

Multicolor Screen Process Printing: Mirrors

Introduction

This activity package deals with the **multicolor reproduction** of a hand-cut screen process production project. In an earlier activity, you prepared a **mechanical color separation** for a cartoon design. You also produced single color screen designs using both hand-cut and photographic stencils. This activity will combine several of the skills you have already mastered, but will also show you how to reproduce a design that contains several colors in close registration.

Screen process printing, often called silk screen printing, is accomplished by forcing ink through a **stencil** which has been attached to a piece of tightly woven fabric stretched over a **frame**. It is a versatile printing method that can be used to reproduce designs on a variety of materials and shapes. Some common screen printed products include hats, T-shirts, and other articles of clothing; plastic, wood, and metal signs; and glass and ceramic products like coffee cups, mugs, glasses, and bottles.

The stencil for screen printing can be created by a number of methods; these methods include paper, hand-cut film, and photographic. In this assignment you are going to use the hand-cut method, learning how to register several colors.

Registration is the process of lining up the color images so that they are placed in the proper position on the printed product. For this activity, you will be using a multi-color screen printing press similar to those used in screen process printing plants.

Job Description

In this activity you are going to reproduce on a glass mirror the cartoon character or design you created earlier as a mechanical color separation. Before you can begin production, you will need to check your mechanical color separation. Since the **image area** for this project is limited by the size of the material you will be printing on, you need to make sure your design will "fit" the mirror. If you are using the less expensive flat mirror tiles, the image area available to you is 12" x 12". If you plan on using the more expensive beveled mirror tiles, the image area available is 10 1/2" x 10 1/2".

Measure the image area of your cartoon character; that is, the space required to print your cartoon. Make sure it will fit on the mirror tile. Consult with your instructor as to the sizes of mirrors or mirror tiles available for this project.

Since you already have the artwork for this project, you will begin by preparing the individual stencils and screens (one for each color to be reproduced) required by your design.

Materials and Supplies

To complete this activity, you will need the following materials:

- color separated mechanical
- masking tape
- lacquer film

Materials and Supplies Cont.

stencil knife
line cutter
adhering liquid
blockout liquid
screen fabric
screen frames
squeegee
multiple head screen press
ink, assorted colors
newspaper
mineral spirits
mirror tiles

Preparing Your Stencils

Hand-cut film consists of a thin layer of gelatin with a plastic backing. There are two types of hand-cut film: **lacquer film**, which is soluble in lacquer thinner, and **aqua film**, which is soluble in water. You can use either of these films for this activity.

Since this activity will require the reproduction of more than one color, you will need to prepare several stencils and screens. Before you begin, make sure you have placed **register marks** on your mechanicals in at least three locations. The register marks should be just outside the image area. They will be used to "register" your colors and will not appear on the finished product. (See Figure 1.) Register marks for each color must line up exactly, one above the other. It would be a good idea to have your teacher check your mechanicals for registration before you begin to cut your film stencils.

1. Cut a piece of film about 2" larger on all sides than your design. Make sure you include the register marks. You will need one piece of film for each color of your design.
2. Separate each of the **overlays** from your color separation mechanical.
3. Place the "black printer" separation the back of your first piece of film using masking tape. Be sure that the film covers all three register marks.
4. Using a sharp stencil knife or a line cutter, cut out the **image areas** on the black printer, peeling up the film only from the areas to be printed

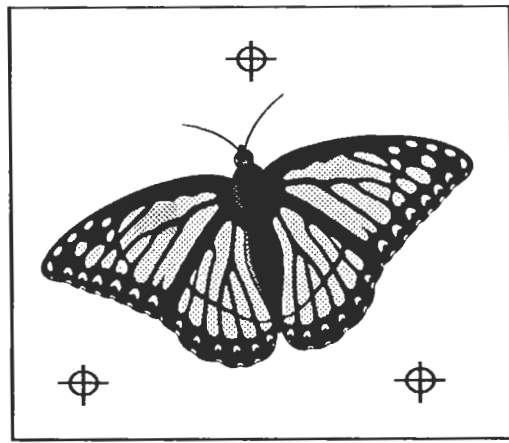


Figure 1 - Mechanical with Registration Marks

black. Include the register marks. Use a light knife pressure, cutting through the top layer of the film only. Do not cut or **emboss** the backing sheet.

5. Repeat this process for each color separation. If you are going to print your design in four colors, you will need to cut four stencils.

Printing Equipment

For this project you will be using screen frames like you have done previously, except that you will be preparing more than one frame. Just as each color of your design required a separate stencil, each stencil will require a separate frame. Remember that screens must be tightly stretched on the frame, and that new fabric must be washed to remove the sizing. The screen will be placed on a multiple-head press, which will provide good registration of your colors. **Registration guides** will be used to position your mirror under the screen on the press.

