EASTMAN

Eastman Optifilm™ additive OT1200:

Low VOC solution for improved open time in water-based wall paints

Introduction

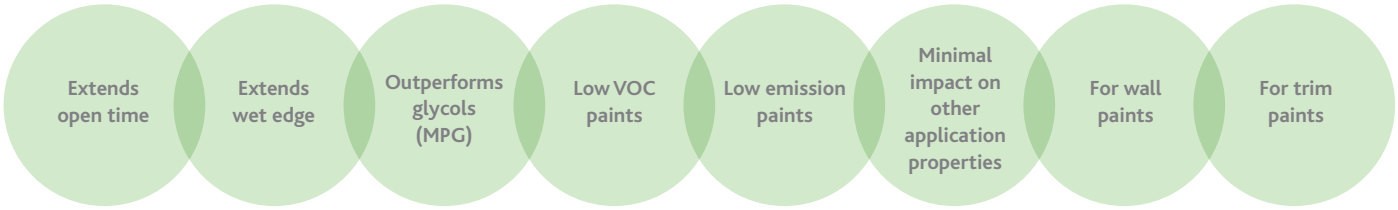
Eastman Optifilm™ additive OT1200 has been designed to enable formulators to produce architectural paints with good open time that can meet the low VOC and emission limits of eco-label compliant coatings.

Without compromising paint performance, Eastman Optifilm™ OT1200 significantly extends the open time and wet edge of many water-based architectural paint systems. Optifilm™ OT1200 functions in a variety of trim and wall paint systems, including pure acrylic, modified acrylics, and alkyd emulsions.

It is common to use ethylene or monopropylene glycol (MPG) as open time extenders. However, these glycols have boiling points below 250°C and are consequently volatile organic compounds (VOCs) according to the European Decopaint Directive (2004/42/EC). Open time and wet edge are often compromised when ethylene or monopropylene glycol (MPG) are removed from a formulation. Eastman Optifilm™ OT1200 provides an effective low VOC option to replace MPG. It has also been shown that not only can Optifilm™ OT1200 match the performance of MPG, but it can significantly improve upon it. During Eastman and customer evaluations, there have been many instances where Optifilm™ OT1200 has significantly improved the open time compared with MPG.

Various wall paints were evaluated based on different polymer chemistries. This technical tip discusses the improvement in open time and wet edge for one of the satin wall paints evaluated.

Features and benefits of Eastman Optifilm™ additive OT1200



Evaluation of Eastman Optifilm™ OT1200 in a white satin wall paint

Eastman Optifilm™ additive OT1200 has been fully evaluated in numerous trim and wall paint formulations. In all cases the open time and workability of the paint is improved. Detailed on the following pages are the application results for a wall paint which provide an insight into the extension of open time that can be achieved through the use of this additive.

Formulation details

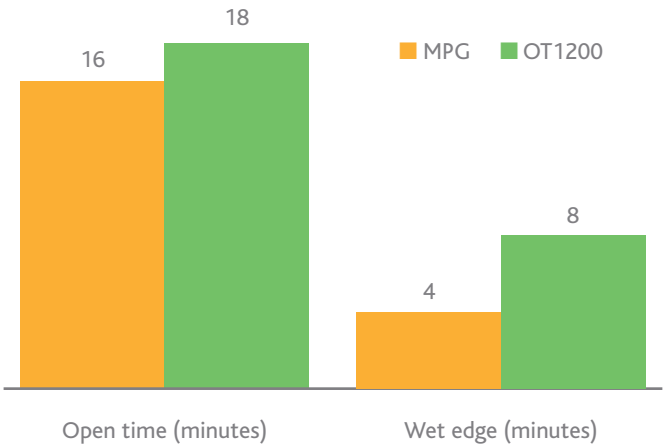
A satin wall paint was prepared using a styrene acrylic binder, Acronal™ S 790 from BASF. It is suitable for interior wall paints. Two formulations were prepared, one based on MPG and the other on Eastman Optifilm™ OT1200. These formulations are detailed in Appendix 1.

