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INTRODUCTION

There are 5 basic steps to photo screen making and printing:

1. Artwork Preparation
2. Coating the Screen
3. Exposing the Screen
4. Developing the Screen
5. Printing

This manual will guide you through the 5 steps with graphic representations and descriptions. Before work is begun, however, you will need to prepare the necessary materials for silk screening.

Necessary Materials For Silk Screening

* Screen, 2" larger on each side than artwork to be screened (*Always coordinate mesh size to ink requirements*)
* Squeegee, 1" smaller than inside screen dimensions
* Ink (*Choose according to printing surface and desired qualities*)
  Photo Emulsion and Sensitizer
  Tape (*see* **TAPING THE SCREEN** *for type you need*): Paper, Plastic or Masking
  Newspapers
  Household Bleach
  Household Hydrogen Peroxide
  Scrub Brush, Soft Bristle
  Bulb – Preferably a 150 Watt Flood Bulb
  Measuring Cup
  Old Rags or Towels (Paper or Cloth)
  A Piece of Glass Large Enough to Support the Screen and Allow for Propping on Both Sides Without Interference With the Light Source
  Spatula – Approximately 1"
  Cardboard – Pieces Cut to About 3" x 6" (For Ink Cleanup)
  Opaque Marker, Technical Pen (Use Ink For Plastic Sheets), Graphic Arts Tape, India Ink, Ruby Film, and Stencil Knife (*see* **ARTWORK PREPARATION** *for full description of choices*)
  For Multicolor Work Only, Registration Pins and a Standard 1/4" diameter hole puncher
  For Multicolor Textile Printing Only – Eye Bolts, L-Angles, wood for Contact Bar and Platen **(See "T" Shirt Platen)**

ARTWORK PREPARATION

The first and most important step in successful screen making is artwork preparation. In photo screen making and screen printing all the steps that follow artwork preparation depend on accurate duplication of your design. In order to render the exact image you want it is absolutely necessary for your artwork to be opaque. Opaque artwork means you cannot see light through the areas of your artwork that you want to print. Hold your artwork up to the light and check this to insure no light shows through the areas you darkened. It is very helpful to check opacity on a light box.

The opacity of your artwork is crucial to obtaining a clean well defined stencil. The artwork you create will become part of the screen and this is called a stencil. The opaque materials you use to create your artwork will stop the light from getting to the photo emulsion, which will be coated onto the screen, and when you shoot the screen the light will not be able to penetrate the opaque materials. If light does not get to the photo emulsion, it will not harden in that area. When the screen is developed or washed out, the parts that were not exposed to light will wash out. Later during printing, the ink will pass through these undeveloped or washed out areas in the screen and the ink will print the exact image of your design.

Basically there are many different materials that can be used to prepare artwork for a photo screen, however they must all be opaque mediums and they must work on clear acetate or clear polyester (plastic sheets). Materials such as

India Ink
Red Ruby Masking Ink
Ink For Acetate
Pressure-sensitive Lettering
Dry Transfer Lettering
Opaque Markers That Work On Any Surface
Technical Pens
Graphic Art Tapes
Ruby Tape
Ruby or Amber Film
Shading Film
Stencil Knife

Actually any material that will filter out ultra violet light will work to create a photo screen because ultra violet light causes the photo emulsion to cross link and become a waterproof coating or stencil.

Creating Artwork.

Making Monocolor Artwork

To make artwork, simply tape your drawing down to the table and tape a sheet of acetate over it. Now you can trace your image with any of the opaque mediums mentioned. You can also create directly on the acetate without tracing. If you choose to make words, you will need a grid sheet or piece of paper with horizontal lines that are straight so your lettering can be transferred to the plastic sheet in a uniform patter (*See Diagram*). Burnish the transfer lettering directly onto the acetate but be sure to put clear Scotch tape over it when you are finished so the letters will not chip or peel while you are handling or storing the sheet.
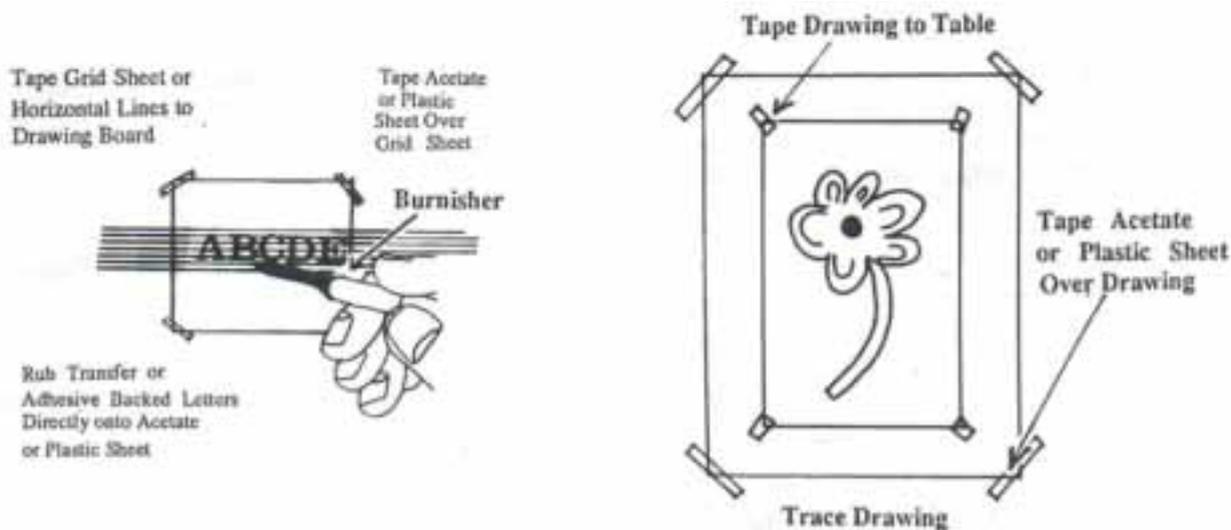
Making Multicolor Artwork

When making multicolor artwork, exact overlaying of colors is crucial to render a print that will not have spaces between colors. This is called registration of colors. Overlapping of colors is called trapping and is crucial to good registration. Good traps mean less difficulty in registering one color to another when printing. All the colors that are supposed to meet or touch each other will fall in the right places in your design.

To make a good trap, the light colors should extend slightly into the dark colors. When printing, the light colors are printed first and the dark colors are printed over them, thus reducing the overlap and rendering the exact size of the color shape in your artwork. Therefore, each acetate will contain a separate color. The size of the overlap depends upon the width of the adjacent or outline color. When an entire pattern is covered by an outline which pulls the images together, the underlying colors must overlap into the outlined area but not surpass the outline.

First, analyze the number of colors in your design and note where each color appears in the entire image. Each color will need a separate acetate or clear polyester sheet.

To make multicolor artwork, you will need registration pins, a 1/4" diameter hole puncher and a separate acetate or clear polyester sheet for each color. Before any work has begun, gather the sheets together and punch a hole in the upper right hand corner, at least 2" above your artwork, and insert a registration pin. Now punch a hole in the upper left hand corner and insert another registration pin (*See Diagram*).

Tape the pins to the drawing board or a table and remove the plastic or acetate sheets. Tape your artwork to the board and place the first acetate on the registration pins. Using a marker, technical pen or other opaque medium, trace the first color of your design. When finished, remove the acetate and replace with the next acetate. Trace the next color. Continue this process until all the colors are traced on separate acetates (*See Diagram*).

After you separate all the colors (this would include the outline that pulls the design together, if your artwork calls for an outline) place all acetates on the registration pins with the overall outline on top. Your overall outline or pattern that brings the design together as a whole should not show spaces between colors when you hold the acetates up to the light. It may help to work on a light box.
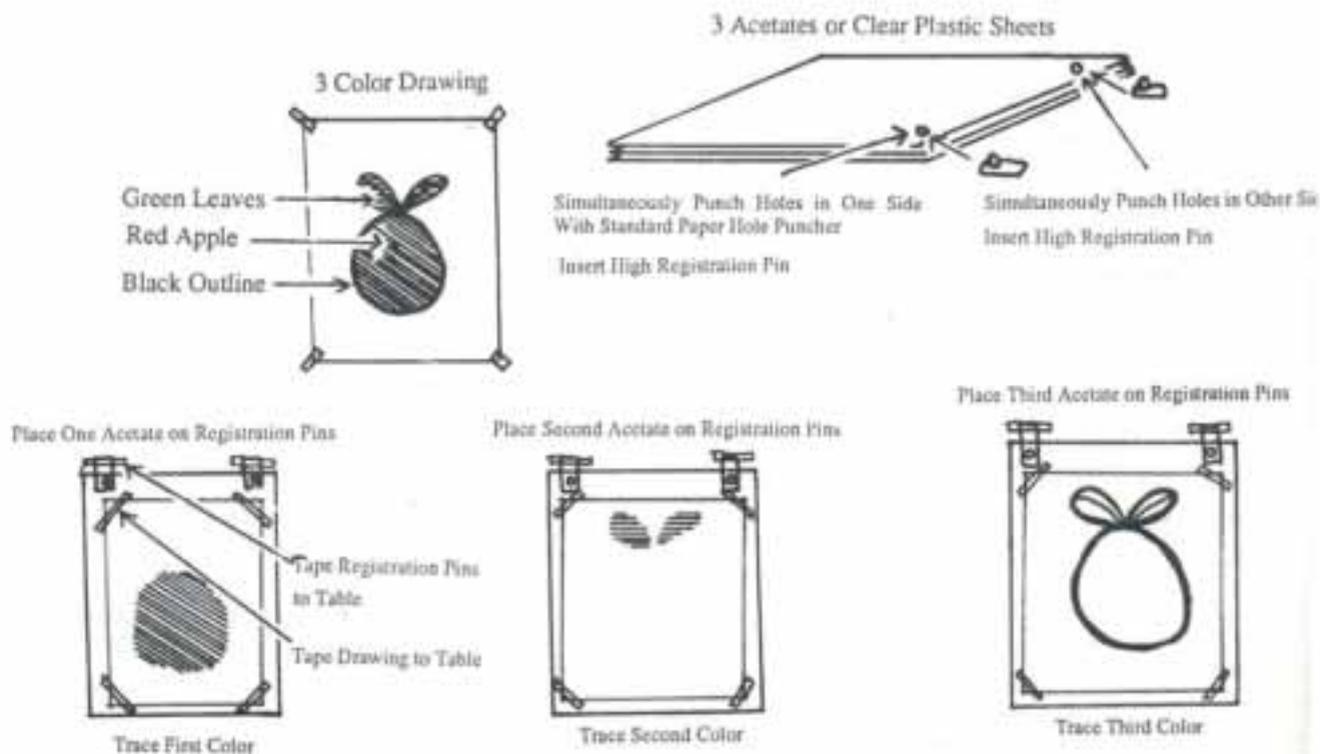
Summary

