



SWARCO LIMBURGER LACKFABRIK GmbH

Road Marking Systems



LIMBOPLAST D480 structure

TECHNICAL INFORMATION

LIMBOPLAST D480 structure

Art.-No.: 5087..., white

Reactive Systems - coldplastic

Version: 2014-08-28

Consider our General Notes on Technical Information Sheets!
No liability is accepted for any errors.

CONTENTS

1	Main characteristics / Fields of applications	3
2	Technical Data	3
3	Mixing ratios / Application techniques / Hardener	4
4	Processing Instructions.....	4
4.1	Preparation of material and application techniques	4
4.2	Optimizing of application properties of coldplastic	5
4.2.1	General information	5
4.2.2	Viscosity.....	5
4.2.3	Reactivity / curing timer	5
5	Road surface / pretreatment.....	6
5.1	General information	6
5.2	Concrete or cement-bound surfaces	7
5.3	Bituminous surfaces	7
5.4	Block paving	7
5.5	Floor coating	7
6	Application techniques	8
7	RPA - Test Reports by BASt (German Road Institute)	9

1 Main characteristics / Fields of applications

LIMBOPLAST D480 structure...

- belongs to the group of solvent-free, multi-component, reactive systems
- consists of two or more components which – through chemical interaction – form a duroplastic compound and cannot be thermally plastified thereafter
- is suitable for bituminous surfaces (e.g. mastic asphalt, asphaltic concrete) and also concrete pavements (priming required)
- has been tested on the turntable simulator at the German Road Institute (BAST)
- is exclusively applied as agglomerate-type **rain safety marking** with enhanced wet night visibility
- is an economical alternative to other types of rain safety markings due to the stochastic (random) distribution of the individual agglomerates
- has an open structure (agglomerates) with excellent drain effect and good resistance against snowploughs
- can be applied with common application equipment / machinery for agglomerate markings (extruder / dispensing shoe)

2 Technical Data

Color	white
Density	approx. 1.87 kg/l +/- 0.1
Potlife	5 - 10 min. (depending on hardener quantity added and air, material, and surface temperatures; cf. "Table Potlife / Curing time!")
Solvent content	Solvent-free
Solvent for cleaning	Special cleaner for marking machines (Art.-No.: 3086).
Storage stability	6 months; unmixed in sealed original packaging and sheltered from frost and direct sun exposure
Overrollability / curing time	Depends on the climatic conditions (cf. table "Potlife / Curing times"). In general the markings` overrollability must be checked before exposing them to traffic impact.
Standard packaging	<p>2-C D480 structure: Tin foil container with 10/15/25/40 kg filling weight; Container upon request</p> <p>3-C D480 structure: white container – 40 kg filling weight - component A blue container – 40 kg filling weight - reactive component B Container for component A and B upon request ;</p> <p>Hardener powder: PE-bags – filling weight corresponds to coldplastic quantity and mixing ratio</p> <p>Hardener beads: paper bags - 20 kg filling weight</p> <p>Liquid hardener: plastic cans - 20 kg filling weight</p> <p>Attention: all hardener types are organic peroxides - they must be separately packaged, transported and stored from the coldplastics in special containers (special cartons and boxes).</p> <p>Drop-on material: paper bags with PE-inlay – 25 kg filling weight</p>
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)
Theoretical consumption	2.2 – 2.8 kg/m ² The minimum of material (without drop-on material) of 2.2 kg/m ² , must not to be underrun. In areas with intensive snowplough junction we recommend a material consumption of 2.5 kg/m ² - 3.0 kg/m ²
agglomerate coverage	min. 60% by vertical viewing (see general information to the technical information)

