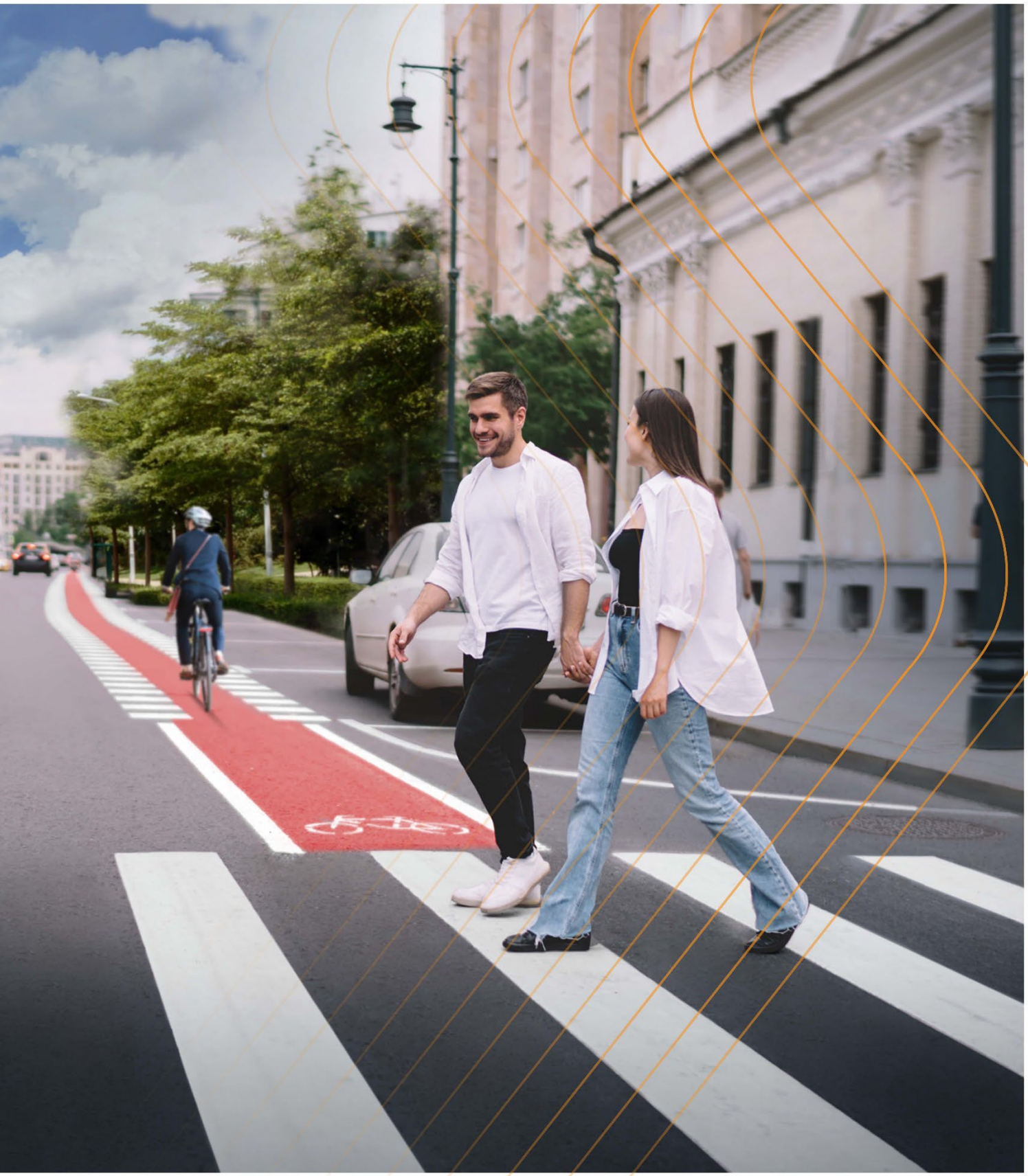
TECHNICAL INFORMATION

LIMBOPLAST D480F AIRPORT



swarco
Road Marking Systems

swarco Road Marking Systems

LIMBOPLAST D480F AIRPORT

Art.-No.: 52D480F9016R (reactive component white)
52D480F....(RAL)R (reactive component colored)
52D480F9016NR (non-reactive component white)
52D480F….(RAL)NR (non-reactive component colored)

