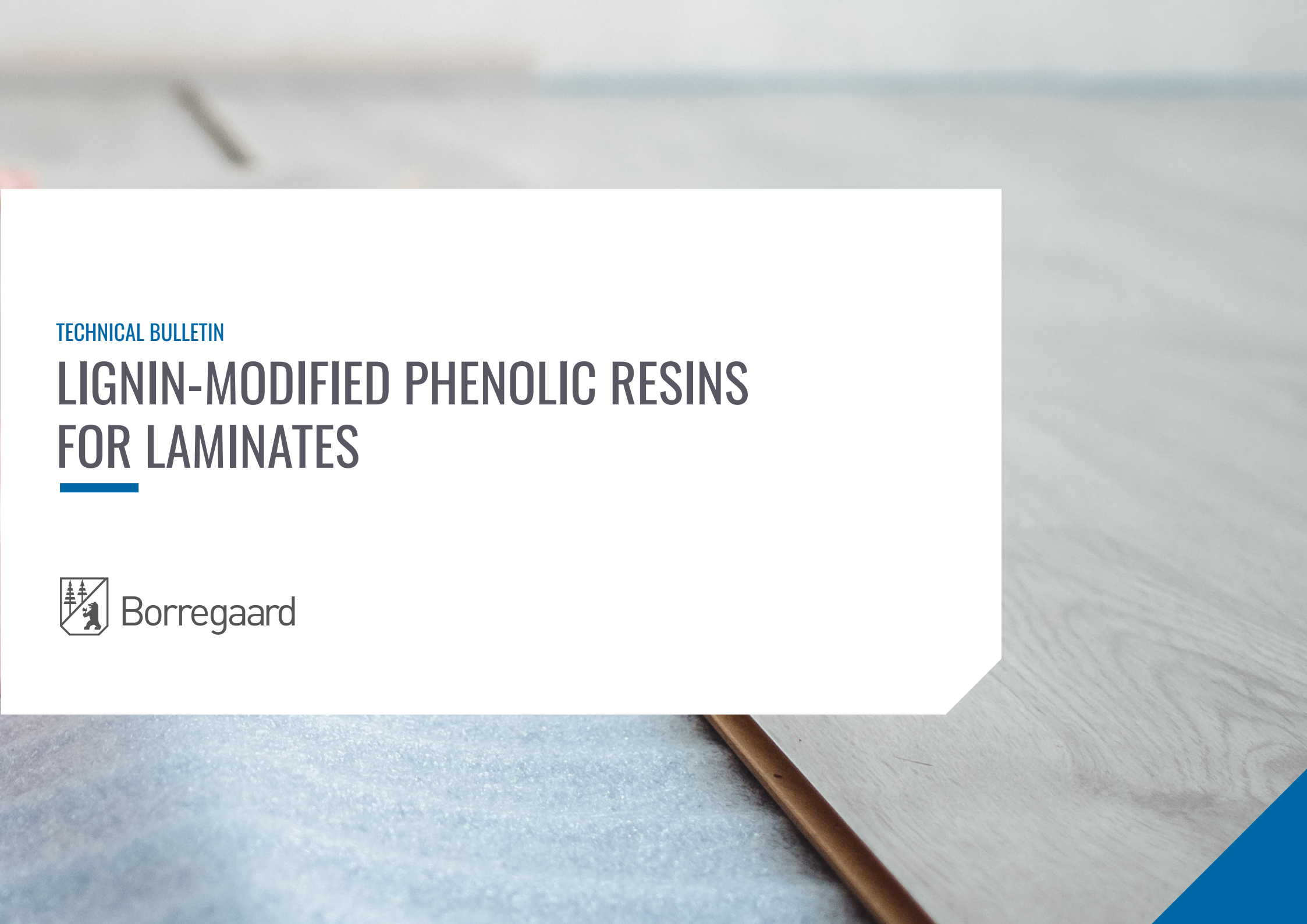


TECHNICAL BULLETIN

LIGNIN-MODIFIED PHENOLIC RESINS FOR LAMINATES

Borregaard

STANDARD LAMINATES PF RESIN (NO LIGNIN) FORMULATION

Short characterization: MR (F/P) = 1.9, MR (U/F) = 0.06, MR (NaOH/P) = 0.03

Raw material	Percentages, %	Amount, g	Comments
Formaldehyde	37	806,98	
Phenol	100	492,40	
Sodium hydroxide	100	2,70	Pellets
Sodium hydroxide	100	2,25	Pellets
Urea	100	35,82	
Methanol	100	57,00	
Total		1397,2 / 1025,0 (after distillation)	

