



DOWSIL™ 87 Additive **DOWSIL™ 88 Additive**



make a big
splash!
WITH DOW SILICONES



Agenda



- Description of Water Repellency Technology
- Technology/Market Background
- New Product Features and Benefits
- Application Data
- Summary
- Marketing Launch Information

Definitions



WATER ABSORPTION

The ability of a paint film to resist water penetration while still maintaining permeability

- Critical for building facades – concrete, EIFS, wood

WATER BEADING

The visual effect of water holding a contact level to the substrate surface

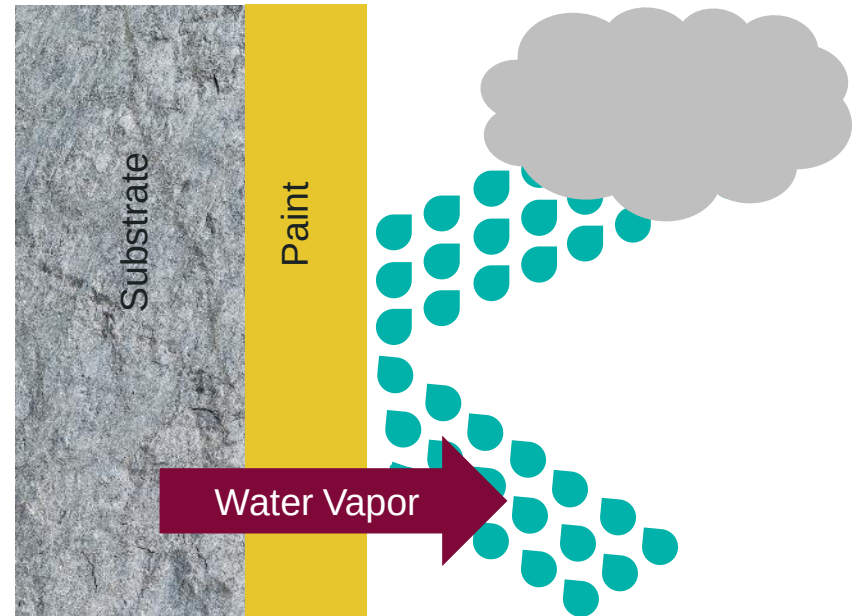
- Not a true indicator of water absorption
- A very good visual for end customers



Requirements of Decorative Paints



- Low water absorption of the paint film is critical to protecting the underlying substrate, particularly in exterior applications
- It also is important that the paint film is permeable to any water vapor coming from the substrate to prevent cracking and blistering
- Water beading indicates low water absorption to the consumer and is easily seen on the surface of the paint



DOWSIL™ 87 Additive and DOWSIL™ 88 Additive create a hydrophobic silicone network in the paint to repel water

Protecting Substrates From Water



COMPETITIVE METHOD

- Resin emulsion of 50% silicone or through the use of a high-quality acrylic resin, which can be costly
- An additional additive is typically required to give water beading

DOW METHOD

- Achieve water protection through an additive approach
- The Dow method allows for:
 - A more simple formulation approach – adding 2%-5% to an existing formulation
 - A more cost-effective solution – 2% of an additive will only add about \$0.12/lb or \$0.26/kg to the formulation

Standard Industry Tests



Water absorption (W_{24})

Water absorption through the paint film is measured as a function of time in accordance with DIN 52617

Water beading

Measured visually using contact angle of the water on the paint film

Water permeability

Typically quoted as “Sd” value and is a function of the Water Vapor Transmission Rate (ASTM 7783-1:2000)

Blocking test

Designed to test the non-adhesion of the coating to itself under normal environmental conditions

Dirt pickup test

Mineral pigment applied with a roller to a draw down of white styrene acrylic paint; the panel is washed and dried, and a brightness measurement is taken based on the L parameter measured by the Cielab equation

