

# Concrete Flooring - Primers Cardolite Product Offering

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# Content

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- Product Offering
- Cure Properties
- Mechanical Properties
- Permeability
- Adhesion to Concrete
- Conclusion

# Phenalkamine Concrete Primer Offering

Properties	NC-558	NX-2003	NX-5454	GX-6019 (exp)
Viscosity @ 25°C (cPs)	500-1,500	500-1,200	700-1,200	1,128
Amine value (mg KOH/g)	320-360	340-375	260-310	291.4
Solvent/Benzyl Alcohol	no	no	no	no
AHEW	95	95	133	133
Color (Gardner)	≤17	≤10	≤14	11
Recommended PHR EEW = 190	40-50	50	70	70

This table highlights some of our key products for flooring, however, other phenalkamines can also be successfully used.



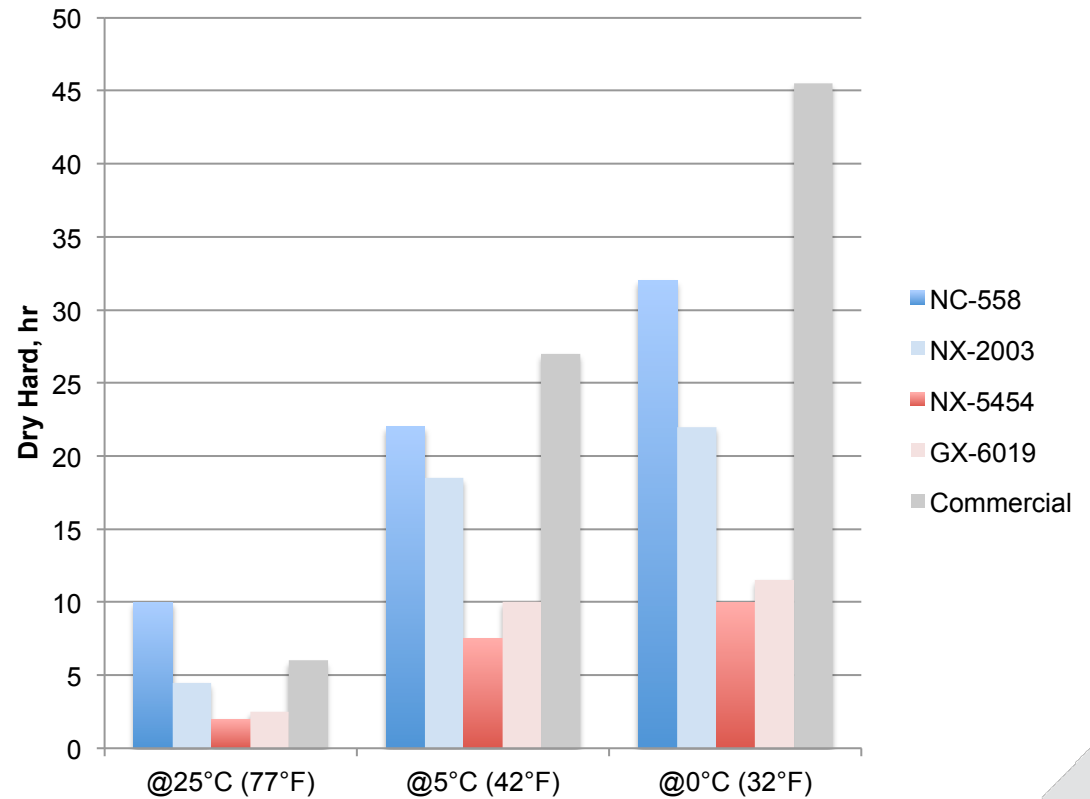
# Cure Speed

# Mix Properties

Curing Agent	Epoxy	phr	Mix viscosity @25°C (cPs)	Gel time, 50g @25°C (min)
NC-558	Epon 828	50	3,780	40
NX-2003	Epon 828	50	3,570	25
NX-5454	Epon 828	70	4,300	18
GX-6019	Epon 828	70	2,775	20
NC-558	D.E.R. 353	49	885	115
NX-2003	D.E.R. 353	49	802	45.1
NX-5454	D.E.R. 353	68	1,110	22
Commercial Primer	-	-	348	48

# Cure Speed with Epon 828

Curing Agent	Film appearance @10°C & 95% R.H
NC-558	Blush
NX-2003	Blush
NX-5454	Clear
GX-6019	Clear
Commercial	Slight Haze