Version: 2021-08-11

Important Information:
Please consider our General Terms and Conditions and the general notes of the Technical Information Sheet! No liability is accepted for any errors! The information is provided to our best knowledge and experience. This information is, however, no warranty for any properties of the material. We provide this information without obligation, also regarding the rights of third parties. The user has to make sure that the material is appropriate for the respective application.

1 Main characteristics / Fields of application

LIMBOPLAST D480F airport…

- belongs to the group of solvent-free, pluri-component, reactive systems
- consists of two or more components which – through chemical interaction – form a duroplastic compound which cannot be thermally plastified thereafter
- has been tested on the turntable simulator at the German Road Institute (BASt) and is approved as TYPE I and TYPE II marking with several test reports
- has been tested with good results by ILF Magdeburg: resistance against kerosene according to DIN EN ISO 2812-3; chemical resistance on basis of DIN 68861, part 1 / DIN EN 12720 (test report ILF)
- according to the requirements of chromaticity co-ordinates, luminance factor and resistance to chemicals of EASA (European Aviation Safety Agency (confirmation is conformed to the DSGS certificates)
- especially suitable for airfield areas outside aircraft operating areas with intensive traffic impact by vehicles
- can be applied on aircraft operation areas. It must be checked in advance, whether flaked off cold plastic parts may be sucked into aircraft engines and cause damage. In case of doubt other products should be used
- available in colors according to DIN 6171, standard colors for airfields
- is suitable for all bituminous surfaces (e.g. mastic asphalt, asphaltic concrete) and also concrete pavements (priming required)
- can be applied with cold plastic application machines with open system / screed box technique or extruder technique

2 Technical Data

Color	White, RAL-colors within limits of color co-ordinates according to Annex 14 ICAO and EASA* (without chromaticity co-ordinates of the color sky blue and grass-green)
Density	approx. 1.84 kg/l +/- 0.06
Potlife	5–10 minutes (depending on hardener quantity added and air, material and surface temperatures; cf. “Table Potlife / Curing Times”!)
Solvent content	Solvent-free, must be applied without adding solvent
Solvent for cleaning	Special cleaner for marking machines Art.-No.: 3086
Storage stability	6 months; unmixed in sealed original packaging and protected from frost and direct sun light!)
Trafficability / curing time	Depends on the climatic conditions (cf. table “Potlife / Curing Times”). In general the marking’s trafficability must be checked before exposing them to traffic impact. BASt test reports (T – specifications) are laboratory results only
Standard packaging	**2-comp. D480F airport:** Tin container with 10/15/25/40 kg filling weight, container filling on request **3-comp. D480F airport:** Tin container white filling weight 40 kg, non-reactive component Tin container blue filling weight 40 kg, reactive component Container – for reactive and non-reactive component; **Hardener powder**: PE-bags – filling weight corresponds to cold plastic quantity and mixing ratio **Liquid hardener:** plastic cans – 20 kg filling weight **Attention:** All hardener types are organic peroxides - they must be separately packaged, transported and stored away from the cold plastic in special containers (special cartons and boxes). **Drop-on material:** paper bags with PE-inlay – 25 kg filling weight

Identification	The regulations and instructions concerning appropriate transport, handling, storage, first aid and measures, toxicology and ecology are stated in detail in our material safety data sheets! The instructions stated on the product label and in the MSDS must be followed.
Processing temperature	min. + 5°C
Surface temperature	+ 5°C to + 45°C
Relative humidity	max. 75% (dew point spreadsheet has to be regarded)
Layer thickness	**Plain marking** : 2–3 mm **Agglomerate**: 1.5–3.0 mm
Theoretical consumption	**Plain marking:** 3.7–5.5 kg/m² (2–3 l/m²) or approx. 1.84 kg/m² per 1.0 mm layer thickness **Agglomerate:** 2.2–2.8 kg/m² (1.2–1.5 l/m²) The actual consumption depends on the applied layer thickness, application technique and type and state of the surface.

