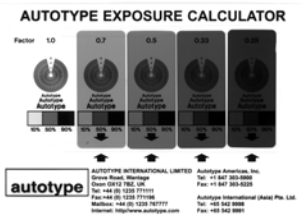
Effective Use of the Autotype Exposure Calculator



Screen Exposure, like photography's f-stop and aperture, is a function of both time and intensity. The Autotype Exposure Calculator from Sericol is a valuable tool for determining the proper exposure of various emulsions on various mesh counts with your own exposure unit in your own conditions. These Summary Instructions are followed by a detailed examination of the Stencil Exposure process.

Summary Instructions

1. Expose the **Autotype Exposure Calculator** at double the current exposure time.
2. Thoroughly develop the stencil, and examine the screen under white light.
3. Examine the colour of the stencil in the areas closest to the **Exposure Factor Percentages** marked on each column, beginning at the 25% column. Look for colour differences.
4. Select the column that shows no colour change between the filter area and the surrounding stencil. Note the Exposure Factor Percentage indicated at the bottom of the selected column, and multiply by the Test Exposure Time to obtain the new exposure time.

Detailed Instructions

1. Using a normally coated and dried screen, use the Sericol Exposure Calculator as your film positive and DOUBLE the normal exposure time. This doubled time is your Test Exposure Time. The object is to intentionally OVEREXPOSE the screen. Write the Test Exposure Time down on the screen.

2. Develop the screen with a warm or lukewarm water spray at medium pressure. Thoroughly rinse both sides of the screen.

3. The **Colour Changes** will be observed and interpreted in this part of the process. Examine the stencil in white light conditions. Ignore the resolution and concentrate for the moment on colour change. Focus on the areas where the Percentage Exposure Factors are indicated, near the bottom of the Exposure Calculator. Look at where the filter areas covered the emulsion and let through only a portion of the available light for exposure. Look for any colour differences between the area behind the grey filter boxes, and the area outside each box. Beginning with the 25% exposure column, inspect each column for noticeable differences in colour between the grey filtered area and the surrounding area. Move up to the next column and again look for colour differences. Repeat this until you find a column where the area covered by a filter is the same colour as the surrounding stencil. This means that all of the diazo hardener has been used, and the stencil is fully hardened. A colour difference indicates that the time indicated by a particular column is **under-exposed**. With Diazo and Dual Cure emulsions, the underexposed columns will be distinctly more yellowish than surrounding fully exposed areas, due to the presence of un-reacted diazo. The key to reading the results is to remember that emulsion colour will change back almost all the way to its original unexposed colour once it has been fully exposed.

4. Select the first column which exhibits **NO Colour Change**, or which is exactly the same colour as the surrounding exposed areas. This column represents the proper exposure time for this particular mesh and emulsion combination. Multiply the **Exposure Factor** (Percentage indicated in the selected column) times the **Test Exposure** used, and the result will be the **Proper Exposure Time** for this particular screen used in the test, including this count and colour, with this particular emulsion, at this particular thickness, with this particular exposure unit, at this particular lamp distance. Differences in mesh, exposure units, stencil materials, and shop conditions will affect the results.

FAQs about Exposure and Using the Exposure Calculator

1. Why should I worry about underexposure?
Screens must be properly exposed to ensure maximum durability on press. Underexposure is often the culprit when screens break down prematurely, especially with water-based inks. Underexposure causes pinholes, weak stencils, mesh staining, and difficult reclaiming. The Dirasol Exposure Calculator will enable you to determine the proper exposure time required for each mesh count, each mesh colour, and each stencil and stencil thickness used in production.

2. What are some symptoms of underexposure?
The most common symptoms are

- Pinholes
- Tacky Stencils
- Poor Stencil Adhesion
- Stencil Delamination
- Foaming during Washout
- "Slimy" feel to inside of screen when wet
- Difficult reclaiming
- Brownish or Yellowish mesh staining

3. What does the Exposure Calculator do?
The job of the exposure calculator is to show you a range of exposure times, especially the range from under exposed through over exposed. The easiest way to use an Exposure Calculator is to follow the Colour Change Method for determining the proper exposure; this method is most effective with diazo and dual cure emulsions.

4. How do I determine my initial Test Exposure Time?
Start by doubling the exposure time you currently use. If the emulsion is new to you and you have no times established, you will have to make an educated guess. A quick check in the Working Instructions for any emulsion or film, or a call to the manufacturer, can give you an approximate starting exposure for your testing purposes.

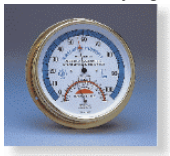
5. How do I interpret the filter columns?
After exposing and developing the screen, examine the stencil. Look at the 25% column, which represents 25% of your Test Exposure Time. For example, if your normal exposure for a certain mesh is 200 integrator units, then your Test Exposure would be 400 units, so the 25% filter area would represent an exposure time of 100 units. The 33% column represents the exposure received at 33% of the Test Exposure, or 33% x 400 = 132 light units in this example. 50% of the Test Exposure 400 would be 200 units, and so on. Simply substitute your actual Test Exposure Time for the 400 in this example.

6. Do I have to perform a separate test for each mesh and emulsion combination?
Yes. Small differences in similar mesh counts may be easily interpolated, but larger differences must be checked with each mesh count, mesh colour, stencil system, lamp intensity, lamp distance, etc.

7. How often should I run an Exposure Calculator test?
Once a week on one screen to confirm that results are remaining consistent, and the full series whenever the lamp in the exposure unit is changed.