LIMBOPLAST D480 structure

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 Road Marking Systems

3 Mixing ratios / Application techniques / Hardener

Product	Art.-No.	Technique	Hardener type
2-C LIMBOPLAST D480 structure reactive component B = base component summer formulation winter formulation	5087 5087W	mainly applied by spiked roller	Hardener powder
Mixing ratio: reactive component B (D480 structure) : hardener powder (BPO) = 100 : 1			
2-C LIMBOPLAST D480 structure reactive component B = base component summer formulation winter formulation	5087HP 5087HPW	2-component applicators	Hardener beads 2000
reactive component B = base component summer formulation winter formulation	5087spezP 5087spezPW	2-component applicators with rotating spatula technique	Hardener beads 2000
Mixing ratio: reactive component B (D480 structure) : hardener beads 2000 = 100 : 4			
2-C LIMBOPLAST D480 structure reactive component B = base component summer formulation winter formulation	5087Cadox 5087CadoxW	2-component applicators, mainly with spiked roller	Liquid hardener
reactive component B = base component summer formulation winter formulation	5087spezE 5087spezEW	2-component applicators with Spottflex Silent technique or perforated plate technique or Air Impulse technique	
Mixing ratio: reactive component B (D480 structure) : liquid hardener = 98 : 2			
3-C LIMBOPLAST D480 structure reactive component B = base component summer formulation winter formulation non-reactive component A	5087NorpolB 5087NorpolBW 5087NorpolA	3-C special marking machines	Liquid hardener
Mixing ratio: component A* (non reactive) + liquid hardener (2% to 4%) : component B (reactive) = 1 : 1			
3-C LIMBOPLAST D480 structure reactive component B = base component summer formulation winter formulation non-reactive component A	5087 (1:1)B 5087(1:1)BW 5087 (1:1)A	3-C special marking machines	Hardener powder
Mixing ratio: component A* (non reactive) + hardener powder BPO (2% to 4%) : component B (reactive) = 1 : 1			

* Component A, mixed with hardener gets a limited storage stability / pot life. Remaining quantity has to be as removed out of the machine, (inclusive hoses) after finishing marking job.
Between October and April LIMBOPLAST D480 structure are delivered in winter formulation, due to weather conditions.

4 Processing Instructions

4.1 Preparation of material and application techniques

LIMBOPLAST D480 structure must be **homogeneously stirred** in its original container before processing! Then the hardener (powder or liquid) is mixed with the base component (LIMBOPLAST D480 structure) at the indicated mixing ratio while using an appropriate stirring device. Never prepare more material with hardener than is needed for the application (observe potlife).

Regarding **3-component LIMBOPLAST D480 structure** (mixing ratio 1:1) the following additional remarks are important:

- The non-reactive component A is processed by homogeneously stirring 2 - 4 % hardener into it and filling it into the dedicated storage container A. The container must then be sealed in order to avoid contamination with component B. Subsequently the homogeneously stirred component B is filled into the dedicated storage container B.

LIMBOPLAST D480 structure

SWARCO LIMBURGER LACKFABRIK GmbH
Road Marking Systems

- ▶ 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 application devices with the **special cleaner for marking machines** (Art.-No.: 3086).
- ▶ The non-reactive component A 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.

Coldplastics (reactive systems) are solvent-free and must be applied without adding solvent (for optimizing of material processability see chapter 4.2).

The cleaning must occur before the complete curing of the material takes place by using the **special cleaner for marking machines** (Art.-No.: 3086).

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

4.2 Optimizing of application properties of coldplastic

4.2.1 General information

The application properties and reactivity of the material depends on temperatures of coldplastic, air- and surface. Proper storage conditions improve application conditions partly.

Attention: use methods described with 4.2.2 and 4.2.3 regarding agent quantities. When exceeding the mentioned quantities and simultaneous usage of two or more methods (agents) grave consequence of application properties or traffic technological properties will occur.

4.2.2 Viscosity

To increase viscosity (e.g. high material- air- and surface temperatures) add about 0.2 % thixotropic agent (Art.-No.: RH10802 solid or RH10459 liquid).

For a reduction of viscosity (e.g. low material- air- and surface temperatures) add about 1% condenser (Art.-No.: 3044).

Attention: Add the needed agent quantity only, otherwise viscosity or settle properties can change.

4.2.3 Reactivity / curing timer

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

- a) addition of max. 0.2 % accelerator for coldplastic (Art.-No.: 8060) or
- b) increase powder hardener quantity by a max. 2% weight percentage.

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% weight percentage for hardener powder or 1% for liquid hardener.

Attention: for ensuring proper chemical reaction don't use less than 0.5% weight percentage for hardener powder and don't exceed 2% weight percentage for hardener powder.

