

Eastman Optifilm™ additive OT1200:

Low VOC solution for improved open time in semi-gloss paint

Eastman Optifilm™ additive OT1200 has been designed to enable formulators to produce low VOC architectural paints with good open time without compromising paint performance.

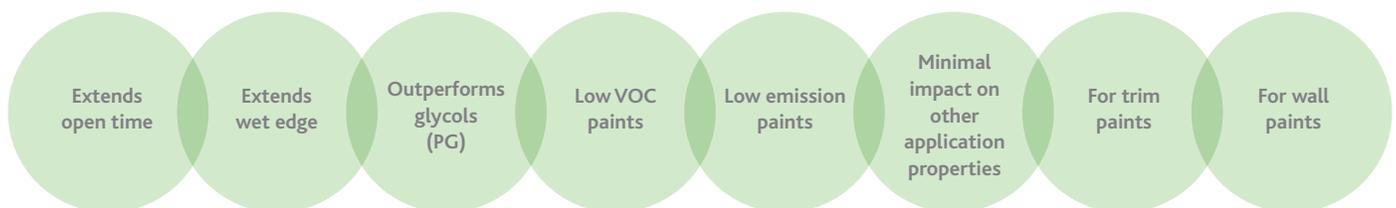
Optifilm OT1200 significantly extends the open time and wet edge of many water-based architectural paint systems. OT1200 has been evaluated in a variety of trim and wall paint systems including pure acrylics, styrene acrylics, vinyl acrylics, and vinyl acetate ethylenes.

Ethylene glycol (EG) and propylene glycol (PG) are commonly used as open time extenders. However, these glycols are considered to be volatile organic compounds (VOCs) according

to EPA Federal Reference Method 24 and ASTM Standard Practice D3960. Open time, wet edge, and workability are often compromised when glycols are removed from a formulation. Optifilm OT1200 provides an effective low VOC option to replace these glycols. Formulation and application results have demonstrated that Optifilm OT1200 can match or improve the performance of PG in a variety of paints while maintaining other key coating properties.

Various trim and wall paints have been prepared and tested. This technical tip will outline the improvement in open time and wet edge for one of the trim paints which was evaluated.

Features and benefits of Eastman Optifilm™ additive OT1200



Evaluation of Eastman Optifilm™ additive OT1200 in a white semi-gloss trim formulation

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 matched or improved at lower VOC. Detailed on the following pages are the application results for a 133 g/L semi-gloss trim paint based on Dow's Rhoplex™ SG-30 acrylic binder with a pigment volume concentration (PVC) of 21% and non-volatiles by volume (NVV) of 35%. PG was used at 3% on total solids in the

control, and was replaced with 3% actives OT1200 while maintaining water content and adjusting back to target viscosity. Details regarding the formulation are provided in Appendix I, and guidelines for incorporation of Optifilm™ additive OT1200 are summarized in Appendix II. The results which follow provide insight as to the extension of open time that can be achieved in the white trim paint with OT1200.

Results

Open time and wet edge

One of the most common techniques for evaluation of open time and wet edge requires a paint film to be drawn down on a sealed chart using a 3-mil Bird bar. A column of "X" marks is made in the center of the drawdown in accordance with Figure 1. After fixed periods of time, paint is brushed four cycles back and forth across the film. The point at which the edge of the drawdown can no longer be worked into the body of the paint is referred to as the wet edge time, while the time at which the "X" begins to show through the paint is deemed the open time.