8. Are all pinholes a result of underexposure?
No, pinholes can result from a variety of problems, though Underexposure is the most common. Other common sources are dust, dirt, and other contamination. Insufficient Mesh Preparation is another common reason. Coating Too Quickly causes foaming in the emulsion coating tray, and can cause air bubble entrapment within the mesh opening. High Humidity and Insufficient Drying are other common reasons.

9. How soon can I expose screens after coating them?
Drying times will vary with temperature, humidity, airflow, emulsion thickness, and quantity of wet screens present in the drying area. Complete screen drying before exposure is essential to the production of direct emulsion and capillary film stencils. High moisture content in the emulsion will prevent the screen from being completely hardened during exposure. Use a drying cabinet with circulating filtered, warm, dry air, or convert a room to a drying area by installing a dehumidifier. A thermo-hygrometer should be used to monitor drying conditions, ideally, 40 - 50% RH (relative humidity) or less, and 80 - 90 degrees F temperature, in a dust-free environment. Too little relative humidity (less than 25%) can result in stencil brittleness. Dust control in the screen area will reduce the number of pinholes in stencils. The screen drying area must be under yellow safelight.



10. How can I prolong the life of a stencil? Will Post-Exposure help?
The best way to prolong the life of a liquid direct emulsion stencil is to ensure that the emulsion has been dried thoroughly before exposure, and then to EXPOSE IT PROPERLY the first time. Post Exposure is a myth - it is time consuming and ineffective, especially for diazo and dual cure emulsions. The reason is that the unused diazo left over from the short exposure time is washed down the drain during image washout or development. Post exposure may help to dry the stencil, but it can do little to harden the stencil without the active diazo component.

11. We have to underexpose our screens to hold the detail we need. What can we do?
Technical services specialists regularly double or even triple the exposure times of most printing plants they visit. **Over 80% of screen printers are underexposing their screens!** Why? The most common answers are "because we always did it this way" and "because we need to underexpose to resolve our detailed images." This should be a red flag! If you have to underexpose your screens to hold the detail, it means that you need one or more of the following: a finer mesh count, or a dyed mesh, or a finer-resolving emulsion or film, or a test of the vacuum pressure, or a point light exposure source, or else the realization that the particular fine detail is beyond the limits of what you can realistically produce under your real-life shop conditions.

12. What factors affect exposure time?
Exposure times will be most affected by mesh count, mesh colour, stencil system, emulsion coating thickness, moisture in the stencil, exposure lamp age and distance, and density of the film positive (or vellum).

13. What is Diazo?
Diazo is a photosensitive organic chemical compound derived from aromatic hydrocarbons, used to form images by a molecular dye process. It is used in many photo applications, including offset litho plates. Diazo is the component that allows the screen emulsion to cross-link and harden when exposed to actinic (UV) light. One of the advantages of using diazo as a sensitiser is that it allows us to use the colour change method of determining the proper exposure time, since exposure to UV changes the diazo from yellowish-brown to transparent.

14. What is a Conventional Diazo Emulsion?
A conventional diazo emulsion is typically composed of water, polyvinyl alcohol (PVOH), and polyvinyl acetate (PVA or PVAC), along with various plasticizers, dyes, and fillers. This mixture is rendered sensitive to actinic light by the addition of a solution of diazo salts.

15. What is a Dual Cure?
A Dual Cure emulsion is composed of very similar ingredients to the Conventional emulsion, but in addition to the diazo sensitiser, there is a special photosensitive acrylate (similar to a UV-curable ink) present that gives the emulsion an expanded range of desirable properties, including higher solids content, better humidity resistance, and improved resolution capabilities.

16. What is a Photopolymer?
A photopolymer is a light-sensitive acrylate (usually SBQ), which provides the light sensitivity of some of the most modern emulsions, and often allows them to be supplied pre-sensitised, rather than requiring a diazo additive.

17. The 25% column always gives the best resolution, so why not use the resolution method instead of the Colour Change Method?
Underexposed screens do offer finer resolution, but at the price of worse edge definition, limited solvent resistance, more pinholes, and difficult reclaiming. Optimum exposure is a compromise between the finest resolution and the greatest durability.

18. Do I need an Integrator on my Exposure Unit?
Yes. Screen Exposure is a function of both time and intensity. The exposure unit needs a Light Integrator, and not just a timer. The light integrator reads the actual amount of exposure light, not just how long the unit has been on. All exposure lamps lose UV light intensity with age and electrical current fluctuations, and the Light Integrator will compensate for the weakening lamp intensity by allowing the lamp to burn longer.

Toll Free **Customer Service** within Australia: **1300 650 504**
Toll Free **Customer Service Fax** within Australia: **1300 650 512**
Toll Free **Technical Assistance** within Australia: **1300 135 357**

EXPOSURE CHART

Date of test: Date/Type of lamp replacement:

Exp. tests performed by: Test Film used: Autotype Exposure Calculator

Exposure Unit: Stencils tested:

Mesh Count	Mesh Colour	Stencil System	Coating Method or EOM	Lamp Distance	Exposure	Misc.
*77.55 PW *150.34 PW	white yellow	Dirasol 145 Dirasol 916	3/1, face coat 5 microns EOM	48" 48"	35 units 150 units	example * example *

Causes of Premature Screen Breakdown

High Heat
High Humidity
Improper Handling
Incomplete Drying
Insufficient Mesh Preparation
UNDER-EXPOSURE

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