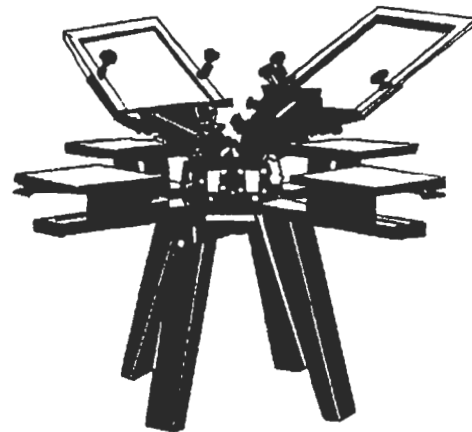


Figure 2 - Multiple Head Screen Printing Press

Adhering Film to the Stencil

Select screen frames that are at least 2" larger on all sides than your stencil. To insure that there is good contact between the film and the frame, place several layers of newspaper (cut smaller than the frame) underneath your film.

Use two clean cloths or cotton pads to adhere the stencil. Moisten one with **adhering liquid** if you are using a lacquer stencil, or with water if you are using an aqua stencil. Wipe the wet cotton pad over a small portion of the stencil. Immediately wipe the area with your dry cloth. The gelatin is softened by the adhering fluid or water, and applying downward pressure on the frame during this process will force the film to stick to the frame. Continue wetting a small area at a time and drying it until the entire stencil has been adhered.

The stencil will darken in color when adhered to the screen fabric properly. Too much adhering fluid or water and rubbing will destroy the stencil. If a small area is not adhered, you may go back over that area carefully.

When the stencil is dry, which takes about 15-20 minutes, slowly peel off the plastic backing sheet.

Before you begin printing, you must block out those areas you do not want to print. The most commonly used materials are masking tape, paper mask (kraft paper), gummed paper tape, or **blockout fluid**. Check with your teacher to see which is the preferred method in your laboratory.

Printing Your Mirror

1. Before you actually print your design on the mirror, you will print a **proof** to make sure your registration is correct. Place your screens on the press after the stencils have been adhered, the backing removed, and open areas blocked out. You will usually print from lightest color to darkest color. Black is printed last, so that the black detail lines will cover the edges of the lighter colors.

2. It is a good idea to place newspaper or some

other protective paper on the press bed. Tape it in place.

3. You will need to place a piece of practice paper cut the same size as your mirror under the frame, and center it with the design. Rotate the heads of the press, and check to see if the image areas line up near the center of the practice sheet. Make adjustments to the position of the screen frame at this time.

4. After the four frames have been adjusted so that the image areas are close to the proper position, return to the frame which will print the lightest color (yellow, for example).

5. Using an ink knife, place a small amount of ink inside the frame above the image area. Select a **squeegee** that is slightly wider than your image. Holding the squeegee at a 30 degree angle, pull the squeegee across the screen while applying downward pressure. To avoid smearing the image, go over the stencil only once for each print.

6. Raise the frame. Notice the location of your register marks on the practice sheet.

7. Rotate the head of the press until the next frame is in position. Lower the screen, lining up the register marks on this screen with the register marks on the practice sheet. The register marks must line up exactly over each other. Adjust the position of the frame by using the adjustment knobs on the press. Once all three register marks line up with the three on the practice sheet, you are ready to print your second color.

8. Ink takes varying amounts of time to dry, depending on the type of ink you are using. You can speed the drying process of air-set ink with a fan. Heat-set ink requires a heat source. Check with your instructor on the ink drying time. Make sure the image on the practice sheet is dry before you add the second color.

9. Repeat the process until you have all four colors printed and the registration correct.

10. Now set up the registration guides or pins so that your mirror is in the exact location as the practice sheet. Do not remove the practice sheet until you have located the registration guides.

11. Place the mirror on the bed; line it up with

your registration guides; and print your design on the mirror. If you are printing more than one mirror, repeat the process until the required number have been printed.

Note: If your register marks print on the mirror, leave them until the image is complete. They can be removed easily with a single edge razor blade.

Cleanup

When you have finished printing, remove any excess ink from the frame and the squeegee, using the ink knife and placing it back in the can. Be careful not to mix colors. If a paper mask or tape was used, remove it from the frame at this time. Using a cloth and **solvent** (water or mineral spirits, depending on the type of ink that was used), clean the remaining ink from the squeegee and ink knife. Place newspaper under the frame, and pour a small amount of the ink solvent directly onto the screen. Wipe the screen with the cloth several times during the process. Continue until all ink has been removed. Check that the screen has no clogged areas by holding it up to the light. Repeat the process for each frame that you used.

Once the stencil has been cleaned properly, it may be saved and reprinted at another time, or it may be removed from the screen so that a new stencil may be adhered. Lacquer film stencils are dissolved with lacquer thinner; aqua film stencils with water. Check your instructor as to the stencil removal procedures to be used in your lab.

Ecology

Read labels on ink cans and solvents. Make sure you dispose of waste correctly. Do not pour solvents down the sink. Recycle unused ink back into containers.