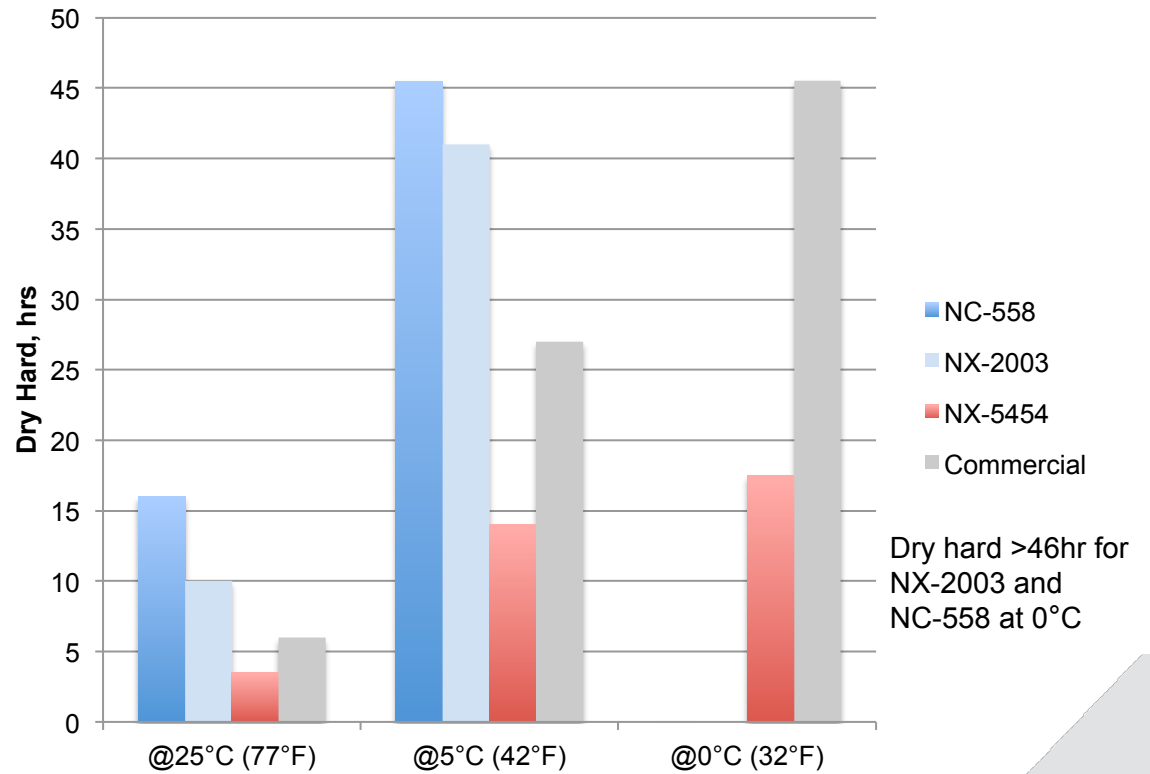
BK linear dry time (DFT 3~3.5mils) ASTM D5895

Commercial: used commercial product A and B parts, composition/resin not disclosed.



# Cure Speed with D.E.R. 353

Curing Agent	Film appearance @10°C & 95% R.H
NC-558	Blush
NX-2003	Hazy
NX-5454	Clear
Commercial	Slight Haze



BK linear dry time (DFT 3~3.5mils) ASTM D5895

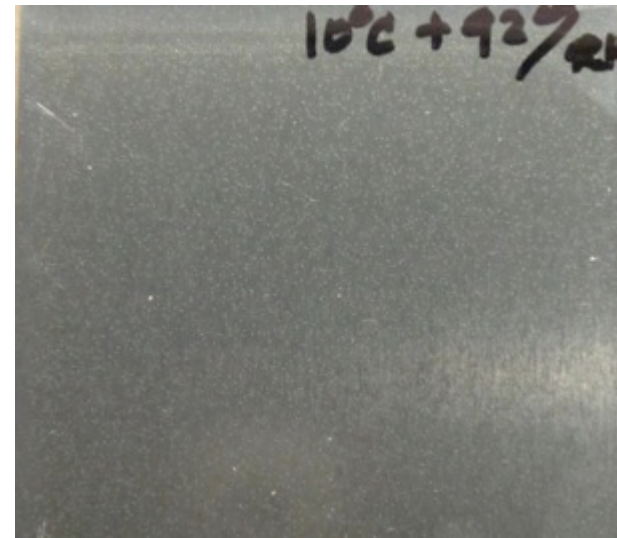
Commercial: used commercial product A and B parts, composition/resin not disclosed.



# NC-5454 Film Appearance

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Film Appearance @ Low Temperature / High Humidity  
(10°C / 92-95% R.H.)



**NO BLUSH!**



# NC-5454 & NC-558 Film Appearance

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System	Appearance over Dry Concrete
Conditions	25°C / 45-50% R.H.
NX-5454	Clear, glossy
NC-558	Clear, glossy

# Mechanical Properties

# Mechanical Properties

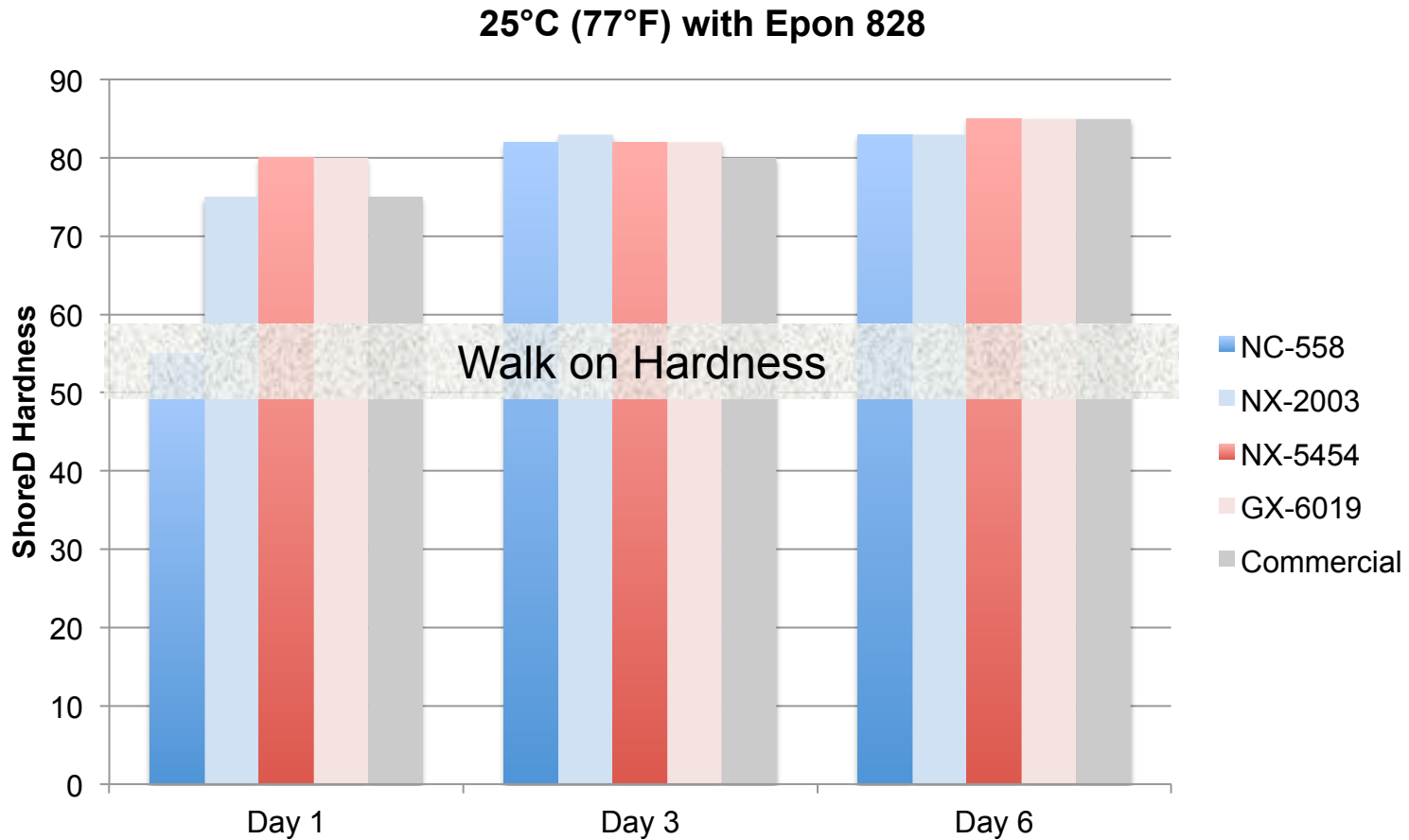
Curing agent	Resin	Direct impact <sup>1</sup> (in-lb)	Reverse impact <sup>1</sup> (in-lb)	Mandrel Bend test <sup>2</sup>
NC-558	D.E.R. 353	90	40	1/8"
NX-2003	D.E.R. 353	40	28	1/8"
NX-5454	D.E.R. 353	85	65	1/8"
GX-6019	D.E.R. 353	62	58	1/8"
Commercial Primer	-	16	4	1/8"