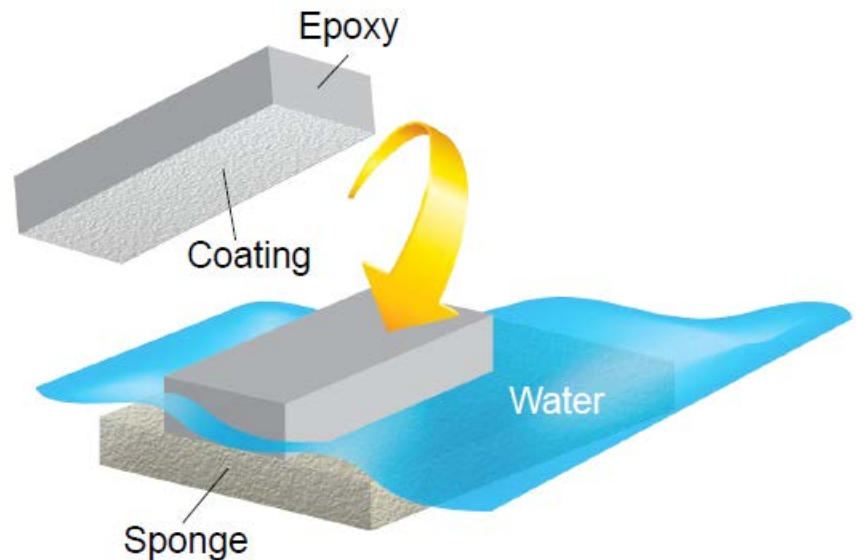
Water Absorption (W_{24}) Test



SAMPLE PREPARATION

Water absorption is measured as a function of time following DIN 52617

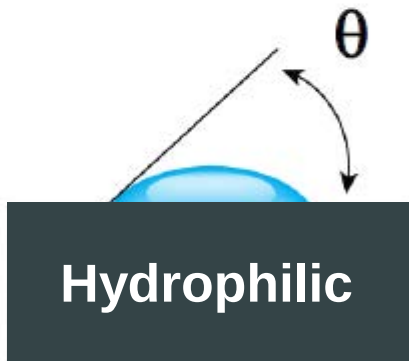
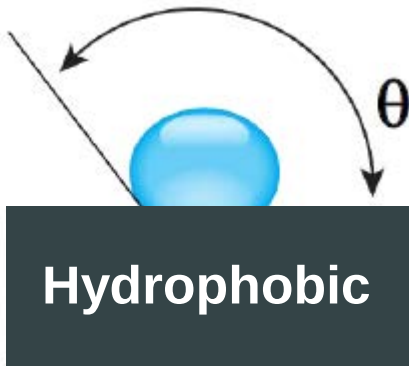
Class	Water Uptake	W_{24} [kg/m ² .√24h]
III	Low	<0.1
II	Medium	0.1-0.5
I	High	>0.5



Water Beading



CONTACT ANGLE



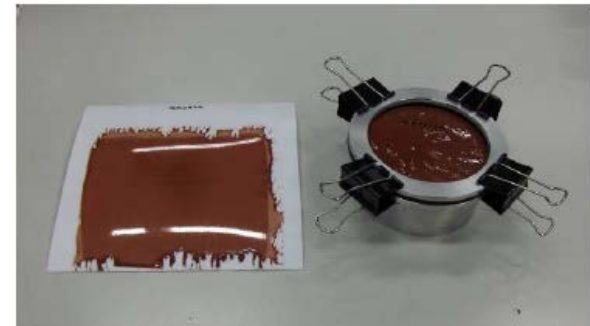
	Water Beading Classification	Water Contact Angle
Hydrophobic	Very good	$>130^{\circ}$
	Good	$100-130^{\circ}$
	Slightly wetted	$90-110^{\circ}$
Hydrophilic	Highly wetted	$30-90^{\circ}$
	Completely wetted	$<30^{\circ}$

