NEW!!! EZ-50 ORANGE-ULANO FILM FOR IMPRINTED SPORTSWEAR

-Donald Marsden, Ulano Corporation

The Two Measures of Image Quality

In a 1964 opinion, Associate Supreme Court Justice Potter Stewart wrote that although he couldn't *define* pornography, he knew it when he saw it! When it comes to print quality, many experienced screen printers are like Stewart. They can't define it but they know it when they see it.

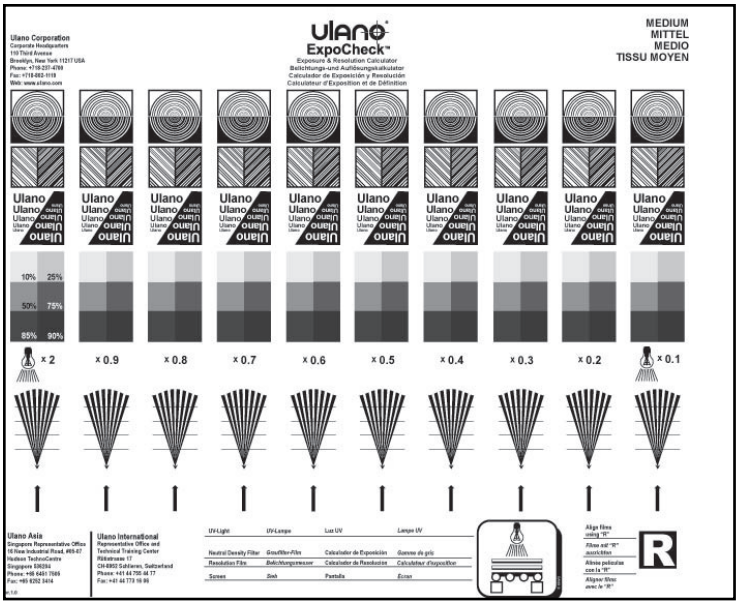


Figure 1: Ulano ExpCheck

Actually, print quality can be defined effectively using just two measures: definition and resolution. **Definition** refers to the "sharpness" of a printed edge, and there is a ratio that can quantify this usually subjective evaluation[1]. **Resolution**, the fineness of detail on a print, is readily measureable as either the narrowest discernable adjacent lines and spaces, or as halftone dots (referred to as "lines per inch" or "dots per inch"). The physical characteristics of capillary film make it much easier and less skill-intensive to produce stencils that have better resolution and definition than direct emulsion.

Capillary Film Print-Side Flatness and Printed Edge Sharpness (Definition)

The flatness of the printing side of a stencil affects the edge definition of the print. (Flatness is measureable in microns with a profilometer and is called the "Rz value." The higher the Rz value, the more irregular the stencil bottom is).

Direct emulsions contain water, so when an emulsion with, say, 50% solids content dries, it loses half its volume. It dries into the mesh structure leaving an irregular stencil bottom. If nothing more is done and the stencil is used to print, image edges will be sawtoothed—the sawtooth pattern replicating the irregular stencil bottom covering the mesh openings. EZ-50 ORANGE and the other capillary films, on the other hand, are coated onto a polyester backing sheet that holds the emulsion flat on the printing side during drying and above the mesh weave. The backing sheet, which should be removed just before exposure, also functions as a dust protector—a second safeguard against pinholes.

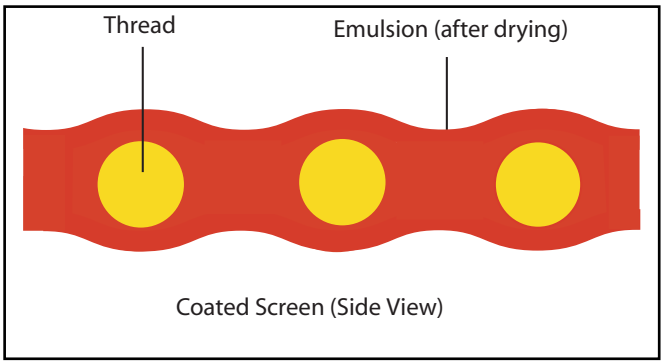


Figure 2: Coated Screen (Side View)

