MURAKAMI SCREEN USA

Technical Newsletter - November 2012

MURAKAMI SCREEN U.S.A., INC. *745 Monterey Pass Rd. Monterey Park, CA 91754 Tel 323.980.0662*

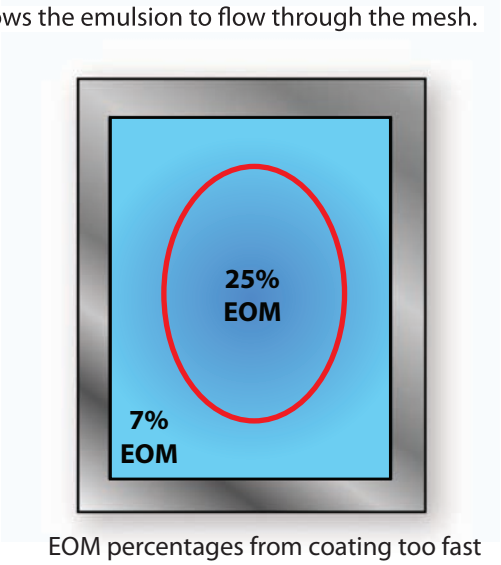
It's what you can't see that matters.

Screen room personnel often fall into a repetitive cycle in screen making. Handling screens becomes a constant work pattern where little thought is given to the condition of the emulsion, the screen room, the exposure process, or the condition of their equipment and the presses. They are constantly in a production 'pinch point' where a finite amount of screens can be processed through their area. Between sampling needs, production, and replacement screens for any that have broken down in production, they often aren't aware of anything but the need to line up the art and get another screen shot. They work at near capacity throughput for their system. Screens that are made in a hurry and rushed to production often look identical to any other screens. They are coated the same way, the exposure is the same time, the blockout and tape job are identical. One screen may last thousands of prints while one rushed to a press may breakdown in 300-500 prints. Same emulsion, same exposure time, same personnel yet some screens work well, some breakdown. The faster they go the more issues production has on press. So what is wrong with this picture? How can we change the process to make life easier for everyone in the shop, and with this process improve profits and company stability?

The problem with the above scenario is this: the screen issues cannot be seen with the naked eye. It's what we don't see that causes most of the problems. So let's look at areas that we find are often neglected in the screen room.

Coating: Coating the emulsion should not be done haphazardly. The thickness of the emulsion from the coating technique used along with mesh type, color of the mesh and more importantly the type of emulsion determines the exposure time. It amazes me how many shops I go into where this is simplified down to 2-3 exposure times for any mesh in the shop, no matter how the product is coated. Some mesh will be underexposed, some over, some exposures are plain lucky and just right with this method. The issue is the screen maker cannot see exactly how thick the coated and dry emulsion is without a tool like a Thickness Gauge.

We often see workers coating too fast and not allowing the emulsion to flow through the mesh. His 110/TPI screens may vary from 0-7% emulsion over mesh to 25%+ emulsion over mesh in the center, and in almost all cases he will look at a chart for exposure times (if he is lucky to have one) and punch in the numbers. The 7-10% EOM screens shoot fine, The 0% can be over exposed but more importantly the 25% EOM screens will be underexposed. On press the 25% EOM screen will break down sooner on a discharge ink print and another screen will be rushed to press, often under exposed or under dried and break down even sooner. Nothing is predictable if only the naked eye is used to qualify the process; everything that needs control is invisible to the worker. Creating predictable results requires knowing what is happening in the areas you can't see. Proper coating technique creates predictable exposure times. Coating slowly with a firm pressure allows the emulsion to flow through the mesh.



EOM percentages from coating too fast

This is one reason to get an automatic coater if you are a large production shop. Consistent coating thicknesses yield predictable exposure times and stronger screens on press. Again in this case Emulsion Thickness is something we cannot see with the naked eye, it needs to be quantified and not an assumption that all the hand coaters or coating machines are doing it right. 7-10% EOM is a starting point for a stronger screen; only a thickness gauge can make this measurement. I have seen shops where it varies by 25% with different people, or worse when the accepted process is to just coat the screen as fast as possible. These habits are hard to break, but better to break them than the company going broke due to unseen problems!

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So let's say we place an automatic coater into the screen making process to get consistent emulsion thickness, or train workers to coat slower with a firm pressure. This should fix the problem; we have consistent emulsion, accurate exposure time for this thickness so our screen strength should be as good as it can be. Nope, there are still more areas that can affect stencil strength that we simply cannot see with eyes alone.