DFT 2~2.5mils over CRS panels after 7days cure at RT

<sup>1</sup>: ASTM 2794

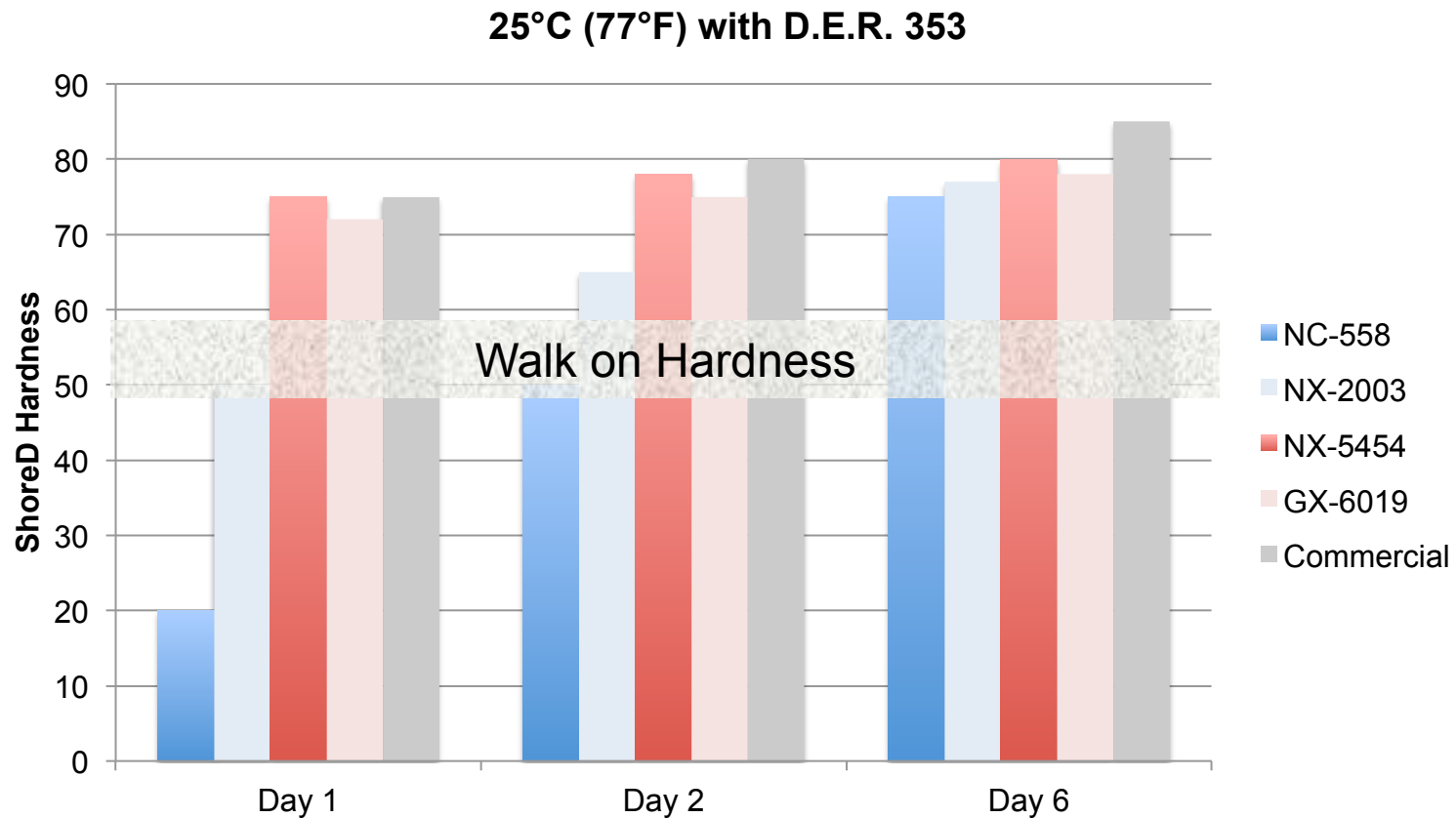
<sup>2</sup>: ASTM D 522, the number in inches represents the failure length of the coating film. 1/8" is the best (no failure). 5" is the worst (the coating film fails in its entire length).