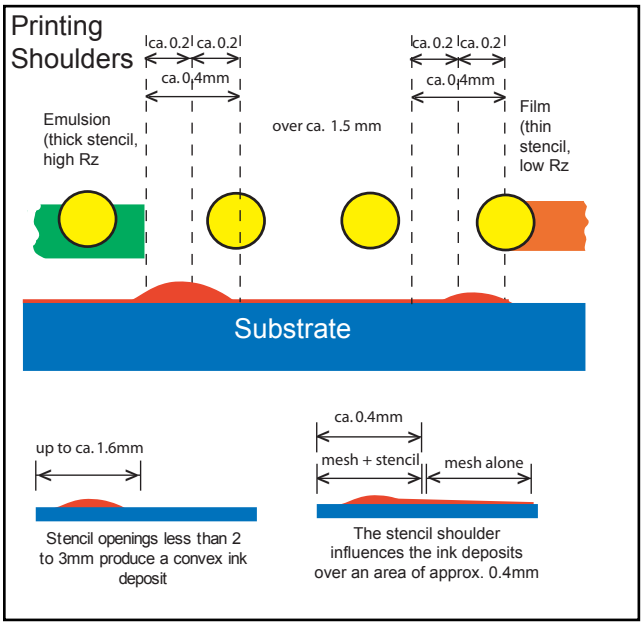


Figure 3: Printing Shoulders

The release of the ink during the printing stroke moves the ink column downward into the open areas of the stencil--but also *outward* from the bottom of the stencil onto the substrate (printing surface). If the stencil bottom is flat (with a low Rz value), its image openings on the printing side lie flat against the substrate. They act as a gasket against the substrate to prevent the ink from flowing under the image edges. If the image openings flange outward from an ideal perpendicular, however, the ink under pressure will flow into the irregularities (especially if it is thixotropic). If the ink is not gasketed, the printed edges will be sawtoothed.

Capillary Film EOM (Emulsion Thickness Over Mesh) and Resolution

Stencil thickness affects resolution. A capillary film's emulsion thickness should be selected in relation to the mesh count that will be used for the job. (The coarser the mesh, the thicker the capillary film should be; conversely, finer mesh should be used with thinner capillary film.) EZ-50 ORANGE works best with mesh counts of 86-196 threads per inch (33-77/cm).

With the thickness-mesh count correlation in place, the EOM of the stencil will be thin. This works to the advantage of improved resolution, because the height of the ink columns in the image areas will be minimal—corresponding to the sum of the mesh thickness and the additional thickness of the stencil material on the printing side of the mesh (the EOM). For lower resolution printing, the ink deposit is determined primarily by the mesh itself, except at the very edges of the stencil where one can often notice an image edge ink "lip." In high resolution printing, however, the edges of the stencil are usually so close that there is no open mesh ink deposit. High resolution images combine the thickness of the mesh and the stencil. When the stencil is too thick, the ink column will be high and prone to collapse (affecting definition and resolution), and in halftone work resulting in dot gain or "PITS" (= piling ink tone skewing).

Obviously, it's quite easy to make a thin coating of direct emulsion—but not if the bottom of the stencil is supposed to be flat. If the first coating of the dried-in emulsion is to be made flat, one or more additional coatings (and dryings) of emulsion must be made to fill the irregularities of the dried-in emulsion, so that they become flat. But with each coating, the EOM becomes thicker. Without careful procedures, the EOM of flat emulsion stencil bottom can build to 14 -23 microns. Capillary film, on the other hand, has an EOM of 5–7 microns.

Consistency: Let *Us* Coat Your Screens

Direct emulsion is a liquid. . . an *emulsion*—a suspension of molecules and particles in water. Like all liquids, it tends to flow and must be confined and controlled if it is ever to be transferred uniformly to a screen, dried, exposed, washed out, and become a solid and well-formed stencil. It's the difficulty of controlling liquid emulsion until it dries and becomes a solid that makes direct emulsion prone to misbehavior and inconsistency.