Open time and wet edge

Open time and wet edge was assessed using a common method as discussed in Appendix 2.

- Compared with MPG, Eastman Optifilm™ additive OT1200 significantly improves the open time and wet edge of the paint.
- Not only can Optifilm™ OT1200 match the performance of MPG, but it can significantly improve upon it.

Figure 1. Open time and wet edge

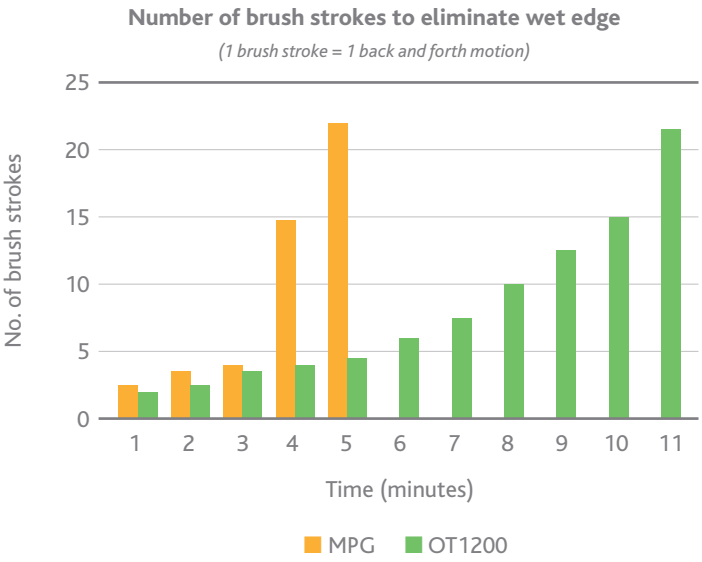


Workability

Extending the open time improves the workability of the paint, i.e., it enables the applicator greater time to rejoin painted edges, blend in imperfections such as sags or runs, and reduce viscous drag to enable easier brushing. In order to demonstrate the workability of the paint, the number of brush strokes to eliminate the wet edge and open time lines was recorded. The test was concluded when the paint required greater than 20 brush strokes (1 stroke = 1 back and forth motion) to remove either the wet edge or open time lines.

- With the MPG system, after 5 minutes of drying, >20 brush strokes across the edge were required to redissolve or rework the paint edge.
- In the Optifilm™ OT1200 system, it was possible to rework the wet edge up to 10 minutes with fewer brush strokes.

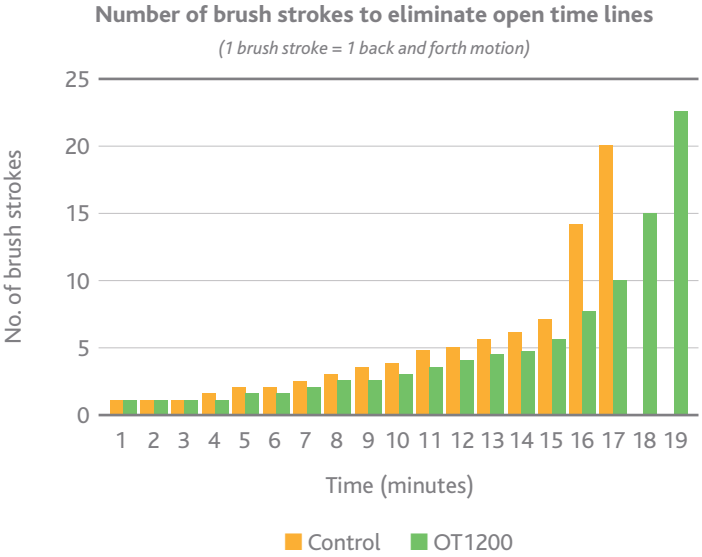
Figure 2. Satin wall paint: workability of wet edge



Again with the Eastman Optifilm™ OT1200 system, it was possible to rework the open time lines with less brush strokes.