# Hardness Development @ 25°C with Epon 828



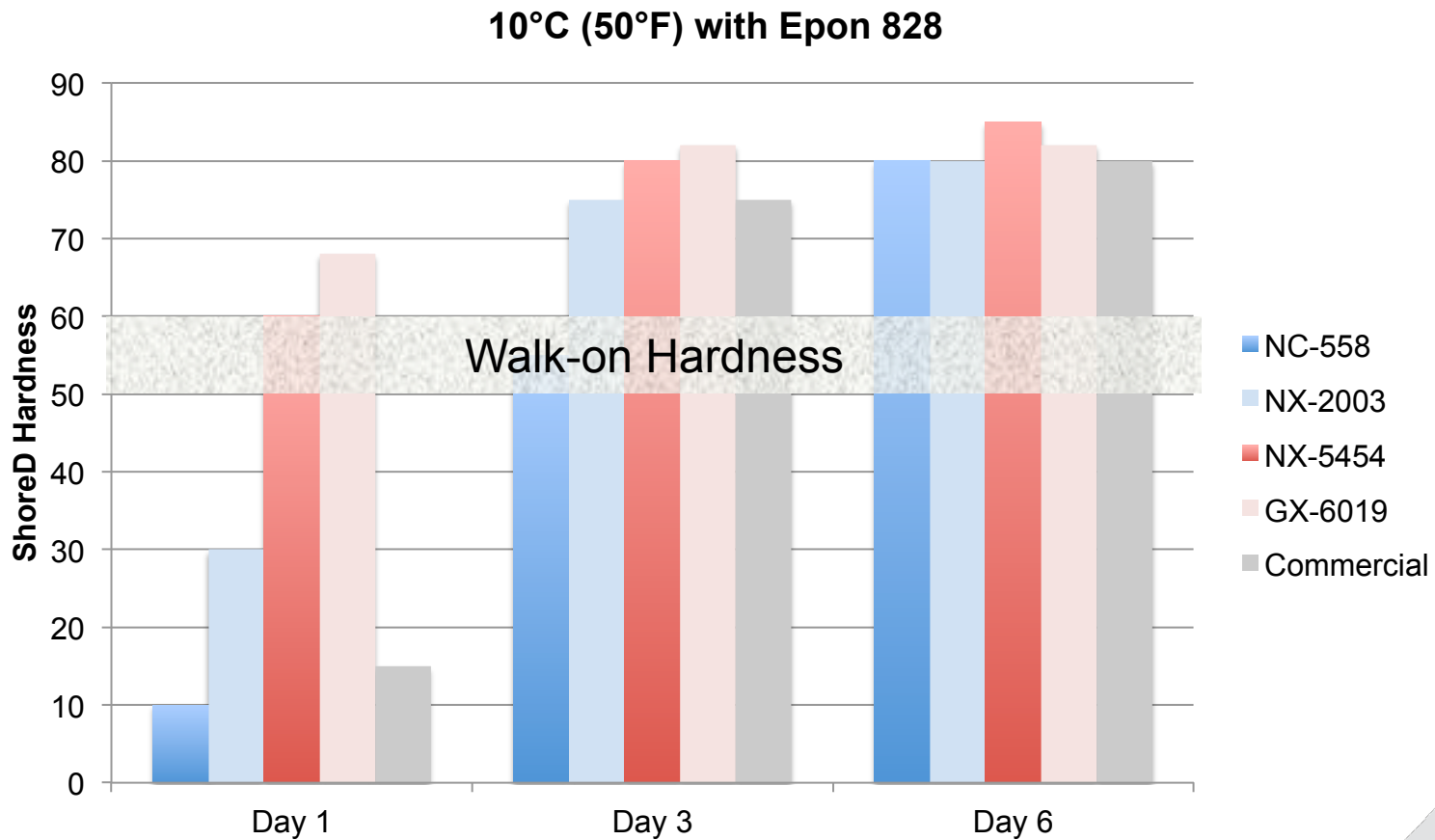
Commercial: used commercial product A and B parts, composition/resin not disclosed.

# Hardness Development @ 25°C with D.E.R. 353



Commercial: used commercial product A and B parts, composition/resin not disclosed.