Capillary film, on the other hand, *is* a solid. Ulano's enormous film coating machines coat to a tolerance of +/- one micron--that's 0.00004 inches! Even an automated coating machine cannot lay down a coating to this tolerance standard—unless it maintains the fill level of emulsion in its coating trough(s). EZ-50 ORANGE and capillary films in general should be thought of as a more finished form of stencil making product than emulsion.

The net result of close-tolerance coating at our factory is perfect stencils in your shop--every time. Because EZ-50 ORANGE is always the same thickness, the exposure is always the same; ink laydown is always consistent, and the shop is always in control of ink deposits, color, curing, and costs.

You'll see below (in both the "Productivity" and "Price Differences, Cost Differences" sections) that the "wet processing" of capillary film means faster stencil production and virtually no costly time-outs for touchups. It also means that capillary film stencils, especially in lint-prone textile shops, have consistency in the sense of being defect-free, especially of the bugbear of pinholes.

EZ-50 ORANGE is sold in pre-cut sheets—15" X 17" and 17" X 24"—sized especially for the needs of imprinted sportswear printers. Pre-cut sheets are consistency itself, perfectly sized for imprinted sportswear printing. With EZ-50 ORANGE, there's no need to stir, pour, or coat the stencil material: just pull it out of a box and affix it to the mesh.

Figure 4: Processing Variables Affecting Stencil Thickness

VARIABLE	DIRECT EMULSION	EZ-50 ORANGE
Dilution of Sensitizer	Diazo Only	
Solids Content	•	
Wetting Dwel Time		•
Coating Angle	•	
Coating Pressure	•	
Coating Speed	•	
Coater Fill Level	•	
Coater Edge	•	

We should address one other matter here: the industry myth that film is *fragile*. Premature stencil breakdown is a risk with any stencil system that is poorly made (generally due to under exposure). Some direct emulsion stencils can last 100,000 impressions; others can't survive 100!

Film is *not* fragile. Water-adhered capillary film stencils, properly exposed, produce 10,000-30,000 impressions. These are numbers well within the requirements of most jobs. And when adhered with a compatible emulsion instead of water, capillary films can produce 50,000-70,000 impressions. Film just isn't any more fragile than a hummingbird or an I-beam.

Finally, we should mention one other way in which capillary film can provide an advantage in stencil consistency, and that is if screen fabric tension is uneven. Low-tensioned mesh areas accept more emulsion during coating, so that under-tensioned areas of a given screen will hold more emulsion than more tightly stretched areas. Exposure times will vary on different sections of the same coated screen. Because of capillary film's uniform coating, its exposure requirement is constant across the entire stencil. Thus, capillary film is forgiving of uneven fabric stretching in a way that direct emulsion isn't.

Productivity and Stencil Throughput

With fewer stencil processing steps than direct emulsion, EZ-50 ORANGE is start-to-finish faster. Fewer processing steps also mean fewer possible errors and, thus, greater consistency.