- Compared with MPG, Eastman Optifilm™ additive OT1200 significantly improves the workability of the paint.
- Not only can Optifilm™ OT1200 match the performance of MPG, but it can significantly improve upon it.

Figure 3. Satin wall paint: workability of open time lines



Open time and wet edge evaluations using the proposed ASTM method were not carried out at the same time as the workability assessment. As such, the absolute values of results may vary depending on environmental and application conditions, but the relative performance of paints containing OT1200 as compared to a control is predictable.

Test	Eastman Optifilm™ additive OT1200 compared with MPG control	Comments	Test method
Open time	↑	Significant improvement with OT1200	Modified ASTM (WK13360)
Wet edge	↑	Significant improvement with OT1200	Modified ASTM (WK13360)
Workability	↑	Significant improvement with OT1200	Internal test
Sand dry time	↑	Relates to improved open time with OT1200	Ballotini glass beads
Levelling	↑	Relates to improved open time with OT1200	Internal test
Gloss	=	No differences in gloss	BS EN ISO 2813
Blocking	↓	Early blocking resistance slightly reduced	ASTM D4946
Opacity	=	No differences in opacity	ASTM D2805
Scrub resistance	=	No differences in scrub	BS EN ISO 11998
Colour	=	No differences in colour	ASTM E1164-09a
Mud cracking	=	No differences in mud cracking at ambient temperature or 5°C	50, 100, 200 and 1000 um (WFT)
Viscosity (low/high shear)	=	Adjusted to specification after addition of open time additive	ASTM D562-81, ASTM D4287, ASTM D2196-10
Storage viscosity (ambient/one month at 50°C)	=	Storage stability good	ASTM D562-81, ASTM D4287, ASTM D2196-10

↑ Improvement compared with MPG control

↓ No improvement compared with MPG control

= Both MPG control and Optifilm™ OT1200 showed similar results

Application performance of satin wall paint

In addition to the open time tests, a range of other application tests were conducted and the differences against the MPG control recorded in the table above.

- The results show that compared with the MPG control it is possible to significantly improve open time, wet edge, and workability without compromising paint performance.

Conclusion

Trim and wall paints tend to be formulated with glycols such as propylene or ethylene glycol to control open time and wet edge. These glycols are volatile organic compounds (VOCs) according to the Decopaint Directive (2004/42/EC). Eastman Optifilm™ additive OT1200 is not a VOC, and its incorporation into a variety of paint formulations will enable formulators to produce low emission and low VOC coatings that conform to various ecological labelling schemes.

In this technical tip, Eastman Optifilm™ additive OT1200 has been demonstrated to be an effective low VOC option to replace MPG in a satin wall paint, without compromising paint performance. It has also been shown that not only can Optifilm™ OT1200 match the performance of MPG, but it can significantly improve upon it by further extending open time, wet edge, and workability of the paint.

Appendix 1. Test methods

Table 1. Satin wall paint

Component	Control	Eastman Optifilm™ additive	Type
Pigment grind			
Deionised water	8.2	8.2	—
Dispex™ GA40[a]	0.3	0.3	Pigment dispersant
Ammonia (25%)[b]	0.1	0.1	Neutralising agent
Acticide™ MBS[c]	0.2	0.2	Biocide
Tiona™ 595[d]	19.0	19.0	White pigment
Microdol H600[e]	3.0	3.0	Filler
Letdown			
Bermocoll™ E 320 FQ (3% solution in deionised water)[f]	15.0	15.0	Cellulose thickener
Propylene glycol (100%)[b]	3.0	—	Open time additive (volatile)
Deionised water	1.79	0.44	—
Sodium benzoate[b]	0.1	0.1	Corrosion inhibitor
Foamaster™ NXZ[a]	0.1	0.1	Defoamer
Vertec™ AT33[g]	0.3	0.3	Chelate thickener
Ropaque™ Ultra[h]	7.0	7.0	Opaque polymer
Acronal™ S 790[a]	39.6	39.60	Styrene acrylic polymer
BYK™ 348[i]	0.23	0.23	Wetting/levelling
Eastman Texanol™ ester alcohol[j]	1.98	1.98	Coalescent
Eastman Optifilm™ additive OT1200[j] (69%)	—	4.35	Open time additive (non volatile)
Total	***100***	***100***	
PVC	***45%***	***42%***	
VOC (g/litre) Decopaint Directive 2004/42/EC	***40***	***1.2***	