Water Vapor Transmission Test

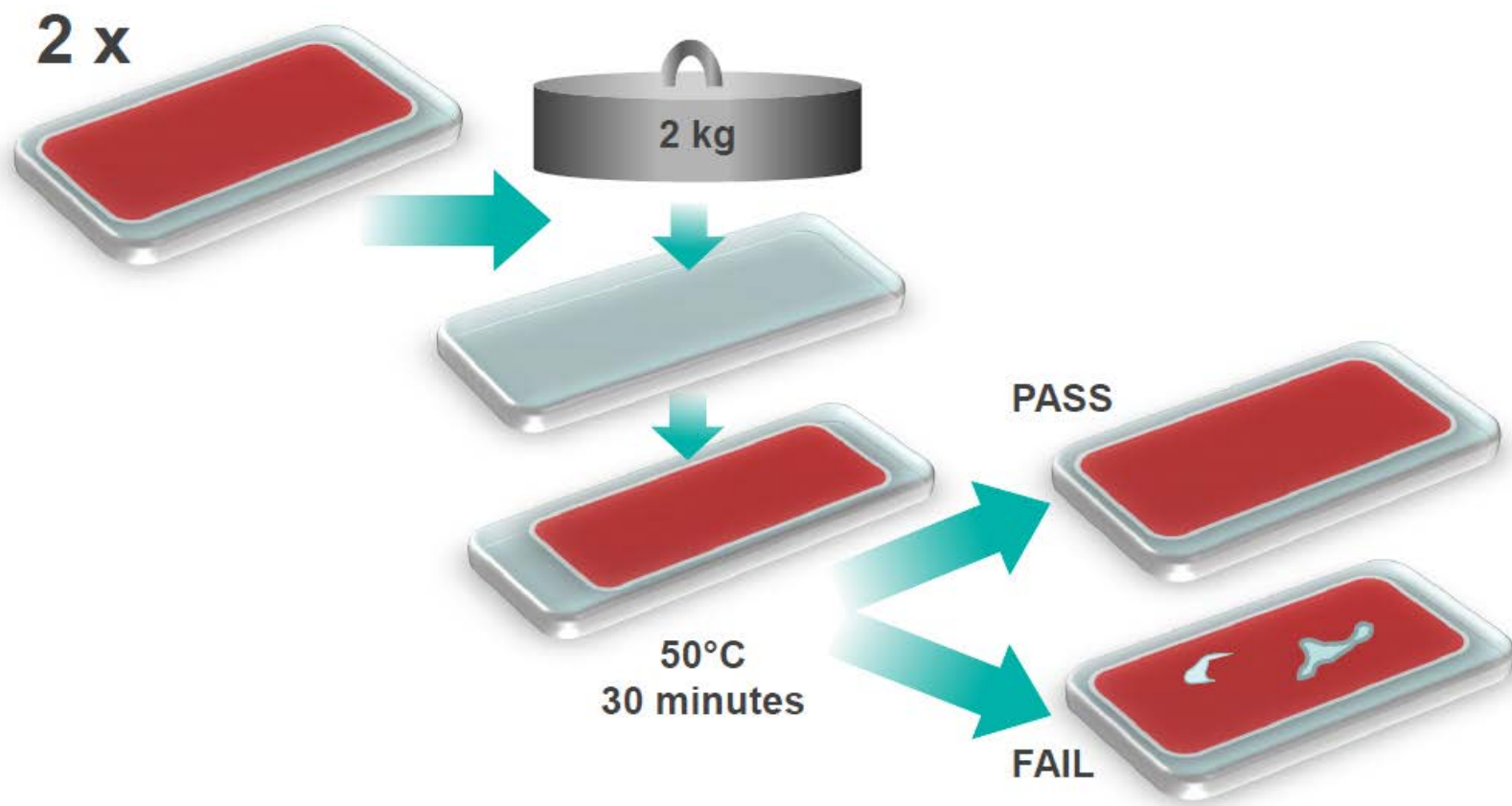


Sd is defined as the thickness (in m) of an equivalent static air layer having water vapor diffusion resistance similar to the tested coating

Sd is a function of the Water Vapor Transmission Rate measured following ASTM 7783-1:2000



Blocking Test



Why DOWSIL™ 87 Additive and DOWSIL™ 88 Additive?



- Architectural coatings companies are looking for new ways to enhance protection of substrates
- Water permeability measurements have been scarcely used in architectural coatings to show substrate protection
- Silanes and siloxanes have long benefited the protection of concrete as sealers
- We will demonstrate how recent testing brings these protective qualities to architectural coatings
- Findings show that silicone technology can provide new and innovative ways to improve architectural coatings
- We believe these additives are disruptive technologies in the market for customers to achieve better performance

DOWSIL™ 87 Additive and DOWSIL™ 88 Additive



Test	DOWSIL™ 87 Additive	DOWSIL™ 88 Additive
Appearance	Milky white	Clear to hazy
Nonvolatile content	38-44%	85% minimum
pH	4.0-5.5	Not Applicable ³
VOC (U.S. VOC regulations, Include/Exclude Value)	85/192 g/l	103/106 g/l
VOC (Europe VOC regulations)	20 g/l	128.5 g/l
VOC contribution to paint at 2% and 5% addition level ¹	3.8 and 9.6 g/l	2.1 and 5.3 g/l
VOC contribution to paint at 2% and 5% addition level ²	<0.4 and 1 g/l	2.6 and 6.4 g/l

¹ Based on U.S. VOC regulations Exclude Value

² Based on European VOC regulations

³ Non-Aqueous System

DOWSIL™





DOWSIL™ 87 Additive



DOWSIL™

- DOWSIL™ 87 Additive is a silicone resin emulsion that provides improved water repellency and excellent water beading in water-based decorative paints
- Impact on water vapor permeability of paint is negligible
- Free of solvents and APEO surfactants
- Provides paintable surface when used up to 5% by weight in the paint formulation