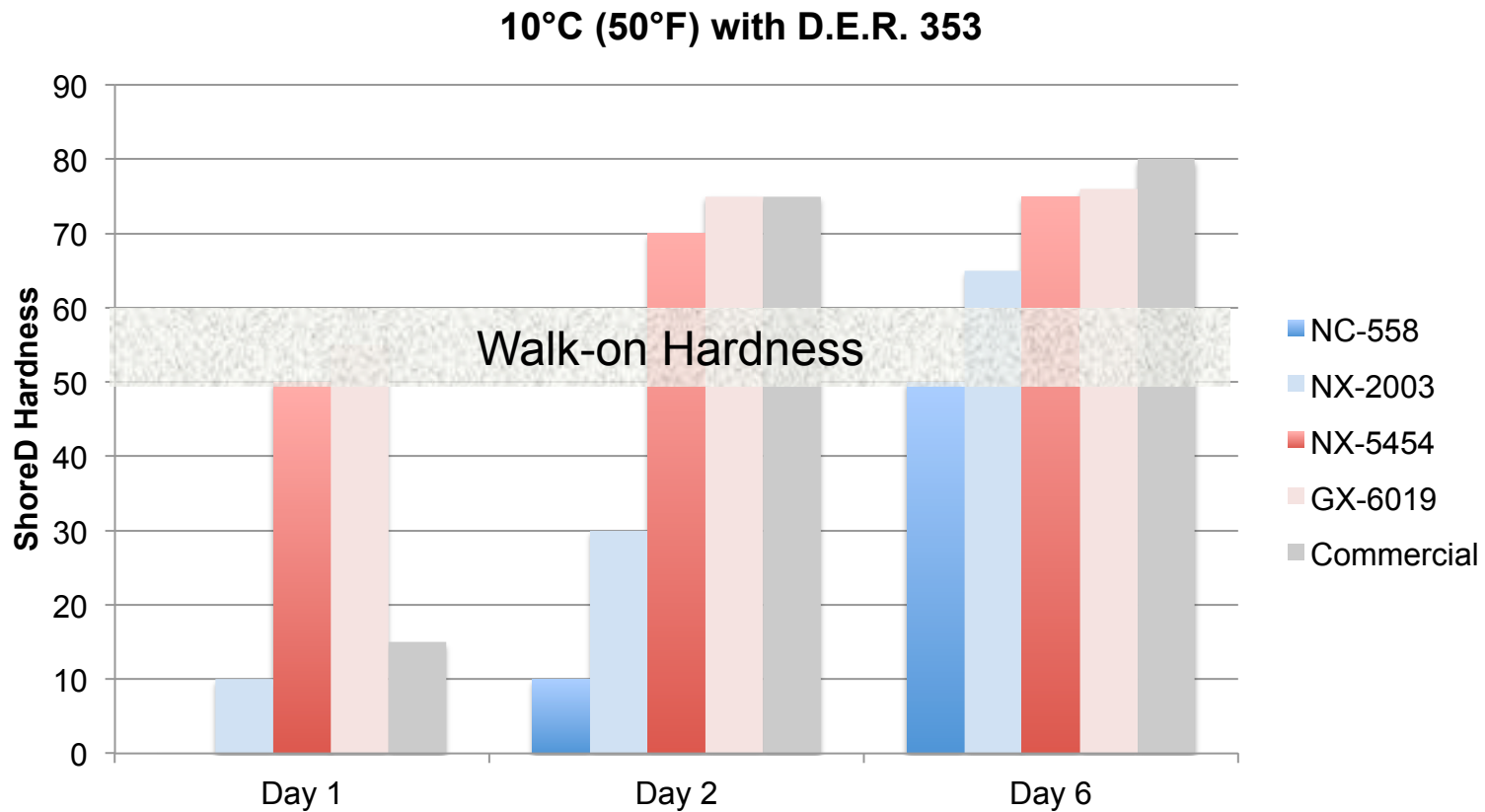
# Hardness Development @ 10°C with Epon 828



Commercial: used commercial product A and B parts, composition/resin not disclosed.



# Hardness Development @ 10°C with D.E.R. 353



Commercial: used commercial product A and B parts, composition/resin not disclosed.  
NC-558 was tacky on the first day

# Permeability



# Vapor Transmission NC-558

**Formula**  $P = (q \cdot L) / (A \cdot t \cdot dP)$

q: quantity of vapor which traversed the film (Kg)

L: film thickness (m)

A: evaporation surface (m<sup>2</sup>)

t: duration of the test (h)

dP: difference of pressure between the sealed cup and the environment (Kg/m<sup>2</sup>)

P: permeability coefficient (m/h)

	Coating System	P (m/h)
Low permeability →	Primer 1 (Cardolite® NC-558)	1.33 E-10
	Primer 2 (Cardolite® NC-558 + Euredur 13)	1.32 E-10
	Chlorinated rubber	1.94 E-10
	Coal tar epoxy	2.91 E-10
	Aluminium mastic	4.08 E-10
	Read lead-oil based	2.08 E-09
	White alkyds	2.48 E-09

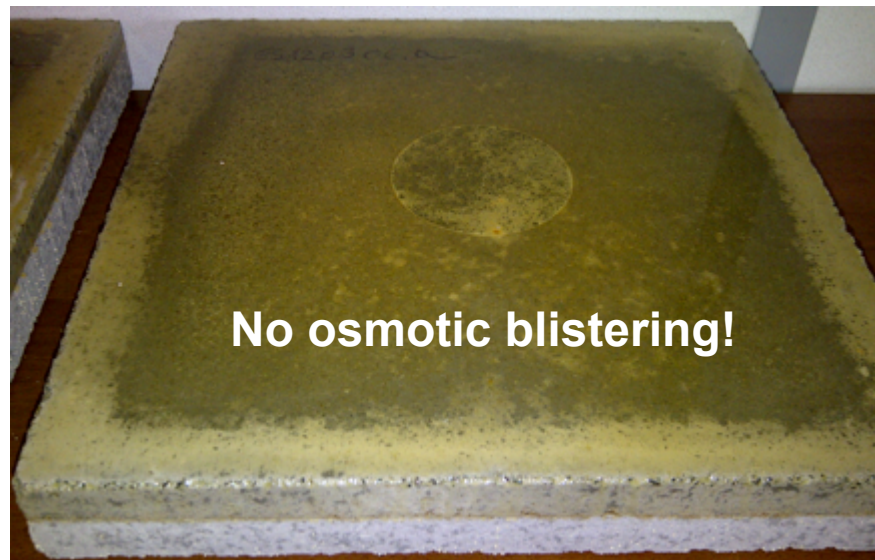
# NX-5454 Osmotic Pressure

## Procedure:

- Concrete blocks were completely immersed in water for 2 weeks. After 2 weeks, blocks were placed sideways to allow water to run off for 30 min. Then edges and top side were coated (DFT +/- 300µm).
- Immediately after application of coating, the concrete blocks were partially immersed in water and exposed to the following cycle:
  - 8hr exposure to IR-lamp (150W) 30cm above concrete block
  - 16hr without IR-lamp

**No changes were observed after 7 days, 1 month, and 2 months. At the 3<sup>rd</sup> month there were no defects, just some color change.**

Formulation	pbw
D.E.R. 358	100
Part B	
NX-5454	50
Accelerator 960-1	1.5
Antiterra U	0.75
Byk A 501	1.5