Humidity: Wet floors, foggy or rainy days, developing screens near your screen storage area are also part of the breakdown issue. It's real tough to know when the inside of a screen is dry just by touching the emulsion. Yet personnel in the screen room pat the screen to feel if it is dry. As long as no emulsion sticks to the hand they shoot the screen. Pat it again to see if it is dry, then tape it out and get it to the press. But they cannot determine what the moisture level is inside the emulsion coating, the part right next to the mesh which needs to be as dry as the surface for a good exposure. This unseen moisture prevents good bonding of the emulsion to the mesh during the exposure process, prevents cross linking within the emulsion, and once on press can make a production manager on a tight deadline go crazy. Again, it's what we can't see with the naked eye here that matters

Emulsion in the center of a coated screen needs to be completely dry to expose well for stencil strength.

The solution is to think of your screen area as an ocean and the desert. Screen reclaiming and developing is the ocean side of the operation, your coating, and screen storage especially, is the desert side. Screens must be as dry as possible for optimum exposure and predictable performance. You can separate the two areas with different rooms, add dehumidifiers to the screen storage area, and add ventilation hoods over the sink to keep overspray from increasing humidity levels in the screen making area. Ovens can be used to help dry screens quickly before exposure as well as drying them well before going to press to make sure the emulsion is dry as it can be.

A moisture meter is used to test the interior wetness of the emulsion and is the only way to know when a screen is dry, even when drying ovens are used. Touching it by hand simply is a guess, good luck. If the screen drying room can be controlled to 35% humidity 24 hours a day, then drying the coated screens overnight will yield a predictable screen that will perform.

Drying one in ten minutes and rushing the exposure and post dry process is a disaster waiting to happen.

Use drying ovens to speed up the process. If you use Diazo in the emulsion keep it at 80 F (26 C) degrees to prevent dark hardening where the image won't wash out. SBQ photopolymers can go higher to 100 F (37 C). Strong screens come from the quality of the process used to make them. Quality of the emulsion is also critical. Like a car lot there are many types and some definitely out perform the competition.

Exposure Lamps: One of the most overlooked areas of screen making is the type and condition of the exposure bulbs. Fluorescent lamps are for small shops where run lengths are short; they cannot produce screens well for automatic textile production. The exposures are adequate, but quite long which can prevent low tonal percentages from exposing well. Typically underexposure is used to get details resulting in weak screens, kind of like putting a gallon of gas in your car and expecting to drive 200 miles. Just won't happen, you need complete exposure to drive an automatic press.

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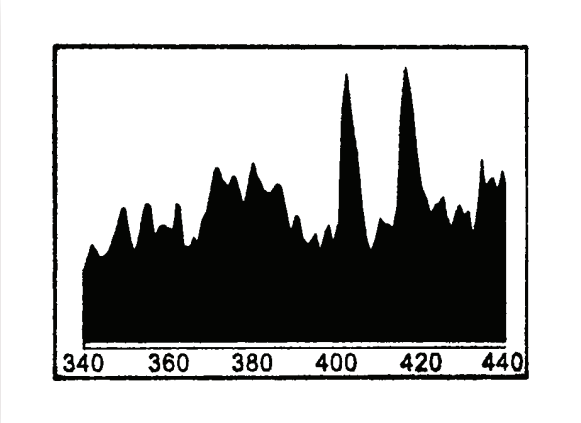
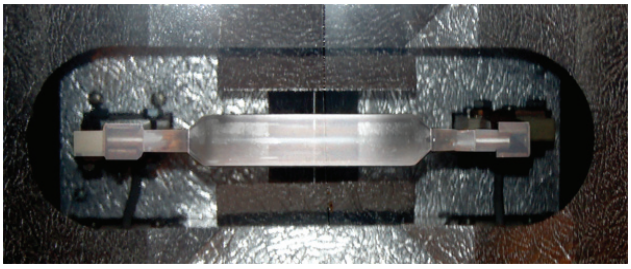
Just up from this level of lamp are 1k lamps. Yes they can expose a screen ok, and do a decent job on halftones due to the pin point nature of the light. But like the analogy above, a half a tank won't let you drive the car all day either. The stronger the lamp the better the exposure, especially strong multispectral lamps that have strong wavelengths in the 380 and 420 nanometer range. The histogram below from a 5000 watt UV lamp shows spikes in these important wavelengths as well decent amplitude in the surrounding spectrum. Quality lamp sources generally provide a histogram like this on the lamp box



So just buying a 5k lamp or higher solves all the issues right? Hardly! How old is the bulb in the lamp? I ask this question a lot when I enter a screen room. "Oh we bought the lamp a couple of months ago." This is fine if the equipment was brand new, but after more questioning I find out it was a used piece of equipment. In this case we have no idea how old the 'bulb' is. Just because the lamp has a bright white light tells us nothing about the UV output of the bulb, nor does it tell us the spectral output of the bulb. Even a good 5k watt system needs new bulbs regularly, even if you are getting the emulsion to expose it may be a very weak exposure after only 6 months of exposing several hundred screens a day. Again we can't see the quality of the light, the UV light that exposes the emulsion best.