DOWSIL™ 88 Additive



DOWSIL™

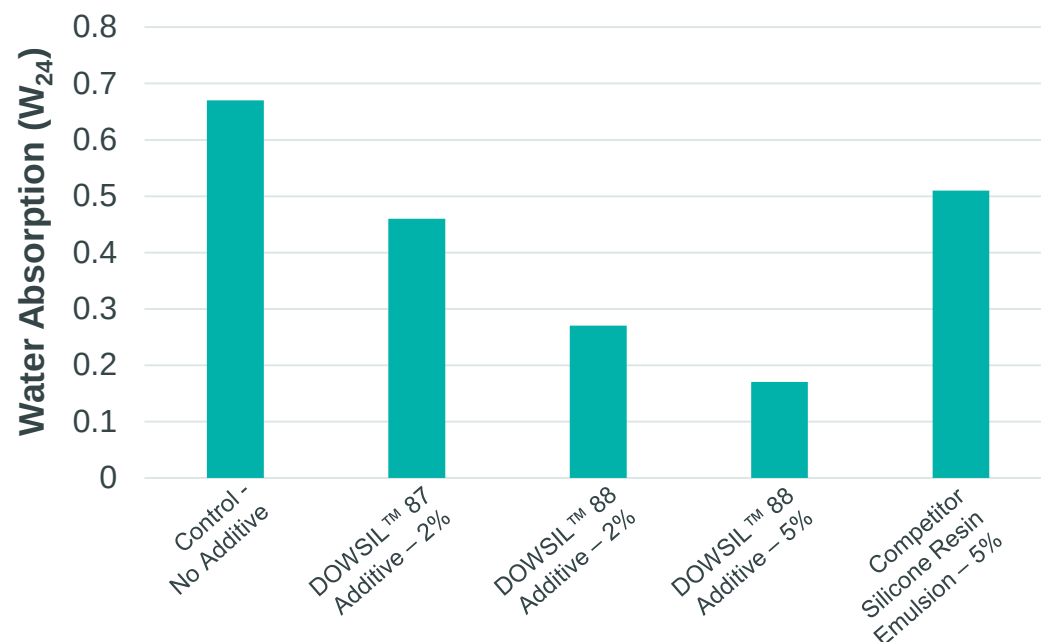


- DOWSIL™ 88 Additive is a silane/siloxane blend that improves water repellency in water-based acrylic decorative paints *containing polar solvents*
 - Compatibility can differ depending on the type and amount of polar solvent in the paint formulation
 - Suitable for use in non-aqueous, solvent-based decorative paints
- Solvent-free but can be diluted in aliphatic and aromatic hydrocarbons and polar solvents
- Impact on water vapor permeability of paint is negligible
- Provides paintable surface when used up to 5% by weight in the paint formulation

Water Resistance



Water Absorption in an Acrylic Emulsion



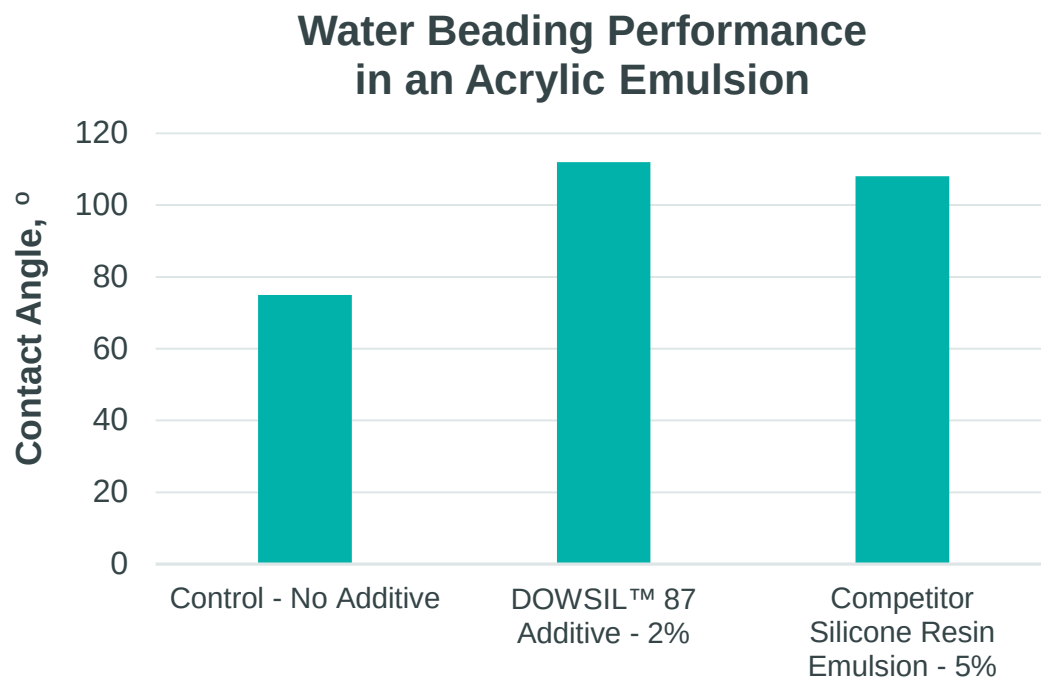
W_{24} of an acrylic-based emulsion paint with and without DOWSIL™ 87 Additive and DOWSIL™ 88 Additive and versus a competitor silicone resin emulsion

- DOWSIL™ 87 Additive and DOWSIL™ 88 Additive provide reduced water absorption at only 2% addition by weight to acrylic-based emulsion paints
- At 5% addition by weight, an even more significant improvement can be seen with DOWSIL™ 88 Additive

Water Beading Performance



At this low addition level, the impact on water beading also is evident with DOWSIL™ 87 Additive, increasing the contact angle of water on the paint film from 75° to >110°