1. Analyze the number of colors in your design.

2. Use a separate acetate for each color.

3. Register all acetates simultaneously to each other by punching holes in the plastic sheets with a 1/4" diameter standard hole puncher and insert pins. Punch the first hole and insert the pin before punching the second hole and inserting the pin.

4. Tape the artwork to the drawing board. Tape the registration pins 2" above the artwork.

5. Place the first acetate on the pins and copy the first color with an opaque medium. Remove the acetate when completed.

6. Place the next acetate on the pins and copy the next color. Remove this acetate and continue until all colors are separated.

7. When colors meet, trap light colors by extending them beyond the original artwork and into the darker or neighboring colors. However, the overall outline color that pulls the image together should not be surpassed. This master or outline color should bring the extended colors back down to their original shape and fit perfect as in the original artwork.

Important Things to Remember

Proportion your artwork according to the space you are printing on. For example children's "T" shirts have a smaller print area than adult "T" shirts and your artwork should be reduced to fit that space. When printing on paper you may want to leave a border around the edges of the paper. Do not print to the end of the paper stock, because the image will not print clearly. (Also, you will not be able to pick the paper up without getting ink on your fingers!)

Opaque Areas in your artwork or areas you cannot see through will print. Light will not pass through opaque artwork and the photo emulsion will not cross link during exposure time. These areas will wash out when you develop the screen and while you are printing; the ink will pass through these washed out areas and onto your stock.

Transparent Areas around your artwork or areas you can see through will not print. Light will pass through the transparent or blank areas around your artwork and expose the photo emulsion causing a chemical cross linking that will harden around your artwork. Your artwork will actually be formed by this process and become part of the screen stencil.

Positives and Negatives

What are **positives** and **negatives**? Generally speaking, a **positive** is the image that is not part of the background. A **negative** is the background which is printed to create the image.

For example, in the images below, the cash register's shape or form is outlined and thus defined as a **positive** picture of the object. The apple and witch are also **positive** images that will print as they are drawn.

The SOS and the globe are defined or shaped by the areas around them and they are **negative** representations of the objects. The opaque areas that surround the SOS and the globe are the parts that will print. Notice, the continents on the globe are **positive** images on the **negative** globe. The transparent areas which are the images shaped or formed by the background will not print. **Ink will only pass through opaque areas in the artwork.**

Film **positives** and film **negatives** can be made by using a process camera and photographic artwork which is in black and white and on paper. These work the same way as hand made **positives** and **negatives** and print as stated above.

It is important to keep in mind the qualities of the ink you are using and the substrate you intend to print on when making **positives** and **negatives**. Some inks dry slowly and large deposits of ink will take long to dry. This may affect the amount of time it takes to complete a project as well as what difficulties a specific design may introduce.

NEGATIVES▲   POSITIVES▲

all opaque areas WILL print

COATING THE SCREEN

Preparation

Once you make your artwork, the next step in the process is coating the screen. It is very important to wash the screen mesh to remove all sizing before you apply the photo emulsion. If there is oil on a mesh from your skin or from handling in the factory where the screen was made, this oil will repel the photo emulsion and you will have spaces in the coating which will ultimately become unwanted open areas in the screen. When it comes time to print, ink will flow through these open areas and be deposited on the stock.

Using your scrub brush, gently scrub the screen with soap and water and rinse. Then with an abrasive cleanser, one which does not contain bleach, such as Bonami, gently scrub the screen again. Be sure to rinse thoroughly. Allow the screen to dry completely (a fan will greatly decrease drying time). Now your screen will be more absorbent and the photo emulsion will better adhere to the mesh.
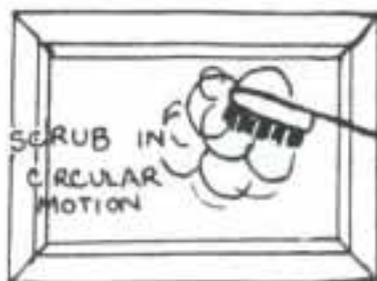
Photo Emulsion

Working in a dimly lit area, mix 4 parts photo emulsion to 1 part sensitizer. For example, 4 ounces emulsion with 1 part sensitizer. Once mixed, this solution is light sensitive with a short shelf life. Measure small amounts to prevent wastage. The amount of photo emulsion and sensitizer you will need will depend upon the size of the screen you are using. Stir this mixture carefully to prevent air bubbles and allow mixture to stand for about 10 minutes. It is best to work in very dim daylight or use an amber bulb because it is bright but will not affect the chemistry of the photo emulsion.
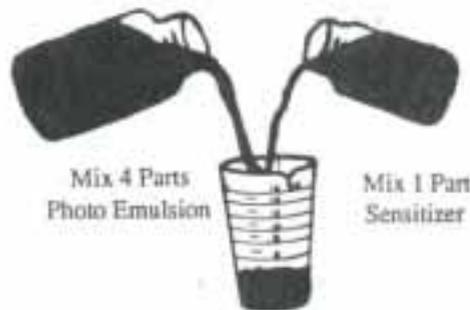
Store excess photo emulsion and sensitizer mixture in a plastic or glass container at room temperature. Be sure to store in a darkened area. This mixture is good for 3 to 4 days at room temperature and slightly longer if refrigerated. (If storing in refrigerator, use an opaque container which will not allow light to expose the photo emulsion.)

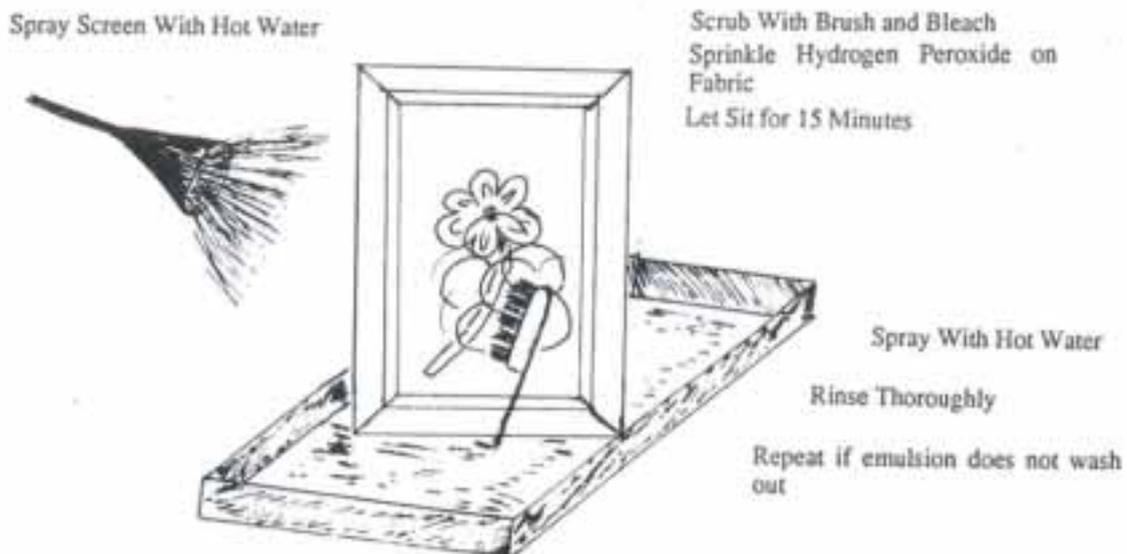Expose the screen and develop within seven hours after coating it. If you need more time, it can still be exposed up to 24 hours after coating the screen. However, the screen must be stored in a dark area until you are ready to expose it. Save the extra mixture to fill pinholes after the screen has been developed but again keep it in a dark area. **CAUTION: Never use photo emulsion on screens made with pure silk fabric mesh.**

Reclaiming the Screen or Removing the Photo Emulsion

After printing, many screeners prefer to leave the image on the screen for future use. If you wish to do so, your screen can be stored indefinitely. If however, you choose to remove the image from the screen follow these simple steps:

1. Remove all excess ink and return it to the container.

2. To clean the screen, follow the instructions on the ink can label. For instance, if using water based ink, clean screen with water. If using oil based inks, clean screens with screen wash. It is very important to get all the ink out of the screen before reclaiming. Any remaining ink will interfere with the chemistry needed to remove the emulsion.