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

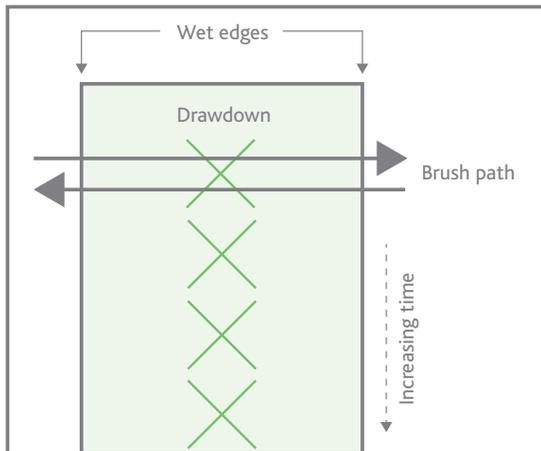
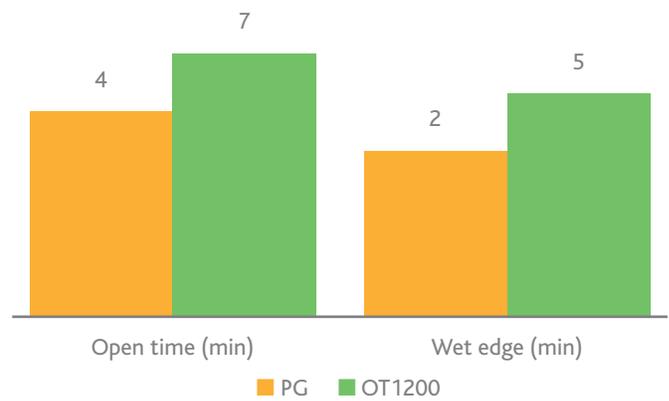


Figure 2 provides a graphical view of the improvement in open time and wet edge achieved in the semi-gloss trim formulation with OT1200. Photos of panels illustrating the improved workability that is possible with OT1200 are provided in Appendix III.

Figure 2. Semi-gloss trim paint: open and wet edge times



Note: Wet edge time is reported as an average of the left edge and right edge values.

Eastman Optifilm™ additive OT1200 significantly improves the open time and wet edge of the paint while reducing VOC.

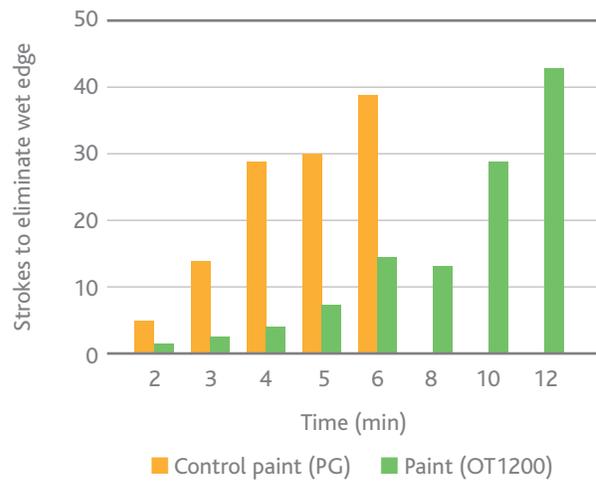
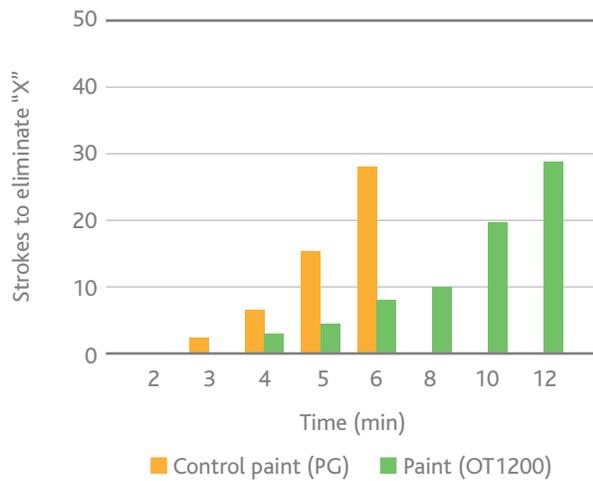
Workability

Extending the open time improves the “workability” of the paint, *i.e.*, it enables the applicator greater time to rejoin painted edges and blend in imperfections such as sags or runs, and reduces viscous drag to enable easier brushing. In order to demonstrate the workability of the paint, the number of brush strokes to eliminate the open time and wet edge was recorded. The test was concluded when the paint required greater than 50 brush strokes to remove either the open time or wet edge lines.

Figure 3 shows the results for a control with PG and a formulation with OT1200.

With the PG paint, 40 brush strokes were required to rework the wet edge at 6 minutes. In the OT1200 system, it was possible to rework the wet edge up to 12 minutes with equal brush strokes. The OT1200 paint demonstrated a similar benefit in terms of open time.