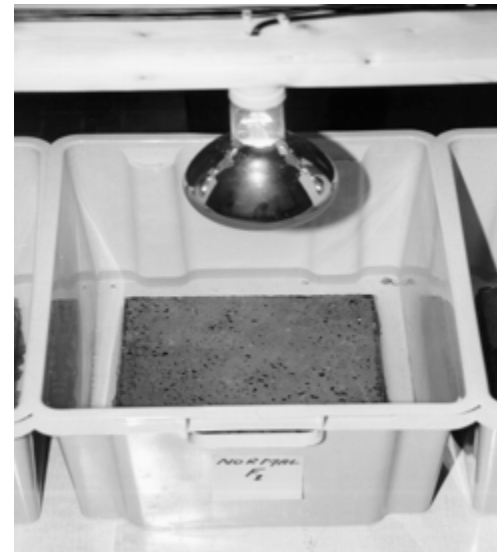
# NC-558 Osmotic Pressure

## Procedure:

- Sandblasted concrete blocks with four primed edges were completely immersed in water for 2 weeks. 3-4hrs prior to primer application blocks are taken out and dried with a cloth. The water content of the substrate varies between 5.5% and 6.8%, depending on the type of concrete.
- Immediately after application of coating (DFT +/- 300µm), the concrete blocks were partially immersed in water and exposed to 8hr exposure to IR-lamp (150W) a day.
- The primed surface reaches 38 °C during radiation. This heat fluctuation of about 20°C accelerates the osmosis.

**No osmotic blistering for both coatings after 3 months of exposure!**

Formulation	pbw	pbw
Bis A (Eurepox 730)	80	80
Necires EPXL-2 (non-reactive flexibilizer)	20	20
Part B		
NC-558	50	50
Euredur 13	0	2