3. Fill a tray or a tub that is larger than the screen with household bleach. Cover the mesh completely. Wait 5 to 10 minutes.

4. With a soft scrub brush, gently rub both sides of the fabric.

5. Stand screen up and sprinkle or spray hydrogen peroxide on both sides. This will create a foaming action. Scrub both sides gently and wait 5 to 10 minutes.

6. Using hot water, preferably with a spray hose, wash the screen.

7. When the screen is thoroughly rinsed, allow it to dry completely and it will be ready for reuse.

    If needed, the process may be repeated.

Spray Screen With Hot Water

Scrub With Brush and Bleach
Sprinkle Hydrogen Peroxide on Fabric
Let Sit for 15 Minutes

Spray With Hot Water

Rinse Thoroughly

Repeat if emulsion does not wash out

Applying the Photo Emulsion

After mixing the photo emulsion and sensitizer in the exact proportions needed, and allowing the mixture to sit for about 10 minutes, follow the three steps illustrated below.

1. Turn screen to outside and pour a sufficient amount of the mixture along the narrow side of the screen.
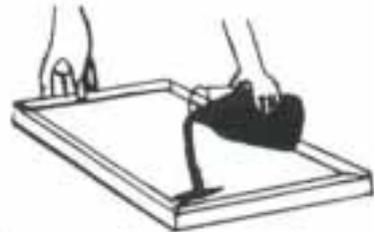
2. In a scraping action, use a coating bar or squeegee to spread the mixture smoothly over the entire length of the screen. Scrape coat outside of screen.

Hold Away From Table

3. For a more durable screen, turn over and scrape coat the inside of the screen from bottom to top. Turn over and scrape coat inside of screen.
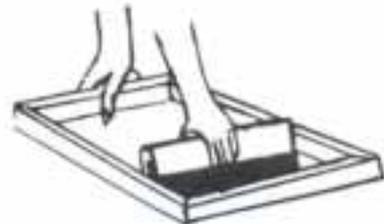
4. Turning to the outside of the screen, repeat the process but do not add more photo emulsion unless there are streaks and empty spaces.

5. Always apply final coat to the inside of the screen.
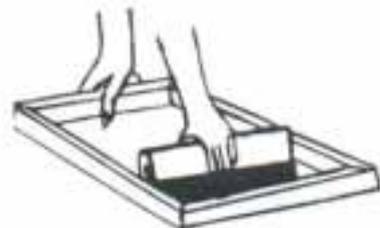
Scrape away excess emulsion and return excess to the container. Do not leave a heavy deposit of emulsion on the screen. Apply even coats. Do not leave lumps or streaks on the screen. Be sure the screen that has been coated does not come in contact with anything that will disturb its smooth coat.

EXPOSING THE SCREEN

Exposing Monocolor Screens for Printing on Paper or Textile

After the screen is thoroughly dry, it is ready for exposure. For home use, one of the easiest ways to expose a screen is to have the bulb or light source placed under the screen and beamed upward toward the artwork (*See diagram*). What is needed is a tight sandwich between the screen and artwork. Place the artwork on the cleaned glass and center the screen on top of the artwork. Use a piece of black construction paper or something similar to cover the inside of the screen. Now place a book on top of the paper. The screen fabric and the artwork are pressed against the glass by the book or similar weight. This is to prevent the light from creeping to areas where it is not wanted, and will give you a sharply detailed screen. Please follow the order of the materials exactly as shown for best results.
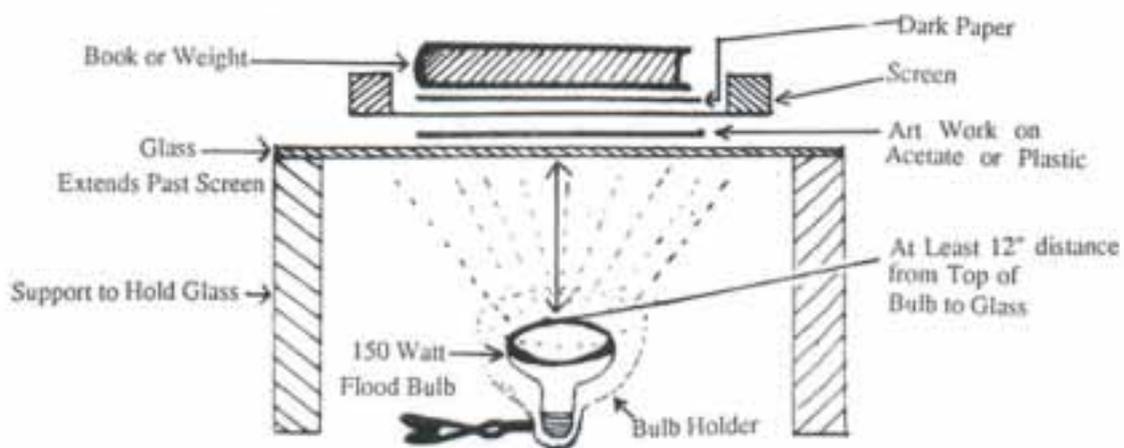

There is an important relationship between how well your screen develops and: (1) **The time of exposure;** (2) **The bulb wattage;** (3) **The distance between the light source and the screen.**

The time of exposure depends upon bulb wattage and the distance between the light source and the screen. Screen sizes 8" x 10" and 10" x 14", placed 12" away from a 150W flood bulb, will cause exposure time to vary from 4 to 6 minutes. Screen size 12" x 16" may need increased distance from the light source to ensure full image exposure. This increase in distance from 12" to 20" will require longer exposure time. Try exposing the screen about 6 to 8 minutes. According to the opacity and line quality of your artwork, you will need to experiment with this formula; however, the following is an approximate relationship. When using a 150W flood bulb, try exposing the screen for about 20 seconds per inch distance between the screen and light source. For screens larger than 14" x 17" this formula may not work. You may even need multiple bulbs to get an even dispersing of light. **Caution:** Prolonged exposure to light when shooting the screen may result in an overexposed screen which will not wash out during development. Overexposure can also burn the stencil. If the light is too close it may expose the center only and not the outer edges.

Exposing Multicolor Screens for Printing on Paper

The screens are registered by taping registration pins to the glass that you are exposing the screens on, and placing your artwork on the pins. Center the screen over the artwork and make an L shape and an inverted L shape at the bottom corners of the screen with tape. **Each successive color is then placed on the registration pins, centered in the screen within the L guides, and exposed** (*See Diagram*).
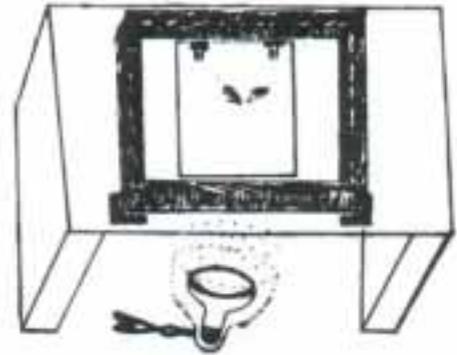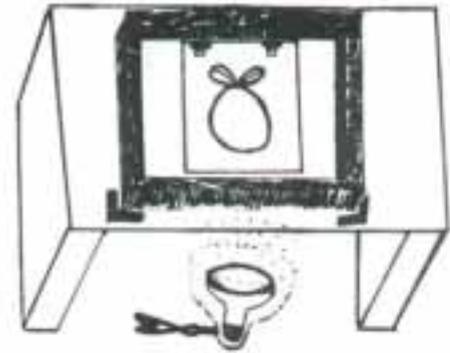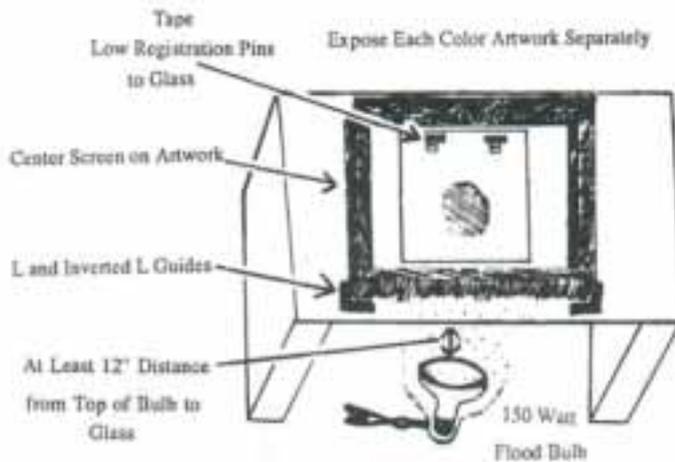
Exposing Multicolor Screens for Printing on Textiles.