Figure 3. Workability of semi-gloss trim paint



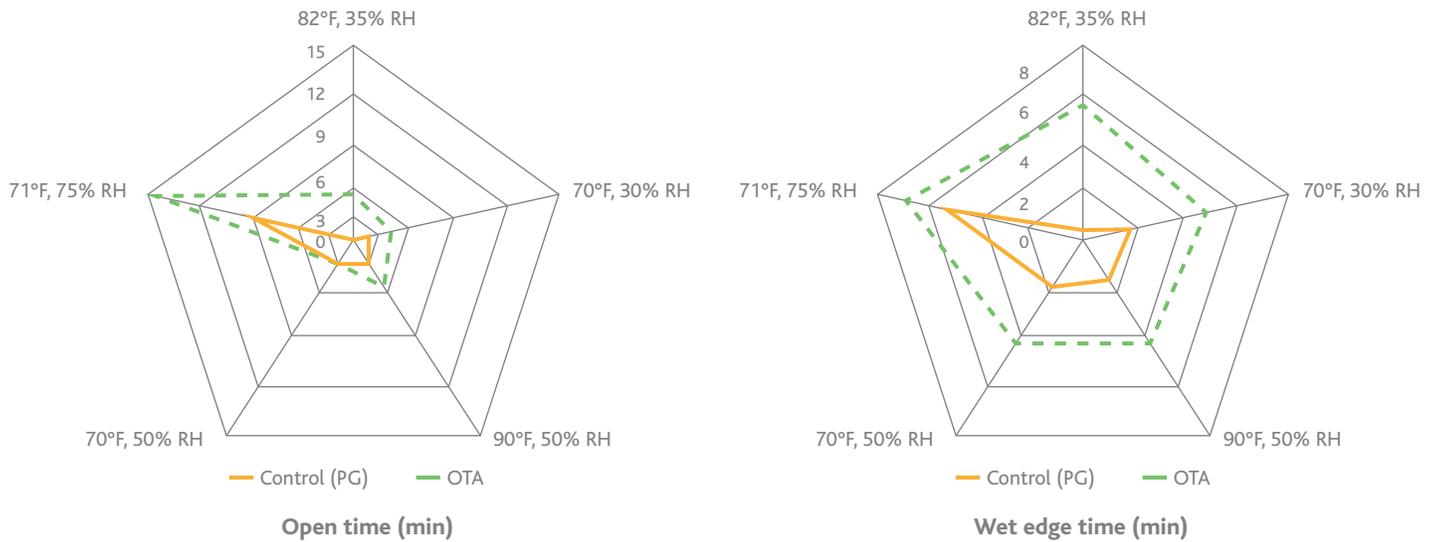
Eastman Optifilm™ additive OT1200 significantly improves the workability of the paint while reducing VOC.

Robustness of semi-gloss trim paint to varying environmental conditions

One of the challenges for the application of waterborne architectural paints is the variation in the workability that is observed when applying coatings under different environmental conditions. Open and wet edge times were evaluated in paints containing PG and Eastman Optifilm™ additive OT1200 under five combinations of temperature and humidity shown in Figure 4. As expected, the humectant PG in the control paint provides poor

open time/wet edge at high temperature/low humidity and good open time/wet edge at low temperature/high humidity. In contrast, the paint with OT1200 provides excellent wet edge time regardless of temperature and humidity. Open times were superior for the lower VOC paints containing the OT1200, except at 70°F and 50% RH where the results were relatively similar.

Figure 4. Open and wet edge times under five combinations of temperature and humidity



Application performance of semi-gloss trim paint

In addition to the open time tests, a range of other application tests were conducted and the differences against the PG control recorded in Table 1.

The results show that with Eastman Optifilm™ additive OT1200 it is possible to significantly improve open time, wet edge, and workability without compromising paint performance as compared with the PG control.

Table 1. Comparison of properties between Eastman Optifilm™ additive OT1200 and PG control paints

Property evaluated	OT1200 vs. PG control	Comments	Test method
Open time	↑	Significant improvement with OT1200	See Figure 1
Wet edge	↑	Significant improvement with OT1200	See Figure 1
Workability	↑	Significant improvement with OT1200	See Figure 3
Gloss	↑	Significant improvement with OT1200	ASTM D523
Scrub	≈	No difference in scrub	ASTM D2486
Block resistance	≈	No major difference in block resistance	ASTM D4946
Wet adhesion	≈	Both have excellent wet adhesion	ASTM 6900
Heat stability	≈	Good storage stability for both paints	pH and viscosity 4 wks @ 120°F

Conclusion

Trim paints tend to be formulated with glycols such as propylene or ethylene glycol to control open time and wet edge. These glycols are VOCs according to EPA Reference Method 24. Eastman's open time additive, Eastman Optifilm™ additive OT1200, is low in VOC. Its incorporation into a variety of paint formulations enables formulators to produce low VOC coatings.

