Autotype Capillex CX

Capillary Stencil Film

Controlled Profile Capillary Film for Industrial and Electronics Applications

MacDermid AUTOTYPE

The Ideal Stencil for Industrial Printing

Regardless of the screen printing application, the qualities of the ideal stencil are the same. From a photographic standpoint, the stencil must faithfully reproduce the artwork. The stencil must also define the edges of the print in a way that does not interfere with reproduction accuracy or, in the case of conductive circuitry, the functionality of the finished part.

The keys to producing the ideal stencil are Rz value (surface roughness) and EOM (emulsion-over-mesh ratio, or stencil profile). The stencil must be smooth enough to create a gasket-type seal between the screen and substrate, which prevents the familiar problem known as "sawtoothing". Experienced screen printers know that increasing the stencil profile will smooth out a rough surface, yielding a lower and more desirable Rz value. For many years, this issue has been addressed with standard capillary films or multi-coating direct emulsions.

Fixing one problem leads to another

Building a stencil to the desired Rz value is only half the battle, however. When the stencil reaches the point where it is smooth enough, it is usually too thick to transfer the ink properly, which causes another type of sawtoothing. To distinguish this problem from the one caused by a rough, high-Rz stencil, we call them "positive" and "negative" sawtoothing (see inset at right).

Positive and Negative Sawtoothing

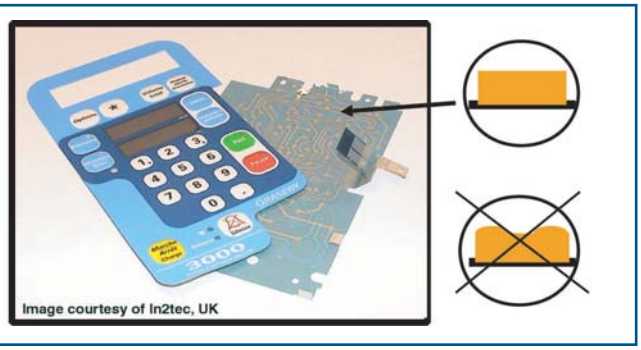
Left: Representation of a print from an ideal stencil possessing the optimum combination of Rz value and EOM

Center: Positive sawtoothing. A print resulting from a stencil with a high Rz value (rough stencil surface). Poor gasketing between the screen and substrate creates gaps which become filled with ink and transfer to the substrate.

Right: Negative sawtoothing, sometimes called "mouse bites". This problem occurs when the stencil's EOM is too high and the stencil begins to interfere with ink transfer at the edges of the image.

Two problems, one solution

The solution to this delicate balancing act of Rz vs. EOM is not found in a direct emulsion or in a standard capillary stencil film. For critical screen printing applications where image acuity and ink deposit are equally important, MacDermid Autotype has developed a new generation of capillary films. The first of these films was Autotype Capillex CP, designed for high line count process color printing. The newest film is Autotype Capillex CX, formulated for printers using coarser mesh counts and requiring heavier ink deposits than those used in graphics applications.



Autotype Capillex CX is a capillary stencil film that addresses the edge-fault problems encountered in many industrial screen printing applications that use coarser mesh counts and require controlled and relatively thick ink deposits.

On medium to coarse meshes, Autotype Capillex CX will consistently produce the same low, controlled stencil profile over a wide mesh range from 150-255 threads per inch.

Autotype Capillex CX is formulated for demanding industrial applications such as:

- Printed circuitry, rigid and flexible
- Membrane switch components: overlays and conductive layer
- Ceramics & glass
- Automotive parts
- Nameplates

The Effects of EOM on Printed Edge Quality

Figure 1 illustrates a cross section of a stencil and mesh, just after the squeegee has passed and the screen is about to lift off the substrate. The stencil is illustrated as low-EOM, about 4 microns.

In **Figure 2,** the screen has lifted off the substrate.

The amount of ink deposited is calculated from the amount of ink in the screen at that start of the print stroke *minus* the amount of ink left behind in the mesh at the completion of the print stroke.

Note that in Figure 2, the ink deposit is fairly flat. The mesh controls ink deposit over the majority of the image and the stencil exerts very little influence over ink deposit at the edges. This is the desired result.

Now let's print the same image, but this time with a high-EOM (13 micron) stencil, illustrated in **Figure 3**. The high EOM makes it impossible for the mesh to flex enough to touch the substrate, and the volume of ink near the image edge is far greater than in Figure 1.

Figure 4 shows the resulting print from the high-EOM stencil. As before, the ink deposited on the substrate

is calculated as described for Figure 2. The amount of ink left behind on the mesh remains unchanged, but the amount of ink in the open areas at the start of the print stroke is greater, as is the ink deposit at the image edge.