*In order to simplify color selectin: in practice RAL colors with color co-ordinates within limits of Annex 14 ICAO and EASA are used. The colors sky blue and grass-green are recommended due to improved recognizability.

3 Theoretical consumption of material

Product	RAL color	Density	Theoretical consumption / Layer thickness		
		kg/l	kg/m² *	kg/m² *	l/m² *
			2 mm	3 mm	2.2–2.8 kg/m²
LIMBOPLAST D480F airport white	9016	1.84	3.68	5.52	1.20–1.52
LIMBOPLAST D480F airport traffic yellow	1023	1.81	3.62	5.43	1.22–1.55
LIMBOPLAST D480F airport traffic orange	2009	1.82	3.64	5.46	1.21–1.54
LIMBOPLAST D480F airport traffic red	3020	1.72	3.44	5.16	1,28–1,63
LIMBOPLAST D480F airport sky blue	5015	1.84	3.68	5.52	1.20–1.52
LIMBOPLAST D480F airport grass-green	6010	1.81	3.62	5.43	1.22–1.55
LIMBOPLAST D480F airport traffic black	9017	1.88	3.76	5.64	1.17–1.49

* rounded consumption

The actual consumption depends on the applied layer thickness and the type and state of the surface.

4 Mixture ratios / Application techniques / Hardener

Product	Technique	Type of hardener
2-C LIMBOPLAST D480F airport **Reactive component = Base component** summer formulation winter formulation	**Open mixture technique** 2-comp. marking machine (screed box), Manual application (trowel, spatula)	Hardener powder
Mixing ratio: Reactive component (base component) **: Hardener powder** (BPO) **= 100 : 1**		
2-C LIMBOPLAST D480F airport **Reactive component = Base component** summer formulation winter formulation	**Shielded mixture technique** 2-comp. marking machine (extruder technique), Manual application (trowel, spatula)	Liquid hardener
Mixing ratio : Reactive component (base component) **: Liquid hardener = 98 : 2**		
3-C LIMBOPLAST D480F airport **Reactive component** **Non-reactive component**	**Shielded mixture technique** 3-comp. special machines	Liquid hardener
Mixing ratio : non-reactive component* + liquid hardener : reactive component = 1 : 1 (2% to 4%)		
3-C LIMBOPLAST D480F airport **reactive component** **non-reactive component**	**Shielded mixture technique** 3-comp. special machines	Hardener powder
Mixing ratio : non-reactive component* + Hardener powder BPO : reactive component = 1 : 1 (2% to 4%)		

* non-reactive component, mixed with hardener gets a limited storage stability / pot life. The remaining quantity has to be as removed out of the machine after finishing the marking job.
Between October and April LIMBOPLAST D480F is delivered in winter formulation, due to weather conditions.

5 Processing instructions

5.1 General Information

In addition to ICAO-Annex 14 national guidelines / recommendations regarding markings for aircraft operations areas or airport ramps, taxiways, runways have to be observed.

5.2 Preparation of material and application techniques

LIMBOPLAST D480F airport must be **homogeneously stirred** in its original container before processing! Then the powder hardener (2-comp. cold plastic) is mixed with the base component at the specified mixing ratio using an appropriate stirring device.
Never prepare more material with hardener than is needed for the application (observe potlife).
It is important to note for 2-comp. machines with shielded mixture technique that the base component and liquid hardener are mixed in the right ratio inside the mixing device.