Figure 5: Stencil Processing Steps

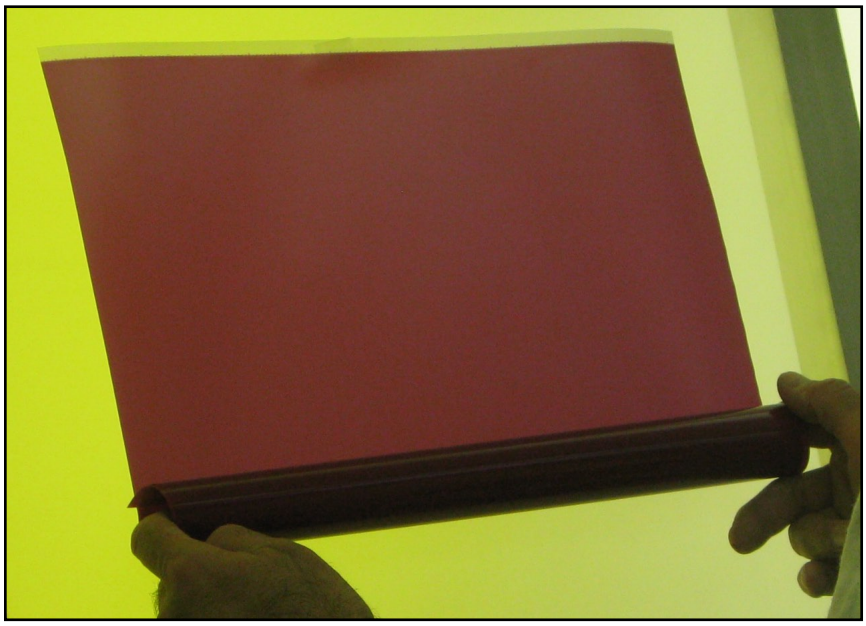
VARIABLE	DIRECT EMULSION	EZ-50 ORANGE
Sensitizing	Diazo Emulsions Only	
Debubbling	Diazo Emulsions Only	
Screen Preparation	•	•
Drying After Preparation	•	
Coating/ Adhering	•	•
Drying	•	•
Coating for Flatness	Probaby	
Drying	Probably	
Exposure	•	•
Washout	•	•
Drying	•	•
Touchups	•	
Blocking Out/ Taping	•	•
Drying	•	•
Returning Leftover Emulsion to Container	•	
Washing Scoop Coater	•	
Total Steps	**12-14 Steps**	**8 Steps**

The additional stencil processing steps for emulsion over film, especially the two additional drying steps (after the degreasing rinse, before coating; and after "face coating), mean that a direct emulsion stencil takes about twice as long to prepare.

Material Price and Total Cost Differences

It's easy enough to determine the price per stencil of either sheet size of EZ-50 ORANGE. The sheets are packaged 50 per carton, so divide your purchase price by 50 and you'll have the price of film per screen.

It's more difficult to determine the price per stencil of direct emulsion because the product is more complicated to use. Probably the best way to calculate is just to keep track over a period of a month or two the average number of screens you can make per gallon of emulsion, then divide the price per gallon by the number of screens. By averaging in that way, your price per screen will include emulsion losses to drips and spills, and leftover emulsion that must be cleaned from scoop coaters. Bear in mind that price differences *per printed item* amount to fractions of a cent!



Determining the *material price* per screen of EZ-50 ORANGE and direct emulsion (you'll probably find that the film costs somewhat more) is a start toward determining the t*otal cost* per screen of each stencil system. Costs should include labor (unless you don't pay yourself or your employees) and production time (including production time lost to pinholes). If pinholes appear when you make the screen, you'll probably dab on some blockout and let it dry for 15 minutes. That 15 minutes is not negligible. It represents 15 minutes of production lost, a quarter hour of someone's salary lost, and a quarter hour of fixed overhead lost (overhead is usually at least 3X direct labor). It's also 15 minutes of lost production—thus, one quarter of the number of shirts you print per house and whatever your selling price for that number of shirts is. The cost of that pinhole has really added up—and would have cost even more had it opened up during the print run itself! The wet processing of EZ-50 ORANGE—adhered to the screen right after the degreasing rinse, before dirt, dust, and lint can settle—virtually eliminates pinholes—with the added protection of the dust-protective backing sheet.

Ultimately, any consideration of costing should include an evaluation of the relative quality of EZ-50 ORANGE vs. emulsion. We have seen how the physical properties of capillary film readily produce thin stencils (low EOM) that are flat bottomed (low Rz value)—so that superb resolution and definition are inherent and easy to achieve with film. That printing quality can allow a shop to compete easily against embroiderers in both edge sharpness and resolution.

That better print quality is worth something. Superior printing adds value, helps retains old customers, attracts new customers, and underlies new kinds of imaging and versatility that can attract new kinds of business. Best of all, consistent and reliable EZ-50 ORANGE helps the printer to deliver work on time—with better total costing of stencil making.

1. B184, SGIA Technical Guidebook

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