If you have a professional "T" shirt printing machine, expose the screens the same as for printing on paper. If you are using the homemade Eye-Bolt, L-Angle system the screens must be prepared in a special way. Each screen must have 2 Eye-Bolts screwed halfway into the top of the wood frame. Half of the threads should be visible. This will give you room for adjustments when printing. Each screen must also have an L-Angle screwed on the frame at the top (*See Diagram*).

Tape a piece of wood the same thickness as the screen, on the exposure glass. Screw a bolt into the center of the wood (*See Diagram*) so the L-Angle can lock up against it. The 2 Eye-Bolts should butt against the wood and the L-Angle must butt against the bolt creating a 3 point contact (See Diagram). Place the screen on the glass in this 3 contact point position. Place your artwork in the center of the screen and tape the registration pins down so all the following acetates will be in the same place. Now expose the screen to the light source. When exposure is complete, remove the first acetate and place the next acetate on the registration pins. Place the screen on the artwork in the 3 contact point position as was done for the first screen. Expose the next screen. Continue this process until all screens are exposed. With this 3 point contact system, all the screens will be exposed in registration and this will make printing much easier for you.
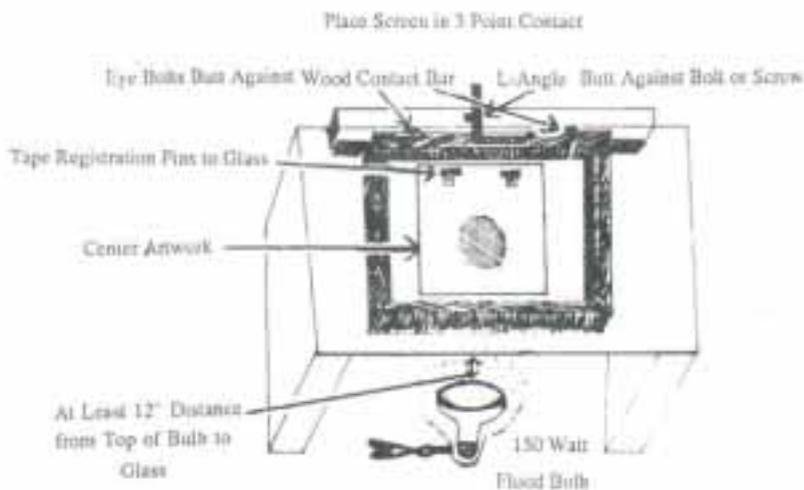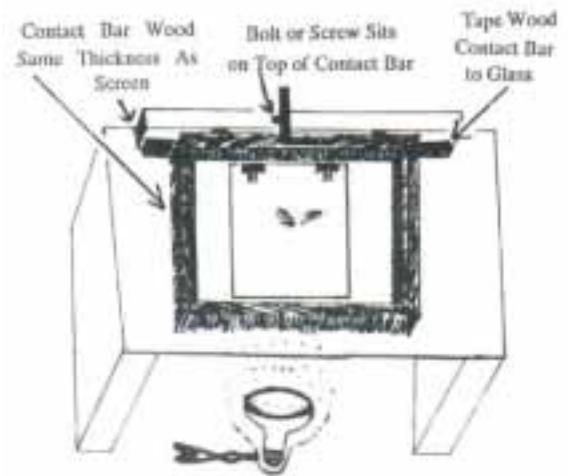
Important Things to Remember

Minimum starting distance should be 12" from artwork to light source. Due to different fabric meshes and line widths of artwork, you may have to experiment with this formula; make modifications as necessary.

If you do not use a bulb holder, but rather an ordinary household lamp, the light will be more diffuse, and you may need more exposure time.

DEVELOPING THE SCREEN

Work in a dim or amber light.

Develop the screen immediately after exposure. After exposing the screen, the image is developed by washing the screen with cool water. Light to moderate pressure is best and can be obtained by using a shower or garden hose with a sprinkler nozzle. All opaque areas that were in your artwork should wash out and your image will become a direct stencil or part of the screen. **Remember: In the open areas where the photo emulsion does not harden, the ink will pass through the mesh, like a strainer, and onto your paper, textile or other substrate.**

Prop the screen up and move the hose from side to side or in a circular motion beginning with the outside of the screen. Turn frequently and wash out both sides. When the image begins to wash out you can turn the regular lights back on.
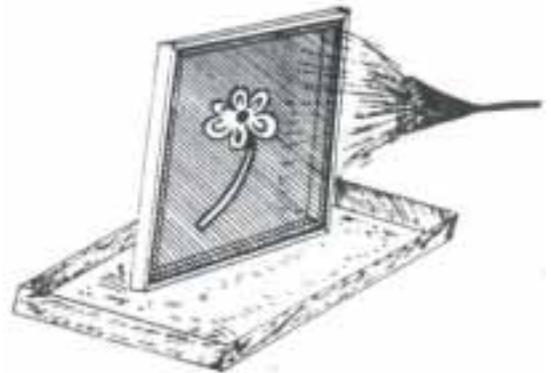
Hold the screen up to the light and check to see if light shines clearly and evenly through the areas that were opaque. If so, then all areas washed out; if not then gently wash again. Be careful, too much washing can soften the emulsion and it may begin to break away in areas that are necessary to define your design.

If the screen washes out quickly and begins to wash away it could be underexposed; you may need to increase the exposure time. If the areas that were opaqued will not wash out, the screen could be overexposed. In that case you may need to reduce the exposure time or make your artwork more opaque.

After your screen is dry, tiny pinholes or starlike specks may appear when you hold the screen up to the light. With a paint brush, dab some excess sensitized photo emulsion onto these pinholes. You can also pain the emulsion in areas that you wish to close or better define. **Do not** wash the screen after you have touched up with sensitized emulsion. Simply place the screen under and ordinary lamp or sunlight to dry.

Blockouts work best for closing unwanted open areas in the screen. With blockouts you can close certain areas in the screen, and print; then you can remove the blockout, and reverse the process, so the areas that **did not** print will now print, and the areas that **did** print will **not** print.

PRINTING

Taping the Screen

Your screen developed well, it is now dry and you want to start printing. Before you start to print, the screen must be taped to prevent ink seepage through the edges where the fabric mesh meets the frame. Since tapes vary in adherence strength and are affected by the ink chemistry, it is important to choose a tape that works with the ink you are using.

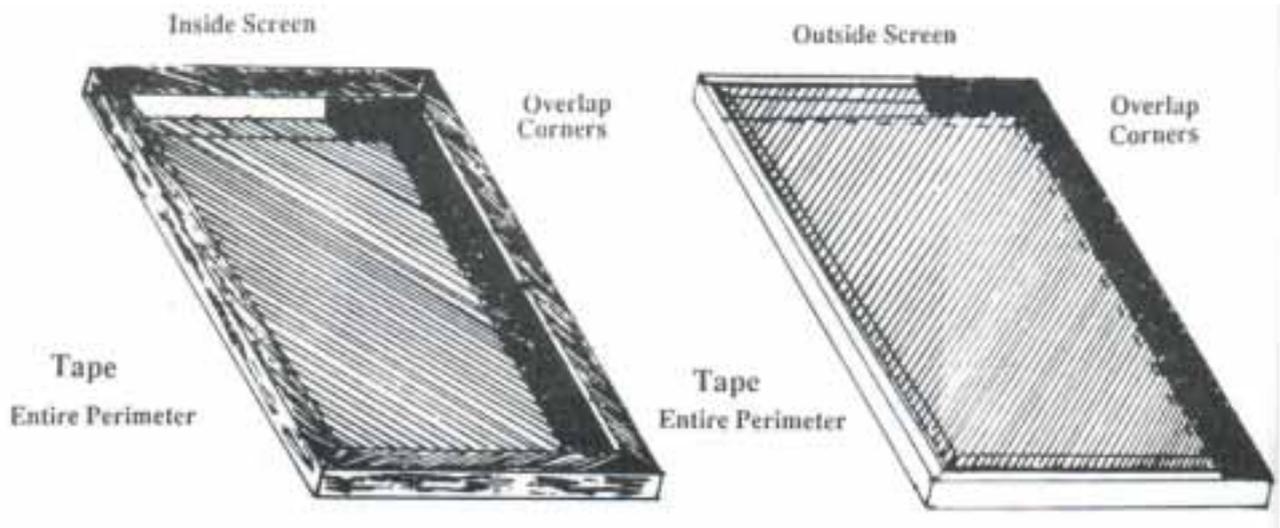**Use plastic tape** when printing with water based ink.

Use paper tape when printing with oil based ink.

Use masking tape when printing with oil or water based inks but it is not as durable as paper or plastic tape and would work only for short runs.

Tape Width should be 2" or more. Measuring the tape length is an important step in making a neat and professional-like screen. When taping the inside of the screen, measure each length from corner to corner with a slight overlap. For example: If your screen is 8" x 10" measure two pieces 8 1/2" and two pieces 10 1/2" for the inside of the screen. Screens are always sized by the inside dimensions. The outside dimensions will be somewhat larger and it is always best to measure what they are and cut eh exact size.