Figure 5 compares two prints made with silver conductive inks under a controlled environment.

At left is the desired result, obtained with a 4-micron stencil. At right is what happens far too often and was achieved with a high-EOM stencil. This is a real life example of "negative sawtoothing". Note that the problem only applies to the leading edge of tracks that are being printed parallel to the squeegee direction. Negative sawtoothing has not occurred on the bottom edge, indicating that vertical lines will not exhibit the problem.

Figure 6 and **Figure 7** illustrate the root cause of negative sawtoothing. Quite simply, the squeegee

and floodbar pressure were insufficient to fill the large open "well" at the image edge. Ink that is not in contact with the substrate just prior to snapoff does not transfer to the substrate. Instead, it remains in the screen at the completion of the print stroke, creating what many printers call "mouse bites" in the print.

NOTE: These illustrations are representative of what is actually happening and are the result of careful measurements taken from numerous test prints using high- and low-EOM stencils.

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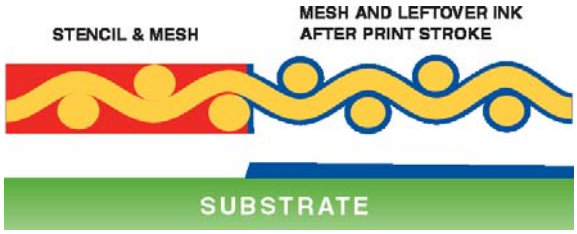

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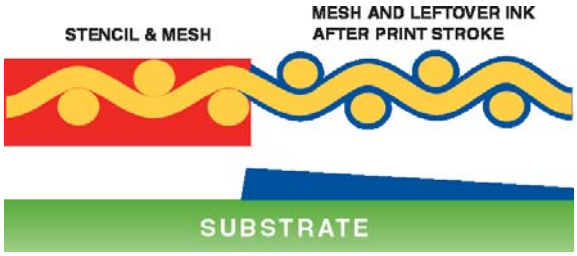

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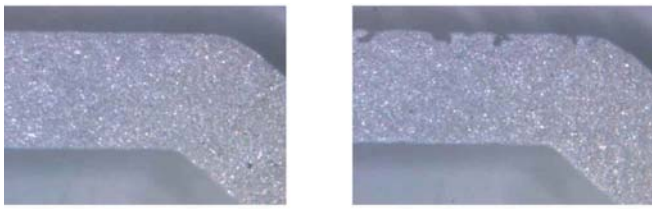

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Autotype Capillex CX at a Glance

Autotype Capillex CX Technical Specifications

Property	Specification
Compatible Inks	Solvent-based, ceramic inks, solder pastes, conductive inks, UV curable
Mesh Range	150 - 305 (62-120 / cm) threads per inch for best results
Humidity Resistance	Very good humidity resistance; excellent resistance to solvents and abrasion
Water Resistance	Low, not for use with inks that contain water
Image Resolution and Print Definition	Very good printed edge definition; 40-micron image resolution when exposed with a 5Kw metal halide lamp at 60"
Estimated Exposure Times	2KW Metal Halide @ 48": 6 min. 3KW Metal Halide @ 48": 5 min. 5KW Metal Halide @ 48": 4 min.
Stencil Profile (EOM)	150 tpi : 4 microns 230 tpi : 4 microns 305 tpi : 5 microns 195 tpi : 4 microns 255 tpi : 4 microns
Stencil Rz (Surface Roughness)	<7 microns
Stencil Removal	Reclaims easily with Autotype Autostrip; pressure washer recommended
Packaging Availability	Rolls: 24"x394"; 41" x 394"; 48" x 394"; Custom cut sheets also available

Autotype Capillex CX Features and Benefits

Feature	Benefit
Low stencil profile (EOM)	Optimized ink deposit for the most desired print results with significant reduction in ink wastage. Improves quality, saves production costs.
Controlled profile	Consistently predictable results The low-EOM stencil promotes consistency of performance in conductive tracks. The conductivity of horizontal and vertical tracks are known to vary significantly, and the low-EOM (reduced negative sawtoothing) of Autotype Capillex CX helps to prevent this discrepancy. EOM remains consistent over a wide variety of meshes, allowing screenmakers to apply the stencil film to a wide variety of meshes without having to "tweak" the application method.
Optimized stencil surface (Rz)	Excellent "gasketing effect" between the screen and substrate for superior printed edge definition. Rz value is consistent over a wide variety of screen fabrics.
Wide exposure latitude	Trouble-free exposing without compromising stencil performance.
Easy washout	Faster clearing of fine details; edges wash clean without high pressure.

MacDermid AUTOTYPE

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