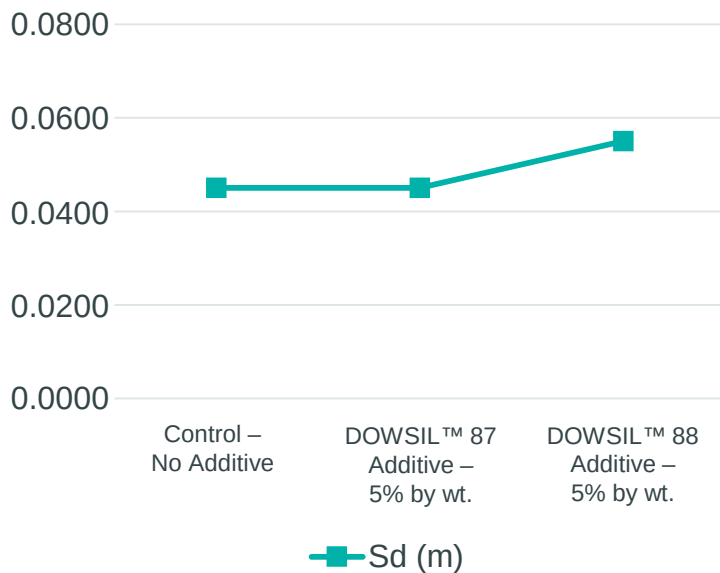


Contact angle of water on an acrylic-based emulsion paint with and without DOWSIL™ 87 Additive and versus a competitor silicone resin emulsion

Water Vapor Permeability Performance



Water Vapor Permeability Performance



Sd of an acrylic-based emulsion paint with and without DOWSIL™ 87 Additive and DOWSIL™ 88 Additive

- Paints with a Sd value of <0.14 are generally considered to have “high” water vapor permeability
- DOWSIL™ 87 Additive and DOWSIL™ 88 Additive have a minimal impact on water permeability of the same acrylic-based masonry paint, even when used at high levels



Performance in a High-PVC Coating



EXAMPLE FORMULATION

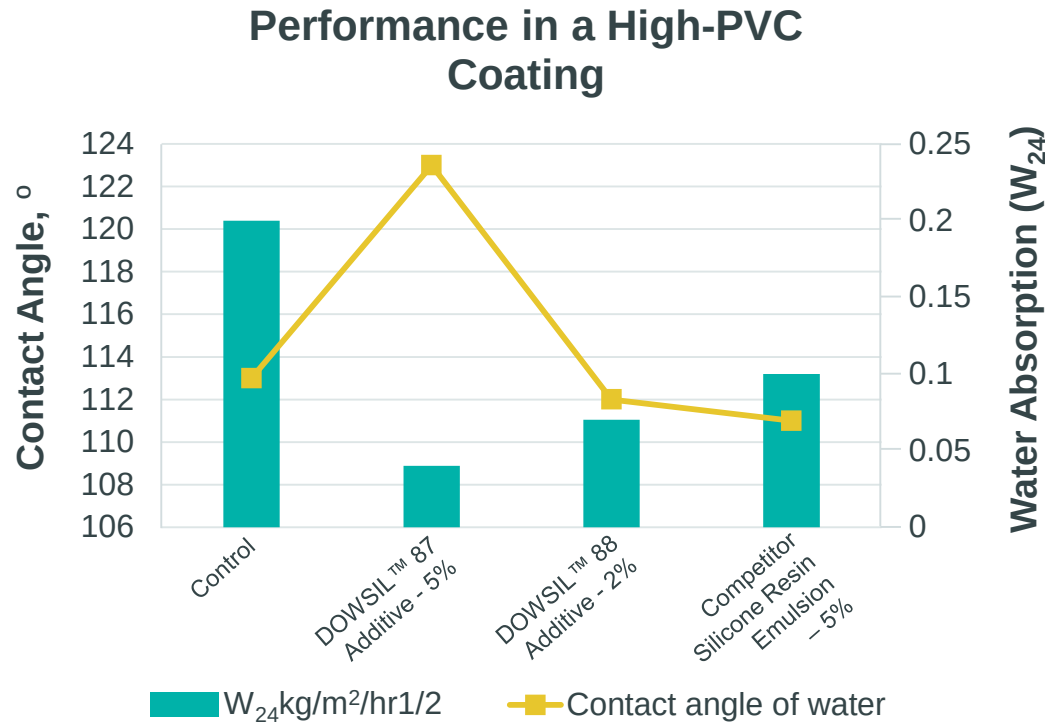


	Component		Parts, wt%
Milling phase	Solvent	Water	17.40
	Thickener	Natrosol 250	0.07
	pH modifier	Sodium hydroxide (20% w/w solution)	0.02
	Dispersant	Dispex GA40	0.38
	Antifoam	DOWSIL™ 68 Additive	0.55
	Pigment	TiO ₂ - TR92	19.72
	Filler	Kaolin – Optimat 2550	4.08
	Filler	Mica - Mica Mkt	5.10
Let-down	Filler	Carbital 115 - CaCO ₃	23.78
	Thickener	Polyurethane thickener – Rheolate 212	0.99
	Resin	Styrene Acrylic Emulsion	26.59
	Coalescing solvent	DOWANOL™ DPnB	1.11
	Biocide	Acticide MBS	0.22
	Total		100

Performance in a High-PVC Coating



- Water absorption of the paint is improved with the addition of DOWSIL™ 87 Additive and DOWSIL™ 88 Additive, beyond the competitor performance at the same addition level
- Water beading (contact angle) also is increased with the addition of DOWSIL™ 87 Additive