After you have measured and cut the correct size length of tape, adhere half of the tape to the mesh and half of the tape along the wood frame (see diagram). Repeat this on the outside of the frame, being sure to cover the entire perimeter on both the outside and the inside of the frame.
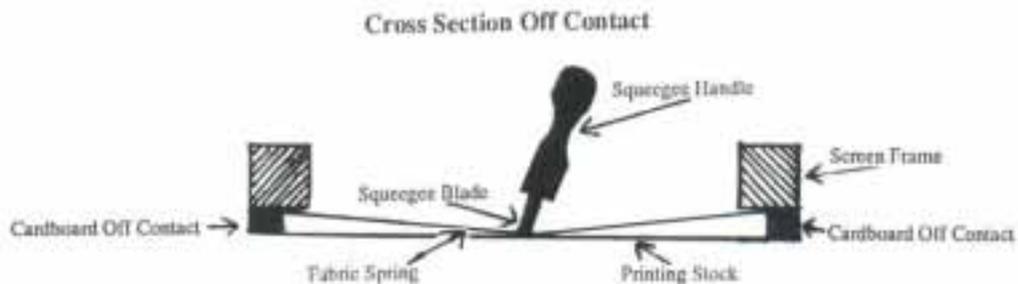
If you made the multicolor screens, the images made by the registration pins can be taped over. If the image is too close to the artwork to be taped, use blockout.
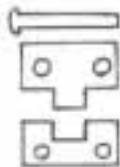

Inside Screen — Overlap Corners — Tape Entire Perimeter

Outside Screen — Overlap Corners — Tape Entire Perimeter

Off Contact and On Contact

There are two techniques of printing, namely **off contact** and **on contact**. **On contact** is defined as follows: When the screen is in the down position or the print position, the screen fabric is resting on the surface of the item to be printed. This needs no special preparation. **Off contact** is defined as follows: When the screen is in the down position the screen fabric is prevented from touching the surface of the item to be printed by a piece of cardboard or other material that is taped to the outside of the screen.

Off contact is usually used when printing on a nonabsorbent surface such as paper. **Off contact** keeps the screen fabric from sticking to the paper after a print is made. When the screen is in the down or print position and not touching the surface of the item to be printed, the squeegee pressure will push the screen fabric down. The **off contact** will cause the fabric to spring away quickly from the paper thus eliminating a static cling (*See Diagram*). When the print stroke is complete, the screen fabric should not be touching the print surface. Prepare **off contact** by taping a piece of cardboard, about 1/16" to 1/4", depending upon the size of the screen, to the outside of the wood frame. Experiment to gain the maximum fabric spring from the paper without creating too much **off contact**.

Cross Section Off Contact

Squeegee Handle
Screen Frame
Squeegee Blade
Cardboard Off Contact →
← Cardboard Off Contact
Fabric Spring
Printing Stock

Hinging the Screen

Some screens come with hinges that are attached to a separate base. These screen printing units fit neatly together. Simply screw the hinges to the back of the base and into the screen, as shown in the Diagram.

Cardboard Under Back Hinges ⟶

Same Thickness as Cardboard Platen
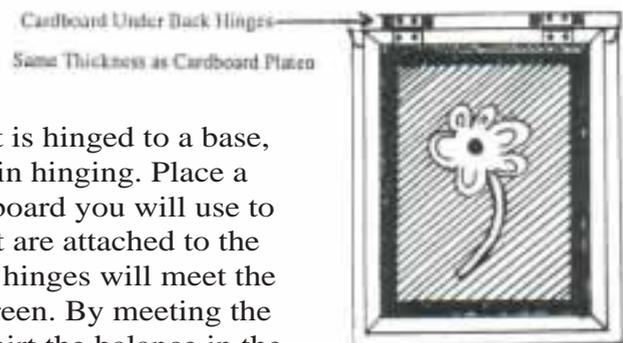
For " T" shirt printing with a screen that is hinged to a base, it is important to make the following variation in hinging. Place a piece of cardboard, the same width as the cardboard you will use to insert inside the "T" shirt, under the hinges that are attached to the base. This will elevate the hinges so the screen hinges will meet the base hinges when the " T" shirt is under the screen. By meeting the height of the cardboard that is inserted in the shirt the balance in the printing unit is reestablished.

"T" Shirt Platen → Insert Cardboard Platen into "T" Shirt
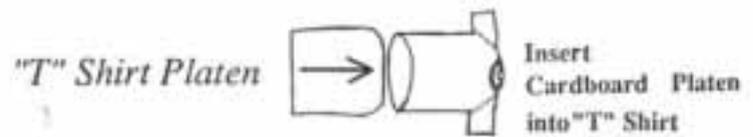
"T" Shirt Printing requires a platen which is inserted into the shirt to prevent ink from going through the fabric and penetrating the back of the shirt. This can be made from cardboard. Cut a rectangle that is wide enough to stretch the shirt tightly so there are no wrinkles in the printing area. It is very important to keep the print area smooth when garment printing. This cardboard rectangle is removed after each print is made, and is placed inside the next shirt to be printed.

Constructing a Platen For Monocolor Printing

A more professional platen can be made with 3/4" plywood with a Birch or Formica top (*See diagram*). Have a lumber yard cut a 15" square with rounded corners so it is easy to slide the "T" Shirt on. Bolt a 2x4 to the bottom of the platen. It should be long enough to extend past the platen so the shirt can drape, and so the 2x4 can also be bolted to a table or a waist-high stationary object. Attach another piece of wood across the top so there will be room to screw hinge clamps. Approximately 2" past the back of the platen, attach a piece of wood the same thickness as the platen. It should be as wide as the platen, and deep enough to screw on hinge clamps (approximately 4" x 15").

Drape Space for Shirt

15" Square Rounded Corners

Screw in Hinge Clamps

3/4" Plywood - Birch or Formica Platen

4"x15" Wood - Same Thickness as Platen

Approximately 2" Past Back of Platen Bolted to 2x4

2x4 Bolted to Platen

2x4 Bolted to Table
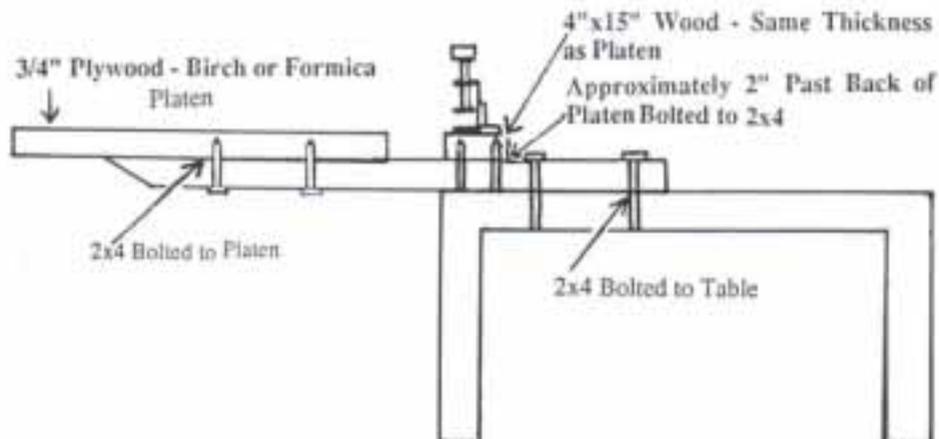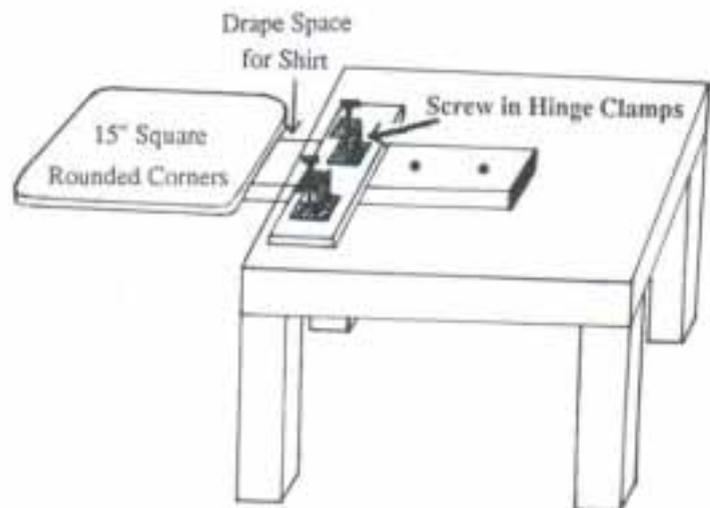
Constructing a Platen For Multicolor Printing

The basic construction remains the same as the monocolor platen; however, instead of using hinge clamps to hold the screen, the 3 point contact bar system is used. Since the platen and the screen sit on the 2x4, the contact bar must be thicker in this case so the eyebolts can butt up against it. To calculate the thickness of this bar, simply add together the thickness of the screen wood and the thickness of the platen.