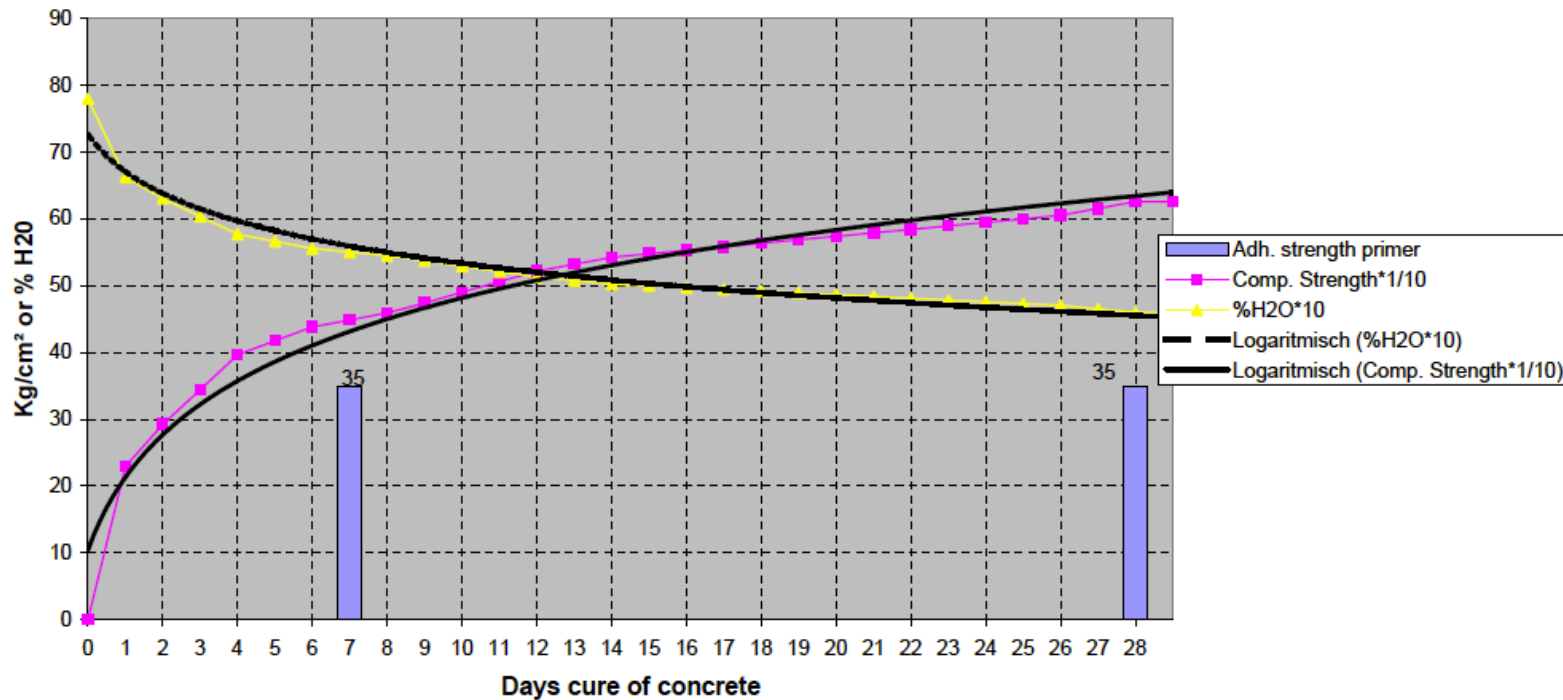


# Adhesion

Green Concrete  
Damp Concrete  
Dry Concrete

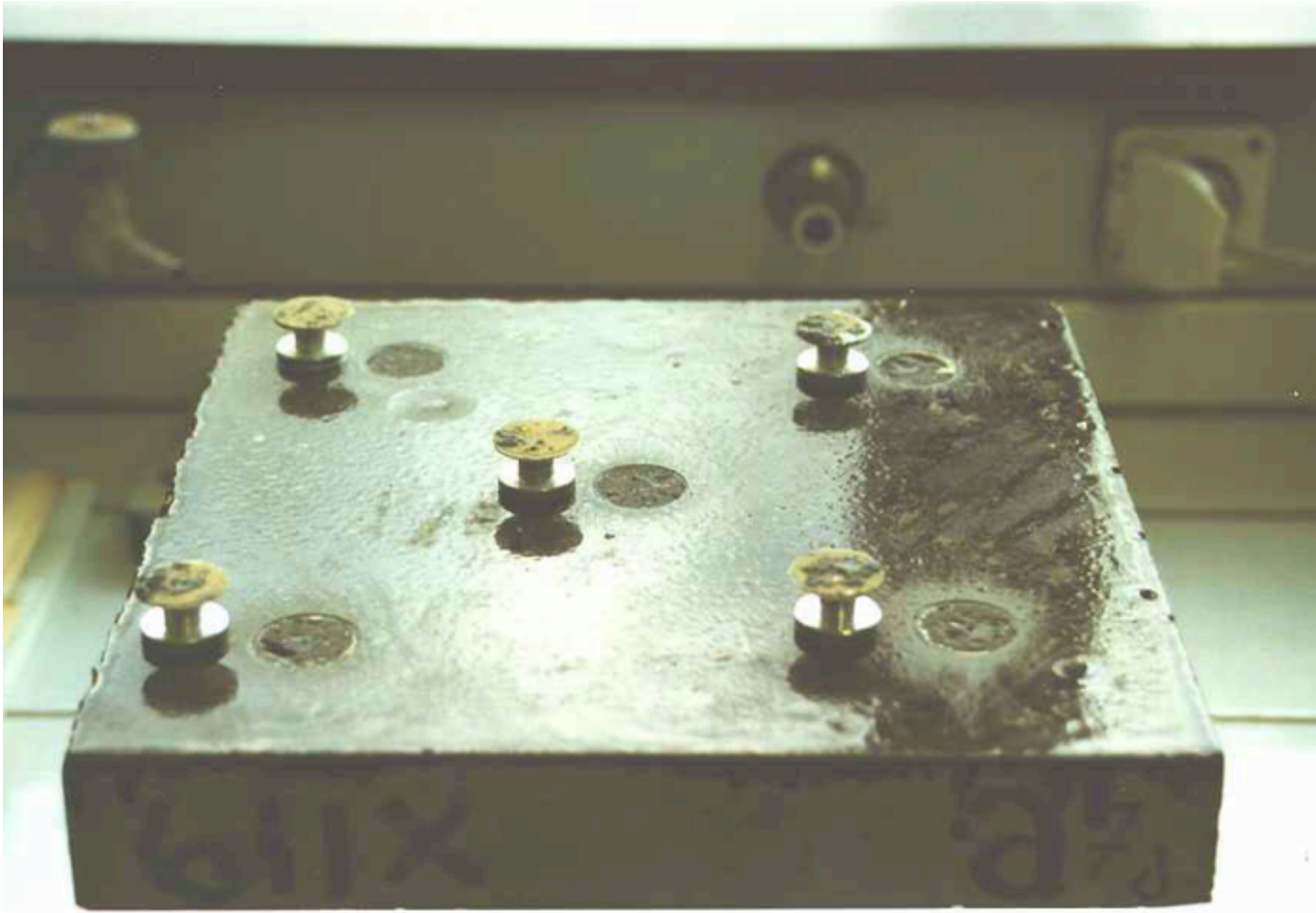
# NC-558 Adhesion to Green Concrete

Concrete requires 28 days to fully cure, but primers based on NC-558 can develop adhesion with concrete after 7 days. This experiment was performed on a high quality concrete (62 N/mm<sup>2</sup>).



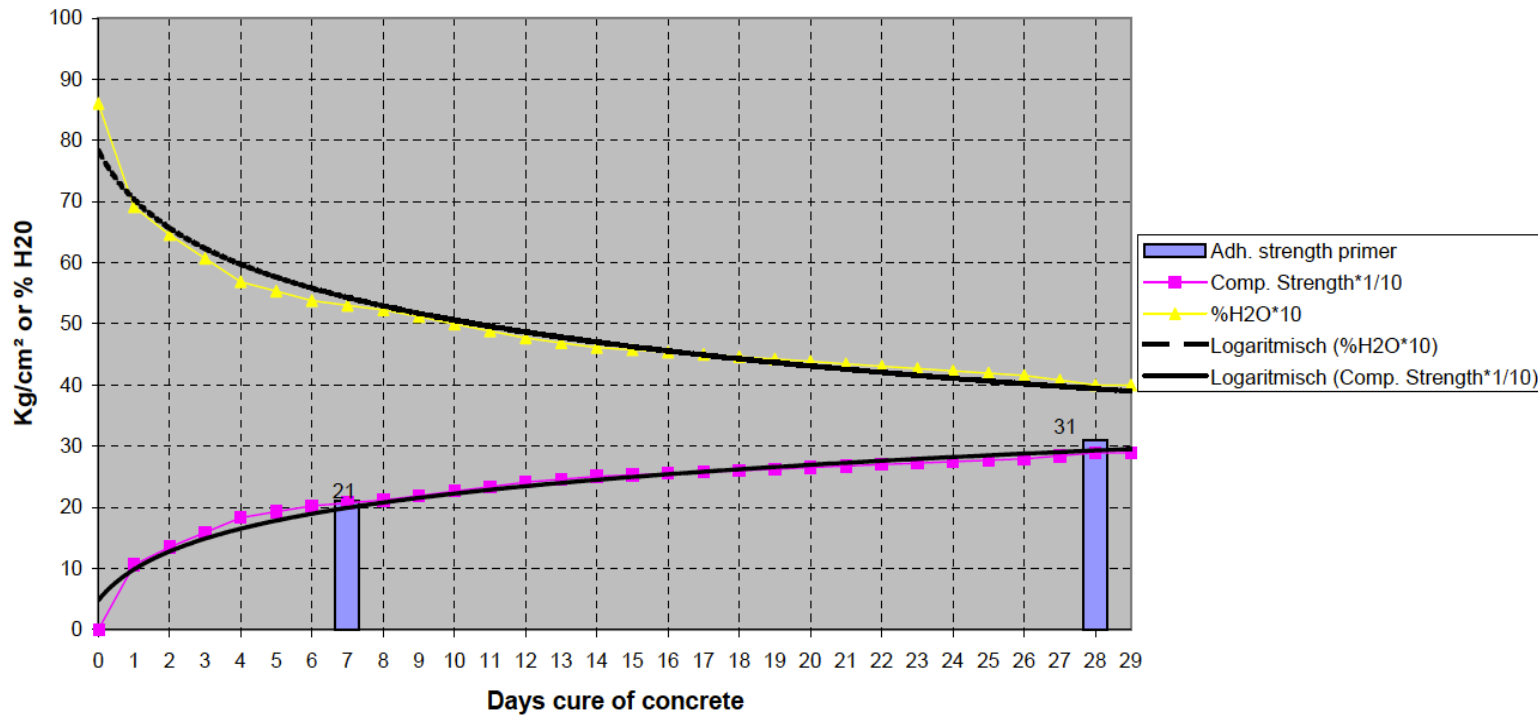
# Adhesion after 7 days on high performance concrete