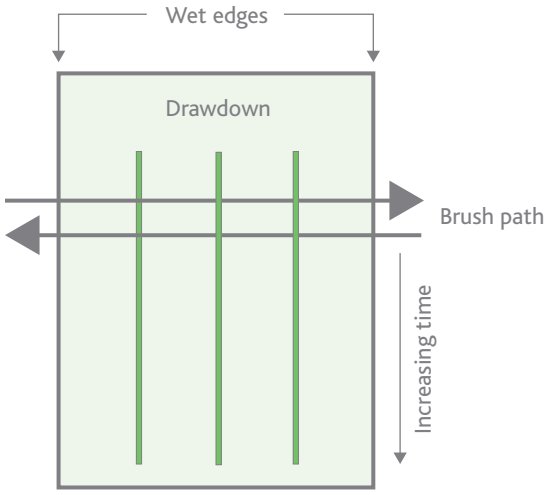
[a] BASF, [b] Aldrich Chemicals, [c] Thor, [d] Millennium Chemicals, [e] Omya, [f] AkzoNobel, [g] Johnson Matthey, [h] Dow, [i] BYK Chemie, [j] Eastman Chemical Company.

Incorporation and formulation adjustments

1. Eastman Optifilm™ additive OT1200 was added under low shear mixing with the other components during the letdown stage. It is important that the paint is stirred while the open time additive is being added.
2. The level of Optifilm™ OT1200 required to improve workability of an architectural paint formulation is typically in the range of 1.5% to 3.5% actives on total weight. This is only a guideline, as properties are paint dependant.
3. Adding OT1200 can reduce the rheology slightly, and the thickener levels may require adjusting to meet viscosity targets. In this formulation, no adjustment in rheology modifiers was required.
4. The following open time additives and levels were incorporated.
   - **Optifilm™ OT1200 = 4.35% (3.0% actives at 100% solids)**
   - **MPG = 3% (3% actives at 100% solids)**
5. Optifilm™ OT1200 contains 31% water, and the overall water level was adjusted to account for this.
6. Optifilm™ additive OT1200 has some mild coalescent activity, and as a result, an MFFT ladder may be utilized to ensure that the overall coalescent content of the paint is appropriate.