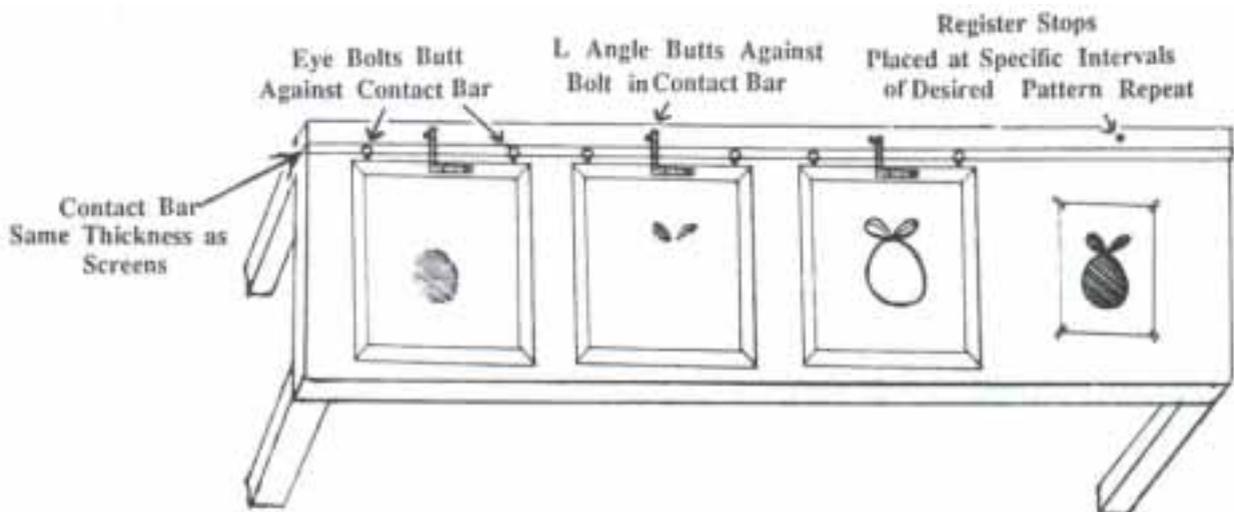3 Point Contact System for Multicolor "T" Shirts

Eye Bolts

L-Angle

Contact Bar

Calculate Thickness by Adding Thickness of Platen and Thickness of Screen
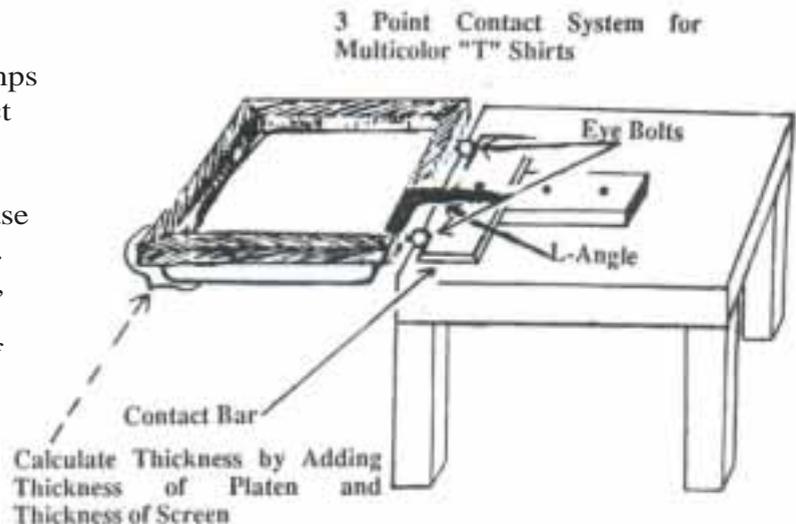
Constructing a Table For Monocolor or Multicolor Yardage Printing

To print yards of fabric with specific pattern repeats a long table must be available or constructed. It must be wide enough to hold the screen and the contact bar. The contact bar must be screwed or taped securely to the back of the table. On top for the contact bar, attach bolts which will serve as register stops for the pattern repeat and for multicolor registration. These bolts should be placed at intervals of the desired pattern repeat. The thickness of the contact bar must be equal to the thickness of the screen so the L-angle can lock against the bolt and the eye-bolts can butt against the contact bar (*See Diagram*).

Eye Bolts Butt Against Contact Bar

L Angle Butts Against Bolt in Contact Bar

Register Stops Placed at Specific Intervals of Desired Pattern Repeat

Contact Bar Same Thickness as Screens

Preparing Registration

Registering the Screen for Monocolor Printing on Paper

When printing one color on paper, you can use a screen with hinges attached to the base or you can use hinge clamps. When the screen and base are purchased as a unit and the hinges are attached to both parts, you cannot move the screen so the stock must move to be centered. When printing an edition of paper prints, it is important to have registration guides that enable you to print the same image on different pieces of paper in approximately the same position. Once you find the place on the paper where you want the image to print, make an L shape and an inverted L shape in each corner of the paper on the printing base. Tape will work nicely as a paper guide. Now you can print repeat images on different pieces of paper in approximately the same position on each separate piece of paper. Place each piece of paper within the L guides to print in consistent registration.
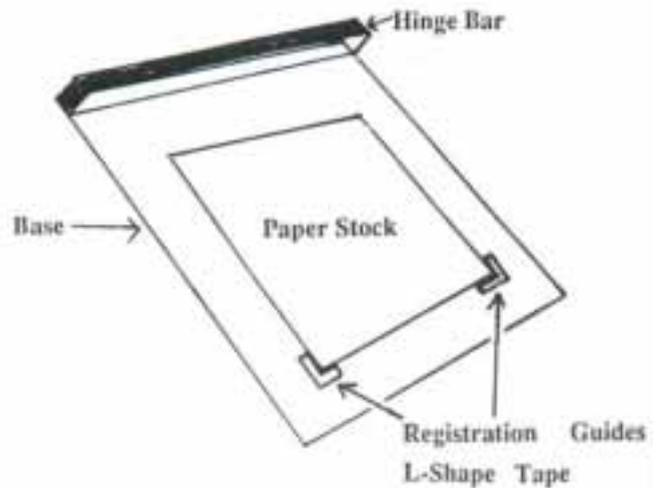
If you choose to use hinge clamps you will need to screw them into the printing table or you can use a C-clamp to hold the back of the hinge clamp to the table. Hinge clamps will enable you to move the screen vertically or horizontally but this is not crucial for monocolor printing.

Registering the Screens for Multicolor Printing on Paper

When printing more than one color on paper, hinge clamps will work better and give you more flexibility since they allow you to move the screen horizontally and vertically. Hinge clamps prevent the loss of registration and make it easier to print. Once tightened, hinge clamps lock securely and do not slip while printing.
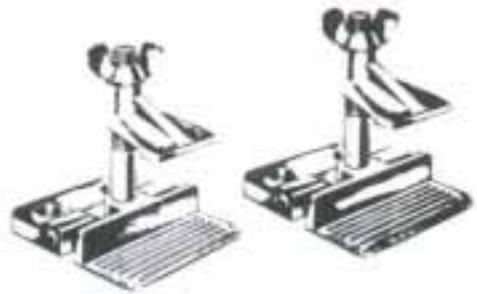
To register the screens you will need to center your main acetate or outline (let's call this the master) to the center of a piece of the stock you are printing on. This will serve as a master for registering all the colors and traps.

Place this master sheet on the printing table and register the first screen to it. Be sure to print light colors first unless your design calls for an opaque light color on a dark ground. Check to see if the screen image lines up with the acetate or master image. Be sure to leave no spaces between colors when they are supposed to meet. This is when the traps you made as artwork are necessary. Move the screen horizontally and vertically to achieve the maximum overlay coverage.

Once you register the screen to the artwork, make a paper guide by placing an L and an inverted L on the printing base where both lower corners of the paper rest. Now you can begin to print. Paper is printed wet to dry so you will need to wait until the first color is dry before you print the second color.

To print the second color, place the master sheet within the guides. Now line the second screen up to the artwork, aligning the design so no spaces appear between the colors where they are supposed to meet. Make doubly sure of the registration by placing a dry print under the screen and seeing if the image falls in the right place. If not, make the necessary adjustments, tighten the hinge clamps and print.

Before you begin to print, tape your original drawing to the print base. Take your first screen, place it loosely in the hinge clamps and move the screen so the image lines up with the portion of your original design that is to be printed. Now tighten the hinge clamps. Replace your original drawing with the stock that is to be printed. Always register stock by placing L and inverted L in lower corners on the print base. This is to ensure that each piece of print stock sits in the exact same place for all colors. If you are not careful enough to place each piece of stock within these guides the successive colors will not line up properly and they will be out of registration.