PROCEDURE

1. Charge formaldehyde and phenol to the reactor.

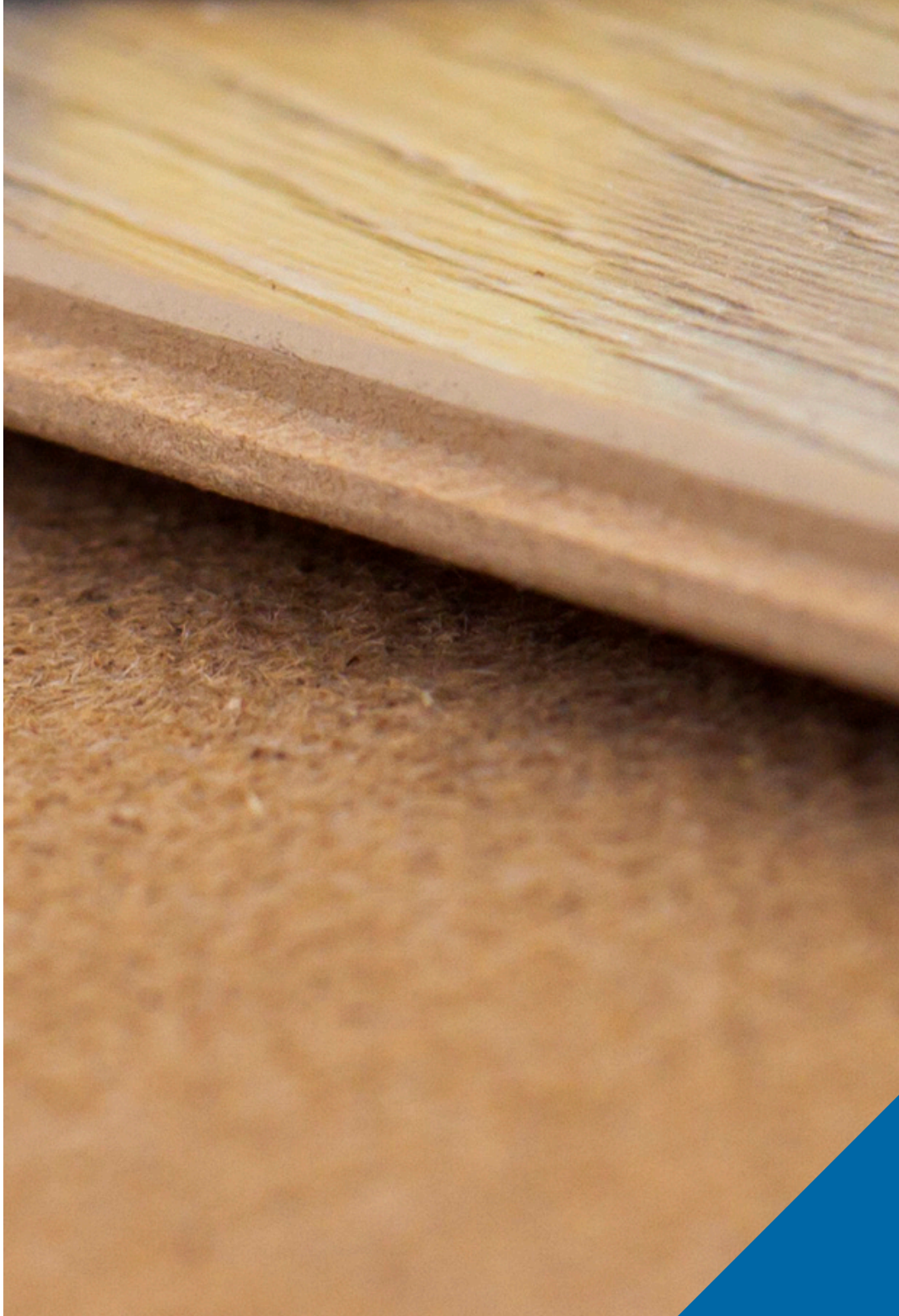
2. Add 1st portion of sodium hydroxide and let the temperature rise slowly to 90°C by 1st heating and then cooling once the exothermic reaction starts.

3. After reaching 90°C hold the temperature there for 15 min.

4. Add the 2nd portion of sodium hydroxide gradually so that the temperature doesn't rise more than 95°C. Keep the temperature t 90°C. The condensation reaction should be kept going until a water miscibility of 1:2,4 ml/g (at 25°C) is reached.

5. Distillation of water (approx. 370 ml water) at 55-65°C and vacuum.

6. Under vigorous stirring urea is added. The mixture is heated to 60°C and stirred for 15 minutes before cooling. Add the methanol when reaching 35°C.



LAMINATES LPF RESIN FORMULATION

Calculated with Borresperse Na (powder), with formaldehyde 37%.

Short characterization: MR (F/P+LS) = 1.75, MR (U/F) = 0.06, MR (NaOH/P+LS) = 0.03

Raw material	Percentages, %	Amount, g	Comments
Water	100	120,00	Tap
Borresperse Na	100	98,48	Powder
Sodium hydroxide	100	4,00	Pellets
Formaldehyde	37	90,00	
Phenol	100	408,00	
Sodium hydroxide	100	1,60	Pellets
Formaldehyde	37	603,12	
Urea	100	28,56	
Total		1353,7 / 993,8 (after distillation)	

PROCEDURE

1. Borresperse Na is dissolved in water to approximately DM 45% and mixed at 40°C.

2. Under basic conditions (pH > 10) the lignin is pre-methylolated at 80°C with formaldehyde 37% for 20 min.

3. Phenol, sodium hydroxide and 37% formaldehyde are added. The temperature is raised to 90°C. The condensation reaction should be kept going until a water miscibility of 1:1,5 ml/g (at 25°C) is reached.

4. Distillation of water (approx. 360 ml water) at 55-65°C and vacuum.

5. Under vigorous stirring urea is added. The mixture is heated to 60°C and stirred for 15 minutes before cooling.