Appendix 2. Evaluation

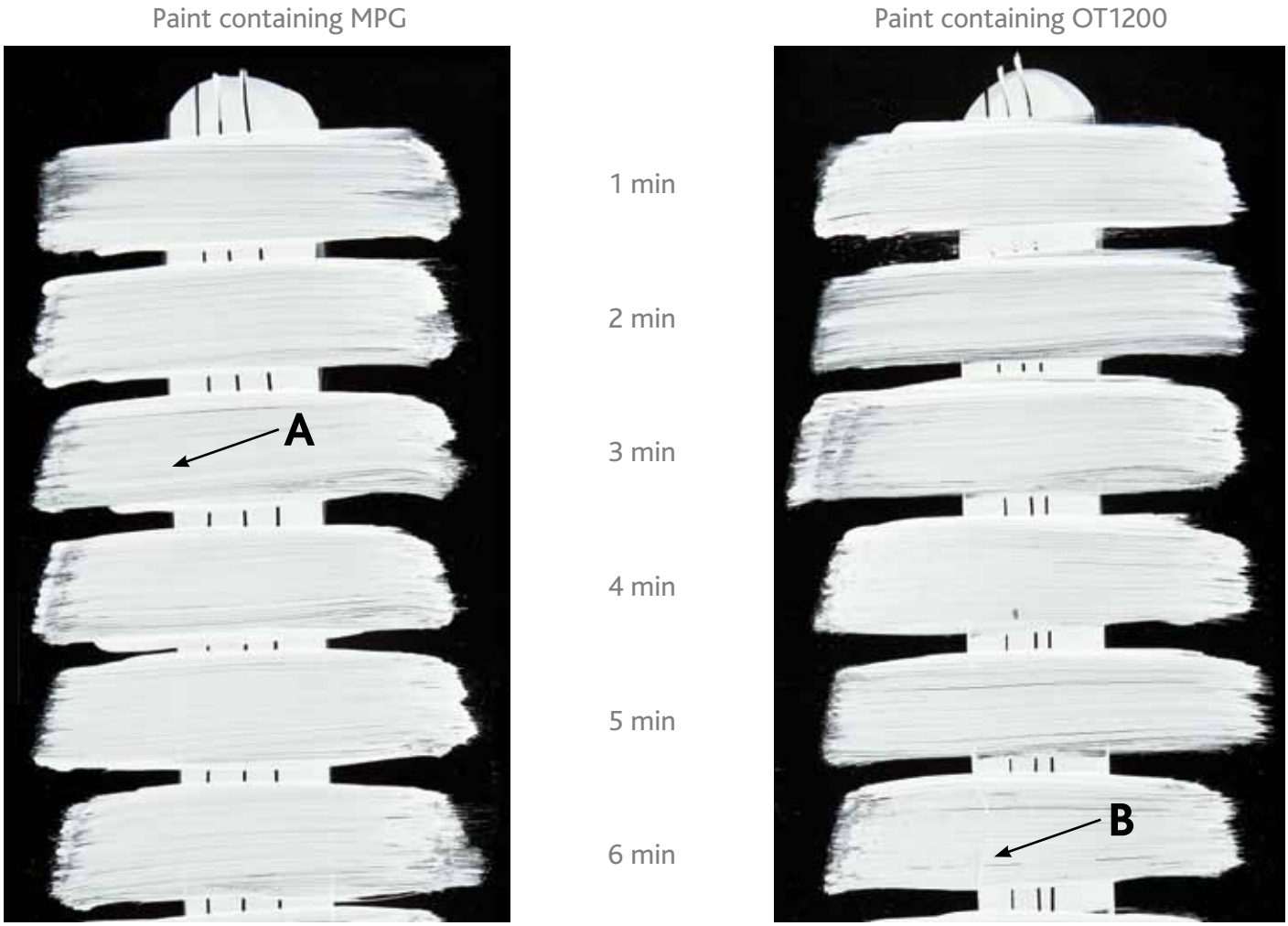
Figure 1. Typical test method for evaluation of open time and wet edge