L and Inverted L
Registration Guides

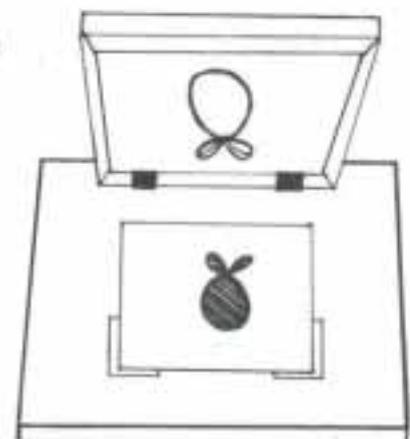Align First Screen - Red Apple - To Master and Print Entire Stock
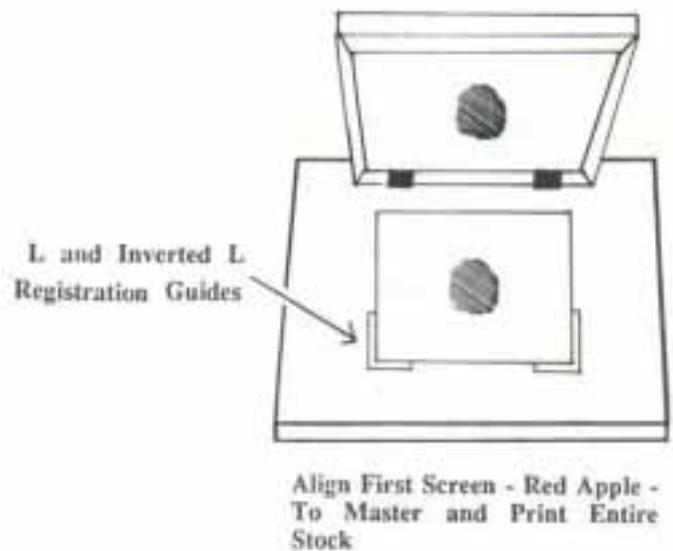
Allow Prints to Dry Between Colors
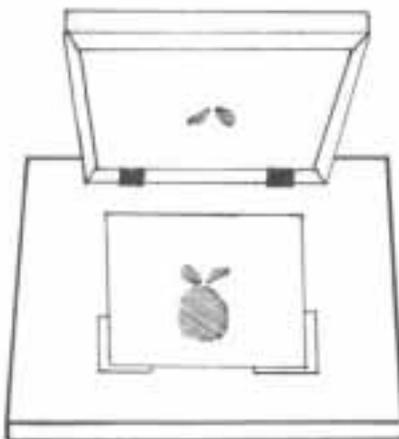
Replace Original Drawing With Stock to be Printed

Always Register Stock

Place Stock in L and Inverted L

Align Second Screen - Green Leaves - To Master and Print Entire Stock

Align Third Screen - Black Outline - To Master and Print Entire Stock
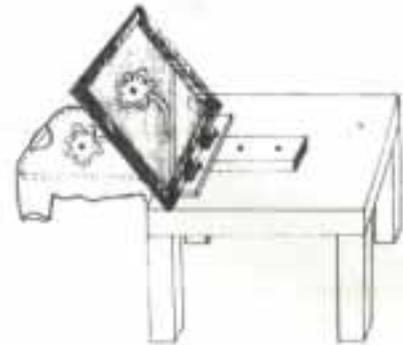
Registering the Screen for Monocolor Printing on Textiles

When printing one color on a "T" shirt, simply center the shirt under the image and tighten the hinge clamps. If you are using a stationary screen and base, center the shirt under the screen. When printing this way be sure the entire image prints before lifting the screen because the shirt will shift on the cardboard. Make test prints to get the feel of laying down the ink before using your good stock.

Always use an adhesive when printing on textiles to prevent movement of the garment when you lift the screen. CrownTM Table Adhesive works very well and does not stick to the garment. Simply apply a few drops to the printing area and allow to dry to a tacky finish. Then place the textile down without creating any wrinkles. Wrinkles will stop the ink from printing properly and cause uneven deposits.

Adhesive Coated Platen Prevents Shirt From Shifting When Screen is Lifted

Registering the Screens for Multicolor Printing on Textiles

If you are using the homemade Eye Bolt and L-Angle system, you will need help printing. Since textiles must be printed wet to wet, you will have to remove each screen and replace it with the next color screen. This might be difficult for one person to do without having the ink dry in the screen or without having to lay the screen down.

If you are printing alone you must create a setup area where each screen would be easily accessible without wasting time and energy looking for screens. A bridge table set up next to your printing area where the screens can be propped up between prints will do fine.

Have the shirts ready and close by. Mounting adhesive is necessary to keep the garment from shifting while printing and now is the time to apply it. You can use a hair dryer to speed up the drying time.

Since you took the time to use the 3 point contact system to register the screens to the artwork when you exposed the screens, they should now be in perfect registration for printing. In the diagram shown, the colors that are going to print are green for the leaves, red for the apple, and black for the overall outline. To determine your print rotation, start by printing light colors and work toward dark colors. Of course careful examination of your art work will determine which colors overlay or print over each other. In this example, the green would print first, the red second and the black third.

Slide the shirt onto the platen with the collar towards you and smooth out any wrinkles that might appear. Take your first screen, in this case the green leaves, and check for placement on the garment before inking the screen. Note: The screen must make 3 point contact with the contact bar. If you need to adjust the shirt do so now. If you are ready to start printing, pour ink in the screen, make a flood stroke and then make a print stroke. Usually, the print stroke is made towards the printer; however with the eye-bolt L-angle system the print is made away from the printer to prevent the squeegee from pulling the screen away from the contact bar. If the screen is pulled away from the contact bar, the print will be out of registration and it could also create a blurred image.

After the print is completed, lift the screen gently and make a flood stroke. Without putting the screen down on the shirt again, check the print. If the image does not look complete put the screen in the 3 point contact position and make another print stroke, being sure to print away from yourself. If the print looks complete, prop the screen on the work table so the outside of the screen does not touch anything.

Now you are ready for screen number two. In this example, screen two is the red apple. Repeat the process exactly the way you printed screen number one. Take the second screen and place it in the print position over the first print, in the 3 point contact position. Check to see if the first print aligns with the second screen. If the screen needs minor adjustments, simply turn the eye-bolts in or out to fine tune the image. If the first print aligns with the second screen then ink the screen and print away from yourself exactly as you did with the first screen.

Finally, repeat the same process with the third screen, which in this case is the black outline. Be sure this last outline fully covers the image. Here is where the traps become relevant. The last screen should also pull the print together and reward you for taking the time to properly complete each step.
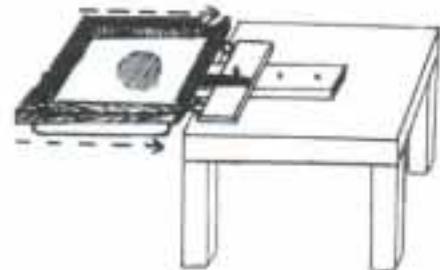
Place Screen in 3 Point Contact
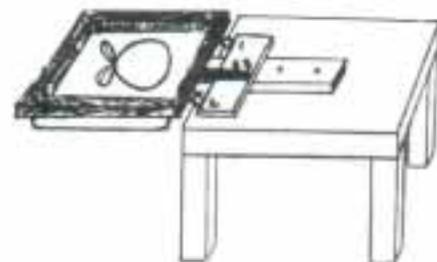
Eye Bolts Butt Against Contact Bar

L-Angle Butts Against Bolt or Screw on Contact Bar

Contact Bar
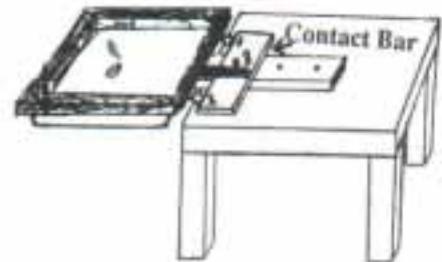
Squeegee Moves Away From Printer

Make 3 Point Contact

It is not recommended to print more than three colors at a time with this 3 point contact system, because the time between prints could cause the ink to dry in the screen.
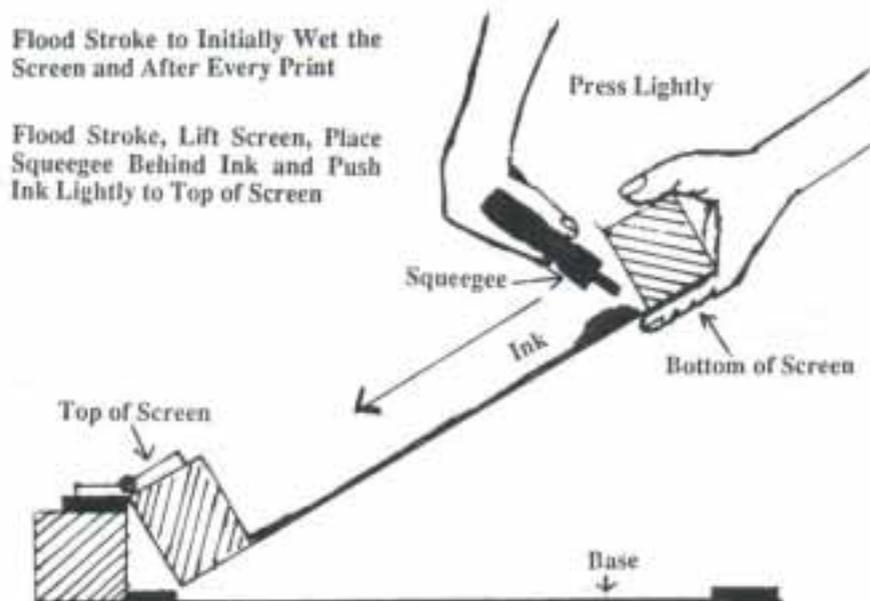
Register the Screens for Monocolor or Multicolor Yardage Printing

When using the 3 point system for yardage printing, you have a choice of printing wet-to-wet or wet-to-dry. For instance, if the table is long enough you can print one color, making all the prints along the line. You can clean the screens and allow the prints to dry and then follow with the second and third screens, waiting between colors. The technique is always away from yourself.

The number of repeats of the pattern can be controlled by the distance between the bolts on the contact bar. It is quite common for professional screen printing shops using this technique to work in teams. This technique is still widely used today. For example, three colors might be printed by three persons following each other down the line, printing a separate color. Note: If the repeated images are too close to each other the bottom of the screen may interfere with the previous print.