WARNING: never look at any exposure lamp with your eyes; you can permanently damage your eyesight. There are tools to measure the lamp output and UV; your eyes aren't one of them. We just assume the lamp is working properly when in fact it struggles to burn screens due to very little UV output. Replacing the lamp with an original manufacturer's lamp can work wonders for the strength of the screen. If the screen is breaking down on press with a 5kw light system it's due to a bulb that is so old it simply can't make UV light well anymore and it is something we cannot see. You get what you pay for in lamps. I recommend buying original equipment lamps as they often last longer and have a better spectral output to expose screens.



With the exposure lamp off you can make a visual inspection of the bulb. The photo above shows an older bulb where the ends have carbon build up and the glass is frosting. This is a lamp that has lost a significant amount of it's strength. While you will still get an ***'image'*** with this lamp, you will not get a ***'proper exposure'.*** The strength of the screen is what makes you money with non stop production, but not an image on the screen created with weak light where the press stops and starts to fix pinholes or the need to replace screens that have broken down on a discharge print run.

Next: Where are all the pinholes coming from?

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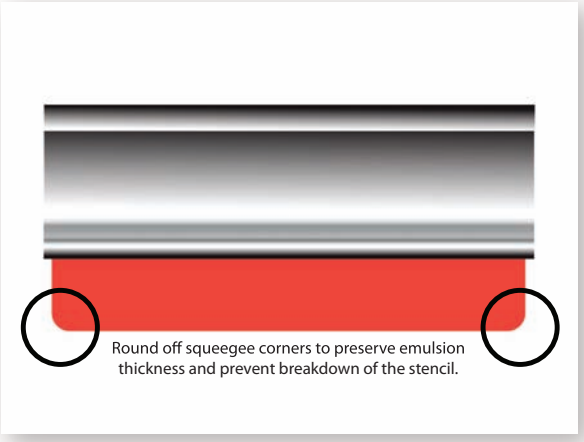
Dust: Have you ever worked in a textile shop that had a shaft of light coming into the building from an opening in the roof? While the air outside this column of sunlight looks virtually clear, the shaft of light from the sun is swimming in dust particles and lint. This unseen dust migrates into the screen room, gets captured by drying fans and deposited onto fresh, wet emulsion that has just been coated onto the screens. The first time this result is seen is in the form of pinholes after exposure or on press. Dust and contaminants are small enough that they can't be seen with the naked eye. Screen rooms that haven't been cleaned in years cause huge issues here. I have seen rooms where cardboard is in layers on the floor to cover spilt emulsion while dust from the cardboard breaking down is causing pinholes during production.

Housekeeping should be a daily ritual. The floor should be mopped, not swept. Rolling racks that can be moved around to allow cleaning is better than fixed racks with inches of dust build up underneath the screens that the fan will pick up and place on the screens. The screen drying area should not be used as a storage area of odds and ends. Fans should be up off the floor. Air should be filtered by any fans pulling air through a wall from the production floor which generates lots of fine dust particles. A clean screen room kept at 35% humidity, with an ambient temperature of 70-80 (26-28 C) degrees produces better screens.

Equipment Maintenance: Even if we control all the exposure variables there are other gremlins in the shop that can render a good screen unusable. Squeegee corners should be rounded.



Granted we can see this. If that is the case why do 90% of the shops continue to leave 70 and higher durometer squeegees as sharp as a knife on the outside corner? We cannot see that these ultra sharp corners are carving a line in the emulsion that is being softened by discharge or waterbase inks. There can be as little as 4-5 microns of emulsion covering the mesh knuckles yet companies leave them square and wonder why the emulsion breaks down. Look at the Grand Canyon in the US. Water eroded rock away into a canyon thousands of feet deep. On a microscopic level your squeegee is doing the same thing to emulsion and you only see it when the discharge ink explodes through the emulsion. Round off the squeegee corners, use as little squeegee pressure as possible to get a good print. Like our friend Mark Gervais said at the SGIA show in Las Vegas recently, 'we sell T-shirts, not pallets'. We don't need to use so much pressure that the pallet is covered with the design. This extra pressure causes un-rounded corners to carve away at both emulsion and mesh.

To print better and reduce squeegee pressure, change the mesh to a more open S-mesh, or to a softer edge for water base or discharge. Back off the squeegee pressure until you don't see it print. Add squeegee pressure sparingly until you get an even print. The head may have been used with a totally different ink like plastisol when the next print is a discharge print. Leaving the squeegee pressure cranked down to plastisol printing levels is not needed for a discharge print.