Evaluation of open time and wet edge

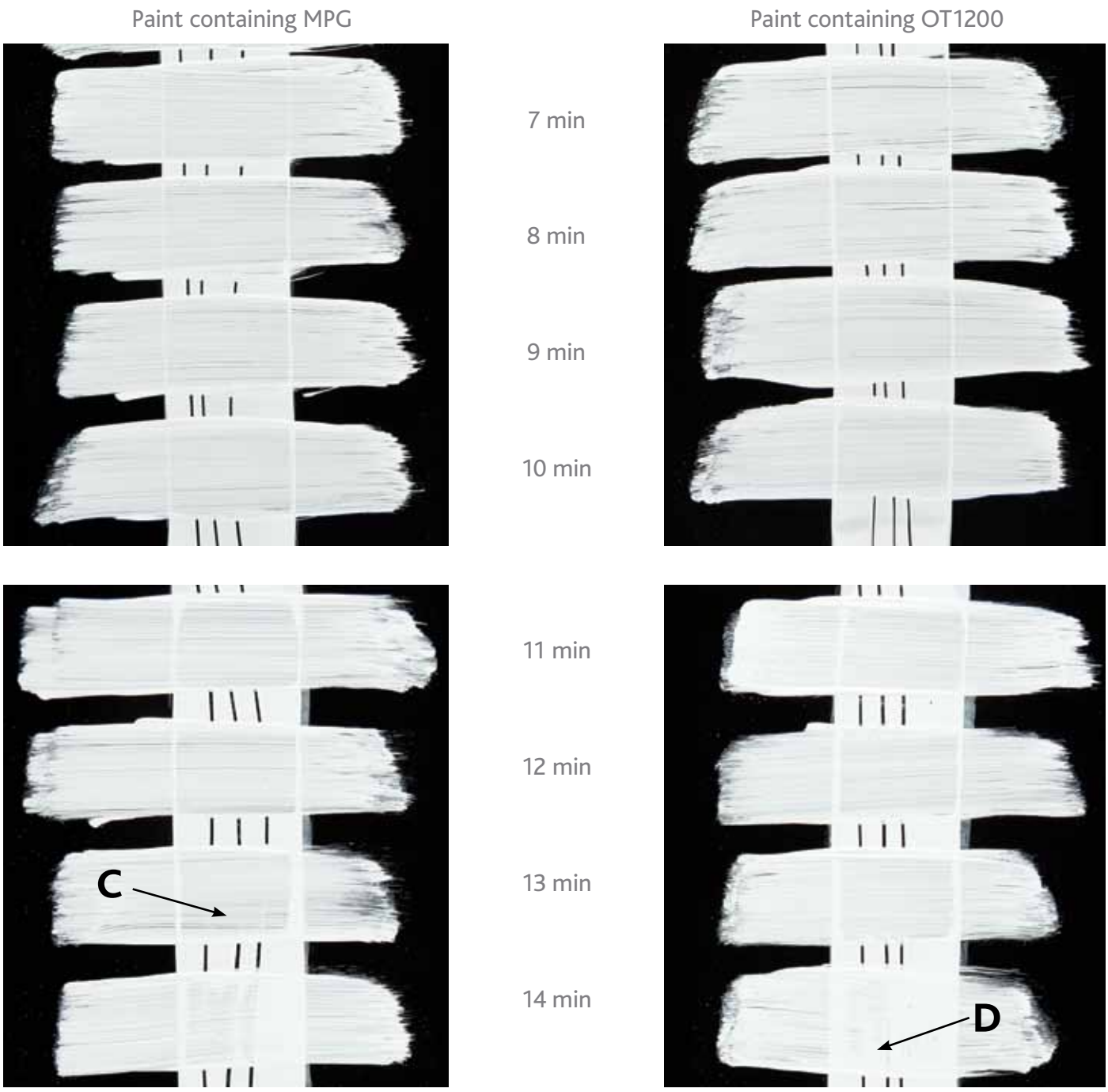
Evaluations were conducted to a draft ASTM standard (ASTM WK13360). Leneta test charts were coated using a 150µm Wet Film Thickness (WFT) block applicator. Immediately after the paint was applied, the timer was started. Sets of three parallel lines were marked on the paint surface with the rounded end of a wooden spatula. After 1 minute, a synthetic bristle brush was used to apply the test paint by brushing in a perpendicular direction to the parallel lines, using 10 strokes of alternating direction (1 stroke = 1 back and forth motion). The test was repeated on a new section at 1 minute intervals. The test was continued until the parallel lines became visible. This time was reported as the open time. The brush was lightly wetted with the test paint before each application. The test panel was dried in the horizontal position at 23°C for 24 hours before noting the parallel lines became visible (open time). As part of the same test, the time when the edge became visible (wet edge) was also noted.

Figure 2. Typical photographic example of open time and wet edge improvement of a satin paint containing either MPG or Eastman Optifilm™ additive OT1200



A indicates wet edge line appearing after 3 minutes
B indicates wet edge line appearing after 6 minutes

Figure 2 (continued). Typical photographic example of open time and wet edge improvement of a satin paint containing either MPG or Eastman Optifilm™ additive OT1200



C indicates open time lines cannot be brushed through after 13 minutes
D indicates open time lines cannot be brushed through after 14 minutes

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