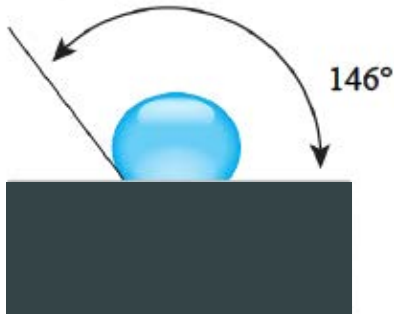


W_{24} and contact angle of water of a styrene-acrylic-based emulsion paint with and without DOWSIL™ 87 Additive and DOWSIL™ 88 Additive and versus a competitor silicone resin emulsion

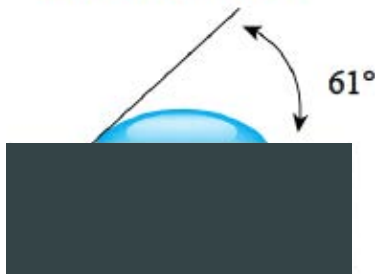
Long-Term Performance in a Waterborne Acrylic Coating



Contact Angle With DOWSIL™ 87 Additive – 1,500 hours QUV: 146°



Contact Angle Without DOWSIL™ 87 Additive – 1,500 hours QUV: 61°



- The long-lasting paint performance and the impact of weathering need to be considered when testing any new additives in a paint formulation
- After application on day one, the acrylic paint with and without DOWSIL™ 87 Additive shows some hydrophobicity (126° versus 131° water contact angle)
- After 1,500 hours of QUV testing (equivalent to ~7 years outdoor exposure), the acrylic paint without DOWSIL™ 87 Additive has lost its hydrophobicity; this is maintained with the DOWSIL™ 87 Additive

Dirt Pickup Resistance



ACRYLIC PAINTS

The desire to achieve better hiding power of paints results in an open film with high PVC (pigment volume concentration), which often has limitations with respect to dirt pickup

- Paint panels prepared with and without DOWSIL™ 87 Additive (5% by wt) before and after an in-house dirt pickup test
- Visually, the surface of the paint with DOWSIL™ 87 Additive shows less dirt pickup than the control; this is supported with a brightness (L^*) value of 88.51 for DOWSIL™ 87 Additive versus 86.78 for the control





DOWSIL™ 87 Additive Performance



WATERBORNE WOOD COATINGS

Weatherability and performance against water penetration also are key to exterior wood coating applications



Test Formulation

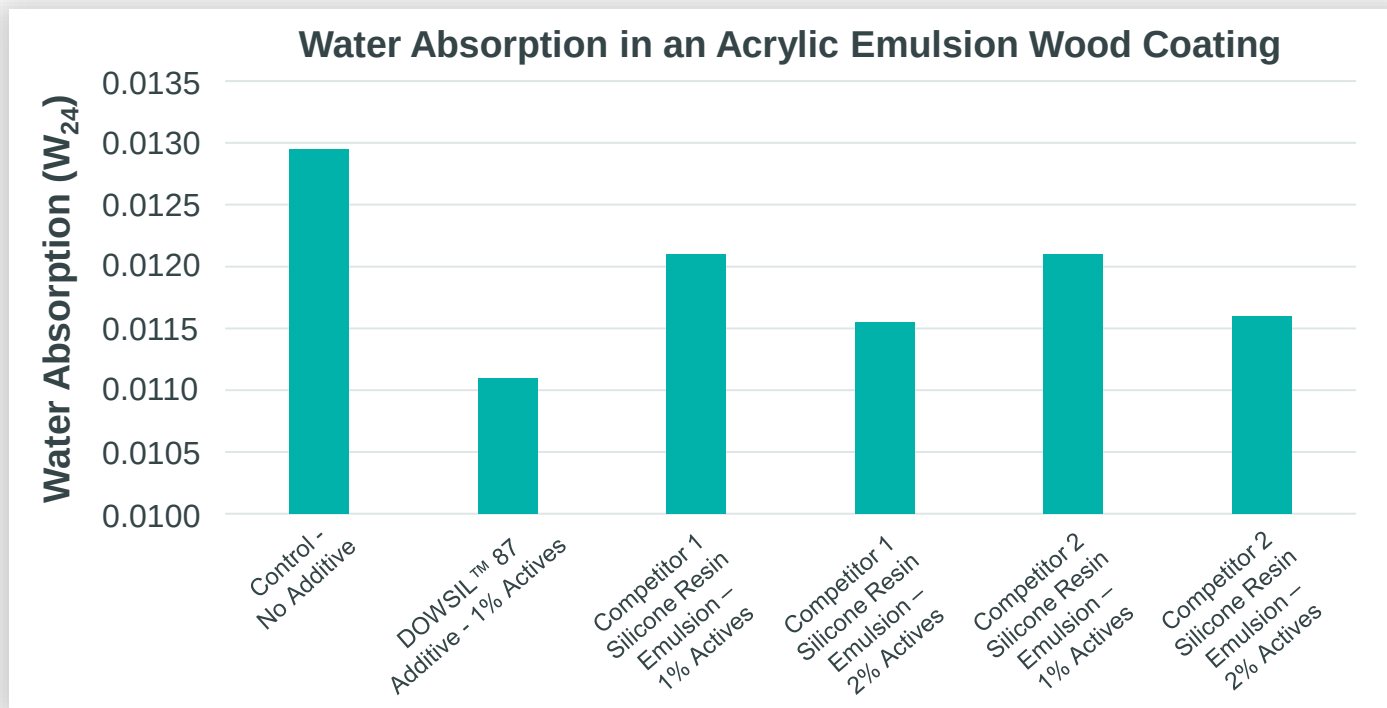
Component	Weight %
Joncryl 8383 Resin	61.45
Water	35.05
DOWSIL™ 74 Additive	0.65
Tafigel Pur 40	1.05
DOWSIL™ 67 Additive	0.80
LEVANOX Red 130 LF	0.50
LEVANOX yellow 3910 LF	0.25
LEVANYL black C-LF	0.05
Acticide MBS	0.20
Total	100.00