Regarding the **3-component LIMBOPLAST D480F airport** (mixing ratio 1:1) the following additional information is important:

- The non-reactive component is processed by homogeneously stirring 2 - 4 % hardener into it and filling it into the dedicated storage container for the non-reactive component. The container must then be sealed in order to avoid contamination with the reactive component. Subsequently the homogeneously stirred reactive component is filled into the dedicated storage container for the reactive component.
- Extremely clean working conditions are essential when processing the components. Minimal contamination or intermixing of the components may lead to premature hardening. Therefore the use of different stirring devices or auxiliary tools for each component is recommended.
- Only merge the components in the mixing tube directly before application since even little intermixing leads to premature hardening with subsequent machine failure.
- Even with only short standstills of the machine it is necessary to rinse the mixing and spray devices with special cleaner for marking machines (Art.-No.: 3086).
- The non-reactive component has a limited storage stability / potlife when combined with the hardener (powder or liquid). Therefore, residuals of the non-processed, premixed materials must be removed from the machine. Otherwise, machine damage may occur as a result of polymerization.

Cold plastic (reactive systems) is solvent-free and must be applied without adding solvent.
The cleaning must occur before the complete curing of the material takes place by using **Special cleaner for marking machines** (Art. No.: 3086).

The exact machine adjustments have to be done according to the manufacturer's instructions. Layer thickness and the quantity of drop-on material need to be evenly distributed. Scattering losses on both line sides make modified machine adjustments necessary.

Theoretical consumption of material and drop-on materials are stated in:

- in the respective test reports by BASt
- in the table 1 "RPA – test reports by BASt" see point 8.1

- in the table “Theoretical consumption of material and drop-on materials” on our website in kg/m² as well as in kg/km of line to be marked depending on typical line width

5.3 Optimizing of application properties of cold plastic

5.3.1 General information

Application properties and reactivity of cold plastic depends on temperatures of material, air and surface. Proper storage conditions may partly improve application conditions.

Within a limited extend viscosity and reactivity / curing time can be adjusted to processing conditions.

Attention: Use methods described in 5.3.2 and 5.3.3 regarding agent quantities. When exceeding the mentioned quantities and simultaneous usage of two or more methods (agents) may have negative consequences on application properties and traffic technological properties.

5.3.2 Viscosity

Increase of viscosity (e.g. high material, air and surface temperatures): addition of max. 0.2% thixotropic agent (Art.-No.: RH13700 solid or RH10459 liquid).

Reduction of viscosity (e.g. low material, air and surface temperatures) addition of max. 1% condenser (Art.-No.: 3044).

Attention: Add the needed agent quantity to the required amount of material for application only, otherwise viscosity or settle properties can change.

5.3.3 Reactivity / curing time

Acceleration of reactivity / curing time (e.g. spring/autumn application jobs with low temperatures)

a) Addition of max. 0.2 % accelerator for cold plastic (Art.-No.: 8060) or
b) Increase hardener quantity up to max. 2% by weight

Retarding of reactivity / curing time (e.g. high temperatures in the summertime)

a) Add max. 0.2 % retarder (Art.-No.: 8050) or
b) Reduce hardener quantity but not below 0.5% by weight

Attention: To ensure a proper chemical reaction do not go below 0.5% by weight for hardener and do not exceed 2% by weight for hardener.
Different potlife and curing times depend on material and surface temperatures, different hardener quantities, addition of accelerator or retarder as shown in the spreadsheet.

Table 1: Pot life and curing times of 2-component cold plastics depending on material and surface temperature

Temp. (°C)	Powder hardener (weight %)	Pot life (min)	Curing time (min)	Liquid hardener (weight %)	Pot life (min)	Curing time (min)
0°	2	-	-	2	-	-
5°	2	31	48	2	28	65
10°	2	23	39	2	17	50
15°	2	12	30	2	15	46
20°	1	11	29	2	14	30
25°	1	9	25	2	12	26
30°	1	7	20	2	10	21
40°	0,5	10	26	2	6	15
45°	0,5	8	19	2	5	12

Table 2: Pot life and curing times of 3-component cold plastics system 1:1 depending on material and surface temperature