LIMBOPLAST D480 structure

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Road Marking Systems

Different potlife- and curing times depend on material- and surface temperatures, different hardener quantities, amount of accelerator or retarder as shown in the spreadsheet.

Table: Curing times of 2-C coldplastic system 98:2 with liquid hardener in relation to material and surface temperatures

Temp. (°C)	Hardener quantity Liquid (Weight %)	Curing time (min)
0°	2	23
5°	2	15
10°	2	13
15°	2	10
20°	2	9
25°	2	7
30°	2	5
40°	2	4
45°	2	3

Table: Potlife / Curing times in relation to material and surface temperatures

Temp. (°C)	Hardener quantity (Weight %)	potlife (min)	curing time (min)
0°	2	-	-
5°	2	17	22
10°	2	16	24
15°	2	8	20
20°	1	8	18
25°	1	7	17
30°	1	7	15
30°	0.5	8	18
40°	0.5	7	15
45°	0.5	6	13

Potlife and curing times of 3-component coldplastics depending on material and road surface temperatures

Temp. (°C)	Hardener quantity (Weight %)*	Potlife (min)	Curing time (min)
0°	4	22	45
5°	4	20	40
10°	4	26	35
15°	4	9	27
20°	2	11	22
25°	2	9	20
30°	2	10	19
30°	1	12	26
40°	1	5	16
45°	1	4	15

* non-reactive component A

Potlife and curing times of 2-component and 3-component coldplastics depending on temperature while adding accelerator or retarder

Temp. (°C)	Hardener Quantity (Weight %)	Accelerator (Weight %)	Retarder (Weight %)	Potlife (min)	Curing time (min)
0°	2	0.2	-	19	30
5°	2	0.2	-	18	26
10°	2	0.2	-	12	23
15°	2	0.1	-	7	19
20°	2	-	-	11	22
25°	2	-	0.1	13	27
30°	2	-	0.1	11	24
30°	2	-	0.2	19	28
40°	2	-	0.2	5	22
45°	2	-	0.2	6	25

5 Road surface / pretreatment

5.1 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.

Attention: LIMBOPLAST D480 structure is not appropriate for large surface applications.

5.2 Concrete or cement-bound surfaces

The pavement components in new road surfaces that prevent good bonding (fine mortar layer, concrete slurries) must be appropriately removed (e.g. with high pressure water jet, fine mill cut or similar). We recommend conducting test applications.

Before applying LIMBOPLAST D480 structure concrete or cement-bound surfaces should be pre-treated with primers:

- a) with spray technique (paint spray machine) with 2-component EP-primer (Art.-No.: 8609000) or
- b) manually (roller) with 2-component B71 for concrete primer (Art.-Nr.: 8010) or
- c) with spray technique (airspray or airless technique) with LIMBOROUTE 2-K 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 coldplastic and the concrete. Primer consumption may vary depending on the concrete's porosity. The humidity of concrete must not exceed 4% during application of 2-component B71 for concrete primer. Primers based on epoxide resins are suitable for residual damp surfaces.

5.3 Bituminous surfaces

Any loose components such as chippings must be removed. Flux oils, releasing agents from road rollers or other asphalt components are detrimental to good bonding of markings or can cause discoloration of the striping. Since a mechanical removal is hardly possible, the surface should be exposed to traffic for 4 - 6 weeks or an initial marking with paint has to be applied. It is recommended to use LIMBOROUTE 2-K K809, instead of a one-component paint when applying an initial marking. A bonding check is required before applying the final marking.

5.4 Block paving

All kinds of block paving are non-static surfaces which can lead to crack formation or spalling on the marking. Therefore no guarantee can be given for any problems resulting from the application of any marking material on block paving. Test applications and surface pre-treatment are recommended to ensure proper bonding.

Compound concrete stone pavements:

Pavement must be primed with 2-component B71 for concrete primer (Art.-No.: 8010), see Technical Information. Afterwards coldplastic can be applied.