Wood coatings formulations based on Joncryl 8383 Resin, a self-crosslinking acrylic emulsion for trim/joinery coatings

Water Resistance



WOOD COATINGS



Water resistance of wood coatings formulation based on Joncryl 8383 Resin, a self-crosslinking acrylic emulsion for trim/joinery coatings

- DOWSIL™ 87 Additive also improves the water resistance of wood coatings
- Performance with only 1% actives DOWSIL™ 87 Additive is superior to the competitive solutions, even at twice the actives levels

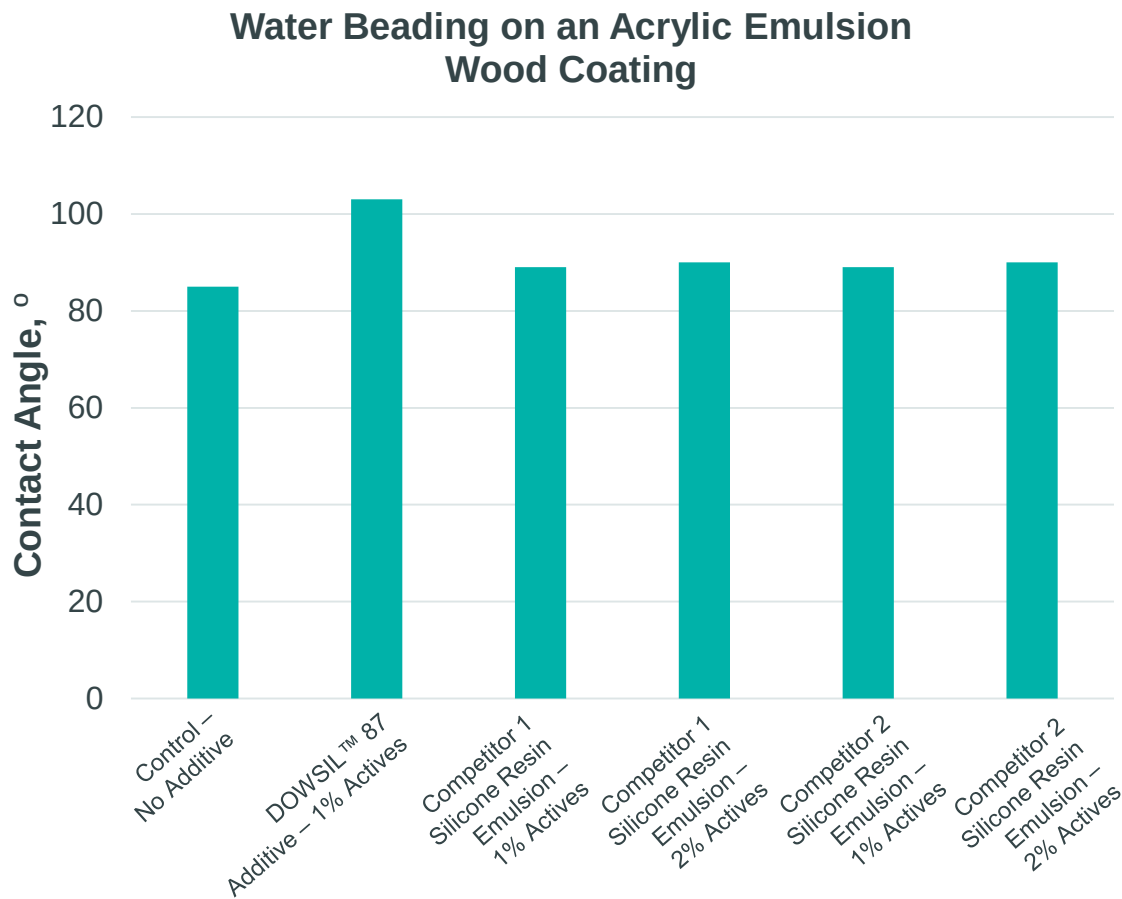
Improved Beading



WOOD COATINGS

- DOWSIL™ 87 Additive also increases water contact angle on wood coatings
- In this same wood coating formulation based on Joncryl 8383 Resin, the contact angle of water on the surface coating was highest when compared to the control with no additive and two competitor water-resistance additives