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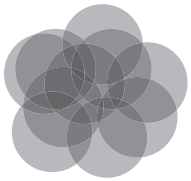
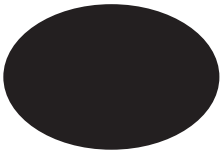
Halftones and Film: While we *can* see tonal values on film or from a CTS machine, we can't see the edge quality of the halftone dots. There is a significant difference in halftone quality produced by different imaging methods. Through a 50 power microscope the difference is pronounced.

Ink Jet is the typical method of creating film for screens. It is economical compared to the other methods that follow but it does have limitations. Here is a graphic example of a 4% dot magnified 50x. Each halftone is made up of many pico liter dots and the shape and opacity of the dot often results in lost tonal values.



Ink Jet
4-10% halftone

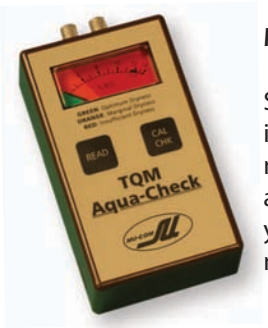
Resolving these fine halftones can be hit or miss depending on the sensitivity of the emulsion and the exposure times. Underexposure can cause breakdown issues downline for water base and discharge, or create endless pin hole repairs on press. The transparency of the pico liter dots can also cause the imaged dot to be too small on screen and be blocked by threads or knuckles. CTS machines use similar ink jet methods or hot wax. Of the two hot wax produces a more opaque dot that images fine halftones better but requires the user to be much more careful with stray threads or tape that can melt and clog these hotter print heads.



True Film
Imagesetters
4-10% halftone

True film imaging of halftones produces accurate halftone dots with very sharp edge and opacity qualities that image well on screen. A typical comparison of the same design with a 100%-0 gradation in the artwork will show much more tonal transition details in the lower percentages than ink jet film. This method, while much more expensive than ink jet film does result in improved print quality of gradations and simulated process printing. CTS hot wax machines can achieve similar results due to better opacity of the finer dots but cannot achieve the edge quality of true film imagesetters.

Tools: You can't fix what you can't see. Every topic discussed here is measurable or observable with the right tools. The following tools can help you achieve better prints, but more importantly allow you to create screens that not only print better, but last longer on press. Non stop production is where printer's make the money.



Moisture Meter

Solves the question of when a screen is ready to shoot. Measures interior moisture levels of the emulsion and also alerts you to humidity issues in your screen room that the screen may be absorbing.

Thickness Gauge

Measures the difference between the mesh thickness and the emulsion thickness. The result is EOM, or emulsion over mesh. Helps you correct your coating procedures to achieve consistent emulsion thickness which helps achieve better, well exposed screens.

50x Microscope

Helps evaluate exposures, stencil edge quality, accuracy of halftones, and allows you see the bubbles formed by coating too fast.

Tension Meter

Each mesh count and mesh type has a recommended tension level. Accurate tension levels should be thought of as what the 'workable tension' is for your shop. The amount of off contact you use, the press type and how gently personnel treat mesh all play a part in determining what tension levels you can use.

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Emulsions: You have many airline choices when you travel. Some are far better than others (trust me on this one as I have spent days waiting for my luggage in the tropics while having only a flannel shirt that I wore on the plane!) The emulsion you choose to use, and especially what the screen worker likes to use is often chosen based on price; or maybe its their buddy who they like that sells them emulsion; or simply it's what they have always used and maybe changing to another emulsion changes exposure times for workers who don't know how to determine exposure times. There is a huge difference in how the components used to make the emulsion are produced. Or the type and quality of the SBQ or diazo sensitizers used and the quality of the manufacturing process and the engineering skills of the company making the emulsion. Just because the company *sells* emulsion doesn't mean they know how to *make* emulsion.

Talk to some industry experts. At the recent SGIA show in Las Vegas, several of our Murakami super stars sat down and brought samples of their prints and talked shop. You couldn't get them to change their emulsions and mesh if you tried, they know what works and it was a pleasure to listen to Mark Gervais from Ningbo in China, one of the world's largest print shops, or Kevin from Forward Screen Printing in Oakland who prints incredible discharge prints, or Tom from Motion Textiles in Sacramento who produces a lot of the guitar/band shirts I use for quality print examples. We sat in a circle and one by one they blew me away with prints they have done. State of the art stuff, and they all would agree, you can only print as good as your mesh and emulsion, its what you don't see that matters,

Expose the Quality.

Link to SGIA show prints
www.murakamiscreen.com/sgia-show-las-vegas/

WWW.MURAKAMISCREEN.COM

SP-1400 - 135-S Mesh

SP-1400 - 135-S Mesh

Prints courtesy Mark Gervais - Ningbo China