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# NC-558 Adhesion to Green Concrete

This experiment was performed on a standard quality concrete (approx. 3.0 N/mm<sup>2</sup>).



Adhesion between primer and concrete is higher than concrete strength



# Adhesion after 7 days on standard grade concrete

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# Typical primer formulation

	NX-5454	NC-558
<b>Part A</b>		
DER 353 <sup>1</sup> (low viscous diluted A/F resin)	100.00	100.00
<b>Part B</b>		
Cardolite® NX-5454 (phenalkamine curing agent)	70.0	-----
Cardolite® NC 558 (phenalkamine curing agent)	-----	50.00
Ancamide K 54 <sup>2</sup> (Tertiary amine, used as accelerator)	-----	1.50
Anti-Terra 202 <sup>3</sup> (High molecular weight wetting and dispersing additives)	0.75	0.75
Byk A 501 <sup>3</sup> (Silicone-Free Air Release Additives)	1.50	1.50

**SUPPLIERS**

1. Dow
2. Air Products
3. Byk



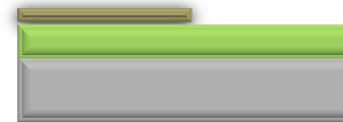
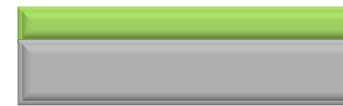
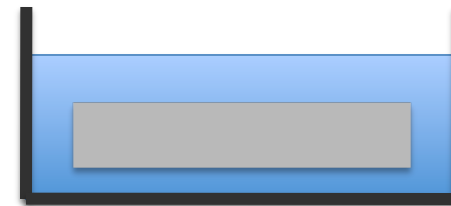
# NX-5454 & NC-558 Adhesion to Damp Concrete

Concrete blocks immersed in tap water for 24 hrs, then freestanding water on the top was removed by blotting with paper towels.

Epoxy primer was applied with a  $\frac{1}{4}$ " nap roller with a front-to-back and side-to-side pattern. After 5 minutes, another layer was applied with a drawdown bar to ensure 10 mils DFT.

PU top coat applied after 18 hours of primer cure. The topcoat applied with a  $\frac{1}{4}$ " nap roller.

Elcometer dollies were attached (Araldite 2011) to the cured film surfaces after a 24 hour cure of respective film. The dollies were allowed to cure for 24 hours to 3 weeks before adhesion pulls were made.







**ADHESION  
TEST**

# NX-5454 & NC-558 Adhesion to Concrete

	24 hour Cure	3 Week Cure			
	Dry Concrete	Dry Concrete		Damp Concrete	
System	Primer Alone	Primer Alone	Topcoat Over Primer	Primer Alone	Topcoat Over Primer
NX-5454	600 psi 4.1 MPa	1000 psi 6.9 MPa	800 psi 5.5 MPa	550 psi 3.8 MPa	300 psi 2.1 MPa
Rupture mode	Dolly to adhesive	Dolly to adhesive	Dolly to adhesive	100% concrete	100% concrete
NC-558	1000 psi 6.9 MPa	1000 psi 6.9 MPa	600 psi 4.1 MPa	500 psi 3.4 MPa	500 psi 3.4 MPa
Rupture mode	50% concrete 50% Dolly to adhesive	Dolly to adhesive	50% concrete 50% Dolly to adhesive	100% concrete	100% concrete



# NX-5454 & NC-558 Adhesion to Concrete

	3 Week Cure	
System	Primer Alone	Topcoat Over Primer
NX-5454	 A photograph of a concrete test specimen, a cylindrical metal rod with a wider top flange, sitting on a wooden base. The top surface is covered with a thick, uneven layer of grey concrete. The edges of the concrete are jagged and appear to be peeling or chipping away from the metal rod.	 A photograph of a similar concrete test specimen. The top surface is covered with a thick, uneven layer of grey concrete. The edges are jagged and appear to be peeling or chipping away from the metal rod.
NC-558	 A photograph of a similar concrete test specimen. The top surface is covered with a thick, uneven layer of grey concrete. The edges are jagged and appear to be peeling or chipping away from the metal rod.	 A photograph of a similar concrete test specimen. The top surface is covered with a thick, uneven layer of grey concrete. The edges are jagged and appear to be peeling or chipping away from the metal rod.

# Conclusion

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- Cardolite offers excellent options for concrete primers
- These phenalkamines are low viscosity, solvent and benzyl alcohol free, and exhibit good pot life.
- Our product offering includes phenalkamines with:
  - Very fast cure even at low temperatures
  - Excellent film appearance
  - Fast hardness development
  - Excellent adhesion to green, damp, and dry concrete
  - Combination of high hydrophobicity, low permeability, and excellent adhesion that prevents osmotic blistering