Natural or cast stone pavements (basalt, granite....):

Marking surface must be primed with 2-C primer B55 for block paving (Art.-No.: 8011). Afterwards apply paving mortar (Art.-No.: 5232...) and pay attention to get an even and flat surface. The overall dimensions should protrude 2 – 3 cm over the marking surface. After curing coldplastic application follows. Consumption of primer and pavement mortar depends on shape of paving.

5.5 Floor coating

For markings on floor coatings one of our indoor marking products should be used.

6 Application techniques

Applied with common self-driving coldplastic extruder or dispensing shoe machines (for large-scale applications) or manually with smaller equipment (for locally limited applications) including various adaptive kits for the creation of agglomerate markings. Currently the following techniques are used to apply agglomerate markings:

- 1) Spiked roller technique
A spiked roller rotating under the dispensing shoe stochastically distributes the material onto the road surface.
- 2) Spring tension technique
A roller whose springs tear off the material flow and distribute it mechanically with pressure and tension.
- 3) Spinning spatula technique (SST)
A roller whose springs (off tension) stochastically spin off the unmixed (without hardener) material flowing from the dispensing shoe and immediately drops on the hardener beads 2000 for hardening (open system – no potlife).
- 4) Perforated plate technique
The material is distributed stochastically through the dispensing shoe via a perforated plate.
- 5) Spotflex-Silent / Spotflex-Classic-technique
The material, mixed with the hardener in a mixing tube, is applied under pressure through a block with an integrated pin system (pins abruptly opened and closed electro-pneumatically).

The different application techniques create agglomerates of different shapes (e.g. spots, drops, etc.). The intensity of structure forming can be influenced both by machine adjustment (gap width of dispensing shoe, spring tension, speed, etc.) and material adjustment. There are no official indications so far about the ideal shape of the individual agglomerates. It is important to observe that material and drop-on materials are spread uniformly over the application surface and that the indicated quantities are respected.

Technique and material adjustment for the drop-on materials must be harmonized to ensure an optimum bead embedment also on the edges of the individual agglomerates.

Practical experience shows that the traffic technological properties of all kinds of agglomerates and their expected useful life depends on the following factors and has to be taken into consideration:

- the processing of the specified material quantity in the BAST-report (including drop-on material)
- an optimal structure with a good shoulder formation
- an agglomerate coverage >60% by vertical viewing
- the processability of the material conforms to the specific weather conditions (see chapter 4.2.2 and 4.2.3) and to the machine- and application technique
- an optimal spreading and embedding (mainly on the shoulder) of the specified quantity / type of drop-on materials
- an optimal configuration of the marking machines and application aggregates, according to the technical requirements of the producer

LIMBOPLAST D480 structure

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 Road Marking Systems

7 RPA - Test Reports by BASt (German Road Institute)

Test report-no.	Layer thickness	Consumption		Drop-on material (DOM)	Traffic technological properties	
	mm	Material kg/m ²	DOM kg/m ²	Identification	New condition	Used condition
stochastic agglomerates						
2000 1DK 02.13	1.5 – 3.0	2.2 – 2.8	0.50	Megalux 0.6- 0.8 KT 18	P7, R5, RW6, Q5, T3	P7, R5, RW4, Q5
2004 1DK 08.12	1.5 – 3.0	2.2 – 2.8	0.40	Swarco P21 without anti-skid material	P7, R5, RW6, Q5, T3	P7, R5, RW6, Q5
2008 1DK 04.07	1.5 – 3.0	2.2 – 2.8	0.50	Swarco P21 without anti-skid material	P7, R5, RW6, Q5, T2	P7, R3, RW3, Q5
2009 1DK 11.07	1.5 – 3.0	2.2 – 2.8	0.40	Swarcoflex 100-600 T18 without anti-skid material	P7, R5, RW6, Q5, T3	P7, R5, RW4, Q5
regular agglomerates						
2005 1DK 10.06	1.5 – 3.0	2.2 – 2.8	0.40	Swarco P21 without anti-skid material	P7, R4, RW6, Q5, T3	P7, R3, RW5, Q5
2012 1DK 08.05	1.5 – 3.0	2.2 – 2.8	0.40	Swarcoflex 100-600 T18 without anti-skid material	P7, R5, RW6, Q5, T3	P7, R5, RW5, Q5,