Printing Techniques

Now you are ready to print. Actually the printing stage is the easiest of all the work you have done and the most time consuming to perfect. Using a narrow blade spatula, scoop some ink onto the screen just below the image area. Raise the screen slightly and spread the ink over the entire image area with your squeegee. **Press lightly; the object is to cover the image with ink, not to push the ink through the screen. This is called the flood stroke.**

Flood Stroke to Initially Wet the Screen and After Every Print

Flood Stroke, Lift Screen, Place Squeegee Behind Ink and Push Ink Lightly to Top of Screen

Press Lightly

Squeegee

Ink

Bottom of Screen

Top of Screen

Base

After you have flooded the screen with ink, lower the screen onto the textile or paper and run the squeegee down the screen. **Apply more pressure; the object is to push the ink through the screen and onto the stock. This is called the print stroke.** Paper printing will require less pressure than textile printing because paper is a nonabsorbent surface. Angle the squeegee with the handle toward your body. The squeegee should be comfortable in your hands. Always use **two hands** for uniform printing.
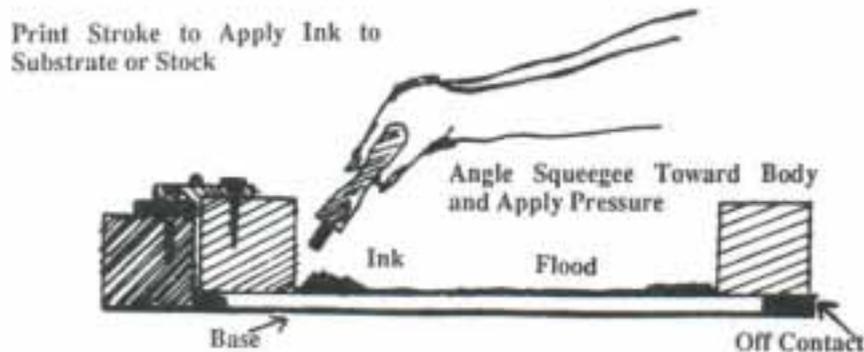
Lift the screen slightly and push the ink back up to the top or flood stroke. Remember to press lightly when flood stroking. Do not move the stock until you have checked the print. If the image looks complete, remove the stock. If the image does not look complete you may want to overprint. When overprinting do not remove or move the stock, simply lower the screen and try again. **Always remember to flood stroke.**

It takes time to develop a good printing technique. Observation and practice will turn you into a good printer, so print, print, print!

Always test print before production runs. Use scrap paper or textile to get the screen going before you use your good stock.

Cleanup.

Scoop all ink out of the screen with cut cardboard pieces. Return unused ink to the container; never waste ink! Remove the screen from the hinges or hinge clamps. Clean the screen according to the instructions on the ink can label. For example, water based inks require water cleanup with a spray hose. Oil based inks require solvent cleanup. For solvent cleanup, place the screen on a stack of newspapers and pour some screen wash inside the screen. Wash it around with a rag or paper towel. Remove the newspapers and repeat the process until the image area is clear. The image area is clean when light shines through when you hold the screen up to the light.

TROUBLESHOOTING

THE FOLLOWING PROBLEMS CAN OCCUR DURING SCREEN MAKING AND PRINTING
AND WHAT YOU CAN DO ABOUT THEM

PRINTING

DOUBLE IMPRESSIONS	May be due to	Moving screen while printing. **Secure screen or have someone hold screen while you print!**
LIGHT IMPRESSIONS	May be due to	Insufficient pressure. **Press harder! Hold squeegee on more of an angle!**
IMAGE LIGHT ON ONE SIDE, DARK ON OTHER SIDE	May be due to	Unequal pressure on squeegee. **Press harder on the light side!**
BLEED IN PRINT OR HAZY IMAGE	May be due to	Too much pressure on flood stroke or Too much pressure when printing. **Reduce pressure!**
INK DRIES IN SCREEN	May be due to	1. Too much time between prints. **Hurry up!** 2. Fine lines in artwork. **Add retarder to ink!** 3. Incorrect mesh. Change mesh! **Print faster!**

SCREEN MAKING

IMAGE HARD TO WASH OUT	May be due to	1. Overexposure during exposing. **Change Time!** 2. Artwork not opaque enough. **Darken It!**
WHITE SPOTS APPEAR WHEN COATING SCREEN	May be due to	Oil from skin left on screen. **Remove photo emulsion, wash the screen thoroughly and start again!**
PHOTO EMULSION WASH AWAY	May be due to	1. Too little sensitizer. **Measure Again!** 2. Short exposure time. **Change time!** 3. Improper distance. **Change Distance!** 4. Water too warm or pressure too strong. **Use cooler water or change pressure!**
PHOTO EMULSION PEELING	May be due to	Emulsion too thickly applied. **Apply less!**
EXCESS PINHOLES	May be due to	Emulsion too sparsely applied. **Apply more!**

When water-based ink dries in screen – use spray bottle with water and spray directly on the screen. Just a small amount will open it up. Certain inks will not wash out if they dry in the screen, so be careful not to leave the screen inked without printing, or the screen may be ruined. CrownTM Retarder works well to slow down drying time and keep screen open longer while printing.

Spray inside of screen only. If the outside gets smeared you must wash the entire outside or print until the smear disappears.

Oil based inks are more flexible in terms of drying time. Use ink thinner or screen wash on a paper towel and apply directly to inside of the screen where the ink has dried. Do not rub the outside of the screen. If the outside is smeared you must clean the entire outside or keep printing until the smear disappears.

Always test print before production runs.

If you have problems that you cannot solve and your local dealer cannot help you, do not hesitate to call our factory.

POSTSCRIPT: ABOUT FABRICS

Choose it or lose it!

The key to good screen making is the proper choice of screen fabric or mesh. If you choose the wrong fabric, you may lose your image. Choose screen fabrics according to:

- The delicacy of lines desired in the artwork. Fine lines and broad lines require different fabrics.
- The type of printing ink used. Since inks differ in viscosity, check the ink can label for suggested mesh size.
- The substrate or object being printed.

Screen Fabrics consist of woven threads. These threads act as strainers for the ink. Tighter weaves allow les ink to pass through the mesh and on to the substrate. More open weaves allow more ink to pass through the mesh and on to the substrate.

Fabric thickness, however, also affects ink deposit. The thickness of the fabric varies according to:

- Mesh count: The number of threads per inch.
- Thread diameter.

There are two categories of fabric construction or thickness: **Multifilament and Monofilament**.

Multifilament Weaves

Multifilament weaves are made up of multiple stranded filaments twisted to form a single thread (*See Diagram*). The surface is rough, less uniform and the fabric is thicker. Photo emulsion adheres very nicely as do hand cut stencils. Thus multifilaments are suited for heavy ink deposits, offer excellent adherence for both knife cut stencils and photo process stencils. Also, multifilaments are usually readily available.

Most commonly used multifilaments are made of polyester. The polyester fabric offers easy removal of the photo stencil. Although silk is also a multifilament, it is not as commonly used since the photo emulsion cannot be removed without destroying the silk fabric. The chemicals used to remove the photo stencil will disintegrate silk, but polyester is not attacked by such chemicals making it more suitable for photo stencils.

The wide thread thickness of multifilament fabrics create a lower open area in finer meshes which make it difficult to print fine detail. However, multifilaments work very well on textiles where a heavier deposit of ink is needed.

Multifilaments range from 6xx to 25xx. The higher the number, the finer the mesh.

Monofilament Weaves

Monofilament weaves are made up of single-strand threads. The surface is smoother because the single strands can be woven closer than multifilament weaves. Monofilaments are much more uniform than multifilaments. For this reason, hand cut stencils do not adhere well to monofilament fabrics. Photo stencils, however, work well with monofilaments. Because the threads can be made with a thin diameter, monofilament fabrics can be woven in very fine meshes and still retain adequate open area for easy ink passage.

Monofilaments also have very good abrasion resistance and are highly stable. This is needed for fine line quality printing. However, considerably less ink will be deposited. When printing halftones this factor is very important. In selecting screen fabrics for halftone printing, multiply the line dot by three to obtain the minimum fabric mesh to be used. Conversely, to determine the minimum dot size that can be printed with a specific fabric mesh, divide the mesh size by three. However, experimentation with this formula should be done when working with higher line dot sizes.

Monofilament weaves can range from 16 to 470 mesh count. Usually, meshes over 355 are used with ultra violet ink. Because these inks do not dry there is no need to worry about clogging up the stencil.

Note: Colored fabrics are recommended when using monofilaments because longer exposure times will still yield high quality stencils. Since light tends to travel quicker along white fabrics, it may creep behind your artwork and affect the photo emulsion. If the artwork lines are thin or if exposure time is long, the photo emulsion may become overexposed.

- *Polyester:* Excellent all-purpose fabric – for multifilament and monofilament weaves.

- *Nylon:* High stretch factor – for printing irregularly shaped substrates.

- *Wire Mesh:* Extremely stable fabric – low stretch factor – heavy deposit of ink – print circuits, ceramics, and garments.

- *Silk:* Oldest known fabric used in screen printing – rarely used due to lack of availability, expense, and vulnerability to chemicals.