Water beading of wood coatings formulation based on Joncryl 8383 Resin, a self-crosslinking acrylic emulsion for joinery coatings



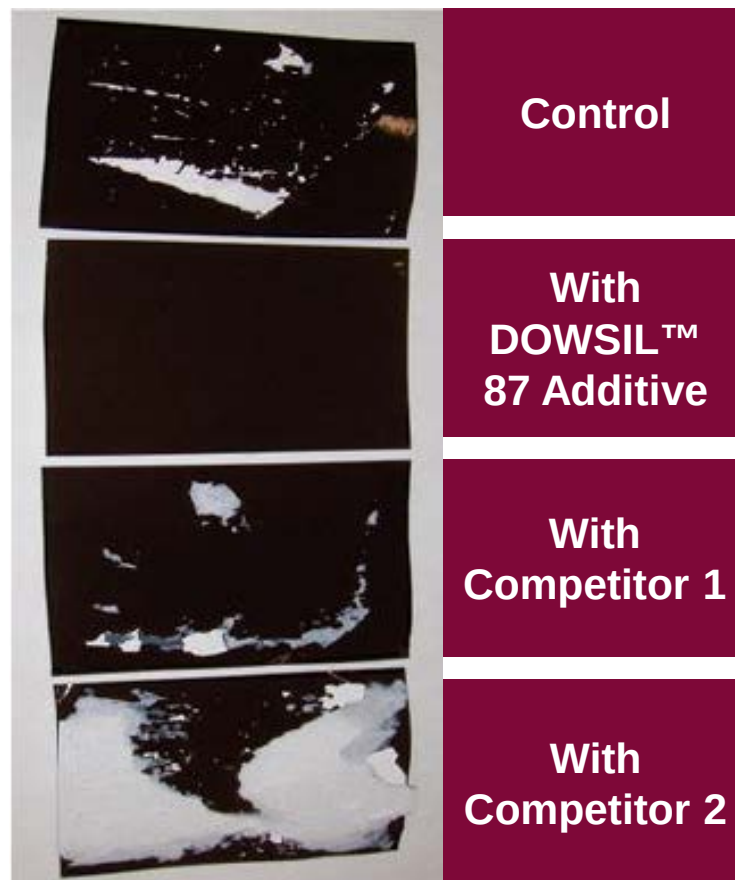
Anti-Blocking Performance

WATERBORNE WOOD COATINGS

- DOWSIL™ 87 Additive also has been found to give anti-blocking performance in wood coatings
- Performance is demonstrated in a trim/joinery coating based on a self-crosslinking acrylic resin emulsion at 20 micron dry film thickness
- Additives were added at 2% actives in the total formulation
- Without the DOWSIL 87 Additive, the surface of the coating shows minor to severe damage
- Some competitive additives even cause further blocking damage
- The addition of the DOWSIL 87 Additive allows the surface to remain intact and the aesthetics to remain good



Surface appearance after anti-blocking test
for DOWSIL™ 87 Additive versus
competitor additives



Differentiated Performance



Property	DOWSIL™ 87 Additive	DOWSIL™ 88 Additive	Competitor
Water repellency	●●	●●●	●
Water beading	●●●	●	●
Water vapor permeability	●●●	●●●	●●●

● = good ●● = better ●●● = best

- A disruptive additive approach to improved water repellency and water beading in waterborne architectural paints
- Use these additives at low addition levels to improve the quality of low- or medium-performance paints at an affordable cost
- Improve the performance of leading brands beyond that of the competition



The Materials

DOWSIL™ 87 ADDITIVE

- 200 kg drum
- 200 kg pail

DOWSIL™ 88 ADDITIVE

- 190 kg drum
- 18 kg pail





Identify Key Targets



WHERE ARE THESE USED?

- Acrylic paints, house/building exteriors
- Wood decking, fencing
- EIFS facade coatings
- Acrylic concrete coatings
- Coatings for stucco





Thank You



The information contained in this communication does not constitute an offer, does not give rise to binding obligations, and is subject to change without notice to you. The creation of binding obligations will occur only if an agreement is signed by authorized representatives of Dow and your company. Any reference to competitor materials contained in this communication is not an endorsement of those materials by Dow or an endorsement by the competitor of Dow materials.

To the fullest extent permitted by applicable law, Dow disclaims any and all liability with respect to your use or reliance upon the information. **DOW DOES NOT MAKE ANY WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, WITH RESPECT TO THE UTILITY OR COMPLETENESS OF THE INFORMATION AND DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. DOW DISCLAIMS LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

®™Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow.

© 2018 The Dow Chemical Company. All rights reserved.

30023848

Form No. 26-2385-01 A