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

Appendix I. Semi-gloss trim formulation^a

Ingredient	Control		3% Optifilm™ OT1200	
	Pounds	Gallons	Pounds	Gallons
Ti-Pure™ R-746 slurry ^b	326.72	16.84	326.72	16.84
Aerosol™ OT-75 ^c	1.60	0.18	1.60	0.18
Rhoplex™ SG-30 ^d	509.65	57.46	509.68	57.46
Kathon™ LX 1.5% ^d	1.81	0.21	1.81	0.21
BYK™ -022 ^e	2.10	0.25	2.10	0.25
Water	137.02	16.45	96.87	11.63
Propylene glycol	31.56	3.66	0.00	0.00
Eastman Optifilm™ additive OT1200 ^f	0.00	0.00	45.78	5.09
Eastman Texanol™ ester alcohol ^f	11.57	1.46	11.61	1.47
Acrysol™ SCT-275 ^d	4.88	0.57	8.46	0.98
Acrysol™ RM-2020NPR ^d	25.50	2.92	47.43	5.43
Totals	1052.41	100.00	1057.07	99.54
Viscosity (KU)	103		104	
Viscosity (ICI)	1.07		1.10	
Density (lb/gal.)	10.5		10.5	
PVC (%)	21.2		21.2	
NVV (%)	34.9		39.1	
VOC (g/L)	133		50	

^a Formulation adapted from Dow 150g/L SG-30 Quality Interior Semi-gloss Slurry TiO₂ Formula, ^b DuPont, ^c Cytec Industries, ^d Dow Chemicals, ^e BYK Chemie, ^f Eastman Chemical Company

Appendix II. Recommendations for the incorporation of Eastman Optifilm™ additive OT1200

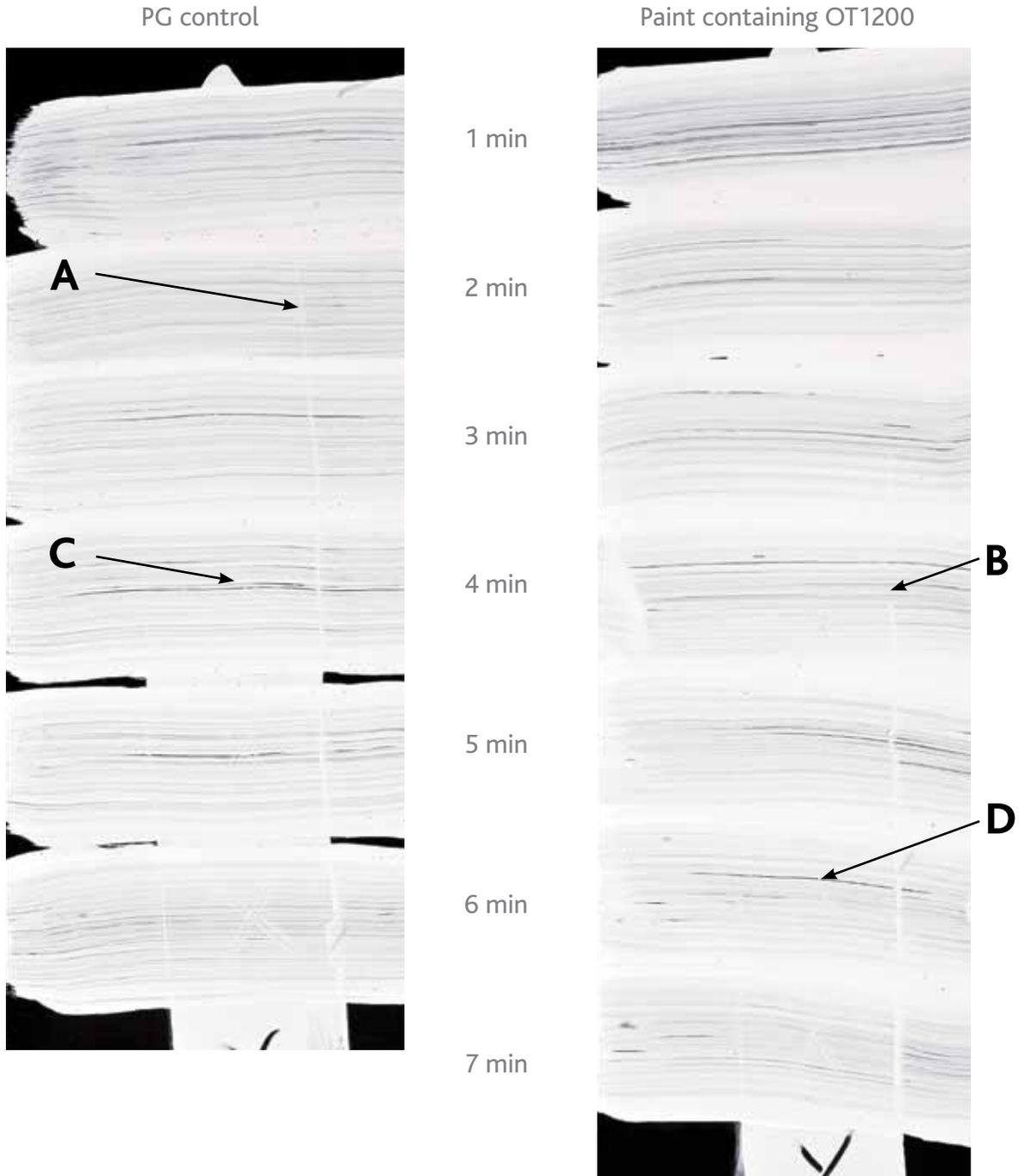
The level of Eastman Optifilm™ additive OT1200 required to improve workability of an architectural paint formulation is typically in the range of 1.5% to 3% actives on total weight. This is only a guideline, as properties are paint dependent.