Temp. (°C)	Powder hardener (weight %)*	Pot life (min)	Curing time (min)	Liquid hardener (weight %)*	Pot life (min)	Curing time (min)
0°	4	-	-	4	-	-
5°	4	21	60	4	33	80
10°	4	16	42	4	26	49
15°	4	11	30	4	16	31
20°	2	13	27	2	21	35
25°	2	10	23	2	16	26
30°	2	11	20	2	13	22
30°	1	13	23	1	21	35
40°	1	10	22	1	14	23
45°	1	8	21	1	11	17
*Related to non-reactive component						

Table 3: Pot life and curing times of 3-component cold plastics as a function of temperature with addition of accelerator or retarder

Temp. (°C)	Accelerator (weight %)	Retarder (weight%)	Powder hardener (weight %)*	Pot life (min)	Curing time (min)	Liquid hardener (weight %)*	Pot life (min)	Curing time (min)
0°	0,2	-	2	-	-	4	-	-
5°	0,2	-	2	15	42	4	24	54
10°	0,2	-	2	12	29	4	18	38
15°	0,1	-	2	11	27	4	17	33
20°	-	-	2	11	29	4	16	33
25°	-	0,1	2	10	24	4	16	34
30°	-	0,1	2	8	20	4	13	27
30°	-	0,2	2	10	23	4	15	34
40°	-	0,2	2	7	17	4	10	24
45°	-	0,2	2	8	18	4	10	29
*Related to non-reactive component								

Table 4: Pot life and curing times of 2-component cold plastics as a function of temperature with addition of accelerator or retarder

Temp. (°C)	Accelerator (weight %)	Retarder (weight %)	Powder hardener (weight %)	Pot life (min)	Curing time (min)	Liquid hardener (weight %)	Pot life (min)	Curing time (min)
0°	0,2	-	1	-	-	2	-	-
5°	0,2	-	1	24	67	2	23	60
10°	0,2	-	1	19	36	2	17	34
15°	0,1	-	1	18	31	2	17	32
20°	-	-	1	15	31	2	15	30
25°	-	0,1	1	14	29	2	16	29
30°	-	0,1	1	13	26	2	13	27
30°	-	0,2	1	18	35	2	16	35
40°	-	0,2	1	14	26	2	11	22
45°	-	0,2	1	12	29	2	13	30

6 Road surface / pretreatment

6.1 General information

The surface must be dry, clean and free from grease, oil and loose gravel and other contaminations. The surface and potentially existing old markings must be checked for their carrying capacity and compatibility with the material to be applied. In case of doubt, test applications and adhesion tests are required. Ideally, old markings should be removed with appropriate mechanical procedures.

In cases of initial markings (temporary markings) LIMBOROUTE 2-comp. K809F is recommended. The paint is suitable for humid surfaces and has good carrying capacity for reactive marking systems.

Thick layer markings are basically not an ideal system for aircraft operation areas. Intensive impact by traffic, snow ploughs, winter maintenance or frost may cause marking spalling. At aircraft operation areas it is dangerous that spalling gets sucked into aircraft engines. In case of doubt other airfield marking system must to be applied.
LIMBOPLAST D480F airport is an applicable alternative for helipads.

Colored marking materials may fade after some time of outside exposure. This is a normal effect caused by sun exposure, water, road salt, dew, condensed water and heat. Constant traffic impact reduces bleaching and shift of color intensity but is not able to prevent fading completely. See our elaborations on that subject in our “General notes on technical information sheets”.
If necessary colored markings are to be renewed. Annex 14 ICOA describes under point 3 “Colors for markings, signs and panels“ paints can fade, therefore specifications for paints only apply to new paint.

Attention: LIMBOPLAST D480F airport is not suitable for large scale asphalt markings.

6.2 Concrete and cement-bound surfaces

The pavement components that prevent good bonding, especially on new concrete, including fine mortar layer, concrete slurries, concrete after-treatments as setting retarders, paraffin, impregnations on silicate basis etc. must be appropriately removed (e.g. with high pressure waterjet, fine millcut or similar). We recommend conducting test applications in case of doubt and to communicate concerns in written form.
On freshly washed concrete surfaces (with grit) poor bonding properties may occur, not caused by marking paint quality. Therefore, we recommend applying test markings.
Before applying LIMBOPLAST D480F airport on concrete or cement-bound surfaces should be pretreated with primers:

a) for spray technique (paint spray machine) use 2-component EP-primer (Art. No.: 8609000) or
b) manually (roller) use 2-component primer B71 for concrete (Art. No.: 8010) or
c) for spray technique (paint spray machine) use LIMBOROUTE 2-comp. K809 (Art.-No.: 14809A)

It is essential to have a sufficient and uniform coverage with primer in order to obtain an optimum bonding of the cold plastic and the concrete. Primer consumption may vary depending on the concrete’s porosity. The moisture of concrete must not exceed 4% during the application of 2-component primer B71 for concrete. Primers based on epoxy resins are suitable for residual moisture surfaces (compare point a) to c)).

6.3 Bituminous surfaces

Any loose components such as chippings must be removed. Fluxoils, releasing agents for road rollers are detrimental to good bonding of markings and can cause discoloration of the striping. Since airfields with new surfaces cannot be left unused and unmarked for 4–6 weeks, test markings and bonding checks are required before applying the final marking. It is recommended to conduct both in sufficient time prior to the cold plastic application.

6.4 Floor coatings

For markings on floor coatings our indoor marking products should be used, LIMBOPLAST D480F airport is not suitable for floor coatings.

7 Application techniques

With common cold plastic self-propelled marking machines or manually with dispensing shoe (screed box) or extruder technique, small hand-pushed marking machines or manually with trowel, spatula or similar.

Attention: Despite the exact layer thickness adjustment at the dispensing shoe, increased consumption may occur when applying the material on coarse surfaces. This is because the hollow parts of the surface are filled first before a measurable layer thickness is built up.

When applying manually, use stencils or adhesive tapes to improve the edges and borders of the markings. Remove tapes in time after applying cold plastic and broadcast drop-on material as soon as possible into the fresh cold plastic in order to get appropriate traffic technological properties.

For large-scale marking jobs self-propelled marking machines are used. For manual markings (e.g. urban area markings) small machines are used. The detailed settings depend on the application conditions and machine type and have to be adjusted according to the instructions of the machine manufacturer. It is important to watch that material and drop-on materials are uniformly spread over the application surface and that the indicated quantities are respected. Practical experiences show, that independent of the used application techniques, liquid or powder hardener properties of hardened cold plastics are identical.

For agglomerate markings, the information relating to application techniques and the instructions for the production and renovation of agglomerates as described in the Technical Information “LIMBOPLAST D480 for plain / structure / profile”.

8 Test reports

8.1 RPA – test reports by BASt (German Road Institute)

Test report no.	Layer thickness	consumption		Drop-on material (DOM)	Traffic technological properties	
	mm	Material	NSM	Identification (divergent identification possible - see relevant test report)	New condition	Used condition
		kg/m²	kg/m²			
Type I marking white						
2020 1DK 12.17	3.0	5.52	0.45	Airport beads Type I T18 M30	P7, S1, R5, Q5, T3*	P7, S1, R5, Q5
Type I marking yellow						
2019 1VK 03.16	3.0	5.43	0.45	Airport beads Type I T18 GG30	P7, S1, R5, Q3, T3, Y2	P7, S1, R5, Q3
Type II marking yellow						
2020 1VK 12.18	3.0	5.43	0.45	Airport beads Type II T18 GG30	P7, S1, R5, RW5, Q3, T3, Y2	P7, S1, R5, RW3, Q3
Type II marking irregular agglomerates						
2004 1DK 08.12	1.5 – 3.0	2.2 – 2.8	0.40	SWARCOLUX P21 T18	P7, S0, R5, RW6, Q5, T3	P7, S0, R5,RW6,Q5
2019 1DK 03.12	1.5 – 3.0	2.5 – 2.8	0.50	SWARCOLUX P21 T18	P7, S0, R5, RW6, Q5, T3	P7, S0, R5,RW5,Q5