Since Eastman Optifilm™ additive OT1200 contains approximately 30% water, an equivalent amount of water should be withheld from the formulation in order to keep total water content on target. Optifilm OT1200 additive should be mixed prior to incorporation. OT1200 is typically used in the

letdown and should be added slowly, under good agitation. If desired, OT1200 may readily be diluted with water prior to incorporation. Optifilm OT1200 may impact the rheology of the paint, and in some systems, thickener may have to be adjusted in order to meet viscosity targets.

Eastman 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 III. Comparison of workability for PG control with paint containing Eastman Optifilm™ additive OT1200



- A indicates wet edge line appearing after 2 minutes
- B indicates wet edge line appearing after 4 minutes
- C indicates open time lines cannot be brushed through after 4 minutes
- D indicates open time lines cannot be brushed through after 6 minutes



Eastman Chemical Company

Corporate Headquarters

P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

Telephone:

U.S.A. and Canada, 800-EASTMAN (800-327-8626)

Other Locations, (1) 423-229-2000

Fax: (1) 423-229-1193

Eastman Chemical Latin America

9155 South Dadeland Blvd.

Suite 1116

Miami, FL 33156 U.S.A.

Telephone: (1) 305-671-2800

Fax: (1) 305-671-2805

Eastman Chemical B.V.

Fascinatio Boulevard 602-614

2909 VA Capelle aan den IJssel

The Netherlands

Telephone: (31) 10 2402 111

Fax: (31) 10 2402 100

Eastman (Shanghai) Chemical Commercial Company, Ltd. Jingan Branch

1206, CITIC Square

No. 1168 Nanjing Road (W)

Shanghai 200041, P.R. China

Telephone: (86) 21 6120-8700

Fax: (86) 21 5213-5255

Eastman Chemical Japan Ltd.

AIG Aoyama Building 5F

2-11-16 Minami Aoyama

Minato-ku, Tokyo 107-0062 Japan

Telephone: (81) 3-3475-9510

Fax: (81) 3-3475-9515

Eastman Chemical Asia Pacific Pte. Ltd.

#05-04 Winsland House

3 Killiney Road

Singapore 239519

Telephone: (65) 6831-3100

Fax: (65) 6732-4930

www.eastman.com/optifilm

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