Vocabulary

screen process printing
squeegee
registration guide
mechanical color
separation
registration
image area
lacquer film

aqua film
blockout fluid
adhering liquid
register marks
stencil
emboss
solvent
proof

Safety

Be careful when using X-acto knives as the blades are very sharp. Always use a cutting surface; do not cut on drawing tables or desks. Store the knife with a blade cover.

Be careful when working with solvents. Make sure you store them properly. If you spill or drip any on the floor, be sure to wipe it up immediately. Falls can result from slippery floors. Dispose of solvent rags properly.

On Your Own

1. Make a display for your display case that demonstrates the process used in multicolor printing. Include examples of :

- your original artwork for this project
- the mechanical color separation
- the frames with the stencils still mounted
- a finished mirror

2. Make two separate prints of each screen; then add the colors in steps so the rest of the school can see how the four colors were applied to the sheet one at a time.



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TEACHER GUIDE

MULTICOLOR SCREEN PROCESS PRINTING: MIRRORS

Objectives: Upon completion of this assignment, students will be able to:

- Prepare a multiple color screen process design for printing.
- Reproduce a multicolor design using a screen process press.
- Realize the importance of careful registration in the multicolor design and reproduction process.

Helpful Hints:

1. It is suggested that the activity packet Mechanical Color Separation for Reproduction be completed prior to beginning this activity. Also, students will need some prior experience with hand cut film.
2. Careful registration is the key to successful multicolor printing. Use commercial pressure-sensitive register marks printed on clear tape, rather than hand-drawn register marks, on the artwork.
3. Before students cut stencils, check their registration. One way to do this simply is to make photocopies of each of their separations, including registration marks. Then make thermal transparencies of the artwork. These then can be assembled one over the other on a light table to check registration.
4. If you cannot make thermal transparencies, line up the photocopies on a light table, one on top of the other, to check registration.
5. If you are using the less expensive mirror tiles, use colored plastic electrical tape as borders. Placing the tape on the mirrors first will help eliminate cuts caused by the sharp edges of the mirrors.
6. Select your stencil and ink combinations carefully. Make sure the ink will adhere to the glass surface of the mirrors. Water-based inks tend to be a bit transparent for this project.
7. Frames with pre-attached screen are available in the *DCPS Stores & Distribution Catalog*, along with squeegees, screen fabric, and stencil materials.
8. Read labels on all ink, solvents, and materials. Make sure students know which solvents are compatible with which inks and stencils. Make a chart for your ink cabinet listing ink types and appropriate solvents.
9. While this activity calls for a rotary head press, the activity can be accomplished with a single-color frame and base. You will need to demonstrate the procedure carefully for your students.

TEACHER GUIDE

MULTICOLOR SCREEN PROCESS PRINTING: MIRRORS (Cont'd.)

10. X-Acto knives are always a safety hazard. Make sure students know the proper procedure for use. Make a storage block for the knives so they can be stored with the blades protected.
11. CAUTION: If you use a plastisol type ink which needs to be heat cured, it can be done with the mirror; however, the glass gets very hot. You will need a clear area for this activity, a drying rack, and a pair of oven mitts to handle the mirrors. They need to cool before applying the consecutive colors or the stencil will melt from the heat.

LANGUAGE ARTS APPLICATION
MULTICOLOR SCREEN PROCESS PRINTING: MIRRORS

Student Name

In all types of jobs you will find that you need the ability to communicate your ideas effectively. Writing skills are necessary in all occupations. Here are a few examples of how writing skills are related to this activity.

In this activity you will be reproducing a cartoon character on a glass mirror. You might include a message along with the graphic design. For example, in the activity where you designed a greeting card, you may have written some "bubble captions" for your character. These captions can contain a message, a joke, or slogan you wish to communicate.

In the space below, write some bubble captions, slogans, or messages you can include with the cartoon character you will reproduce for this project.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

MATH APPLICATION MULTICOLOR SCREEN PROCESS PRINTING: MIRRORS

Student Name _____

In all types of jobs and occupations you will need the ability to apply mathematics effectively. Here are a few examples of how math skills are used in relation to this activity.

The screen printing industry employs thousands of workers to complete many tasks and printing jobs. The money an employee earns is called income, and may be calculated two ways.

Gross income is the amount of money you earn before taxes and other deductions (amounts subtracted) are made.

$$\text{Gross income} - \text{taxes and other deductions} = \text{Net income}$$

Net income is the amount of money remaining after taxes and other deductions are made from gross income.

$$\text{Net income} + \text{taxes and other deductions} = \text{Gross income}$$

Example 1:

Tom's net income is \$205 a week. \$42 is deducted for taxes and \$4 is deducted for health insurance each week. What is Tom's gross income?

$$\begin{array}{rcl} \text{Net income} & + \text{taxes and other deductions} & = \text{Gross income} \\ \$205 & + \$42 \quad + \$4 & = \$251 \end{array}$$

Tom's gross income is \$251 per week

Try these: Calculate the income of these workers.(show work)

1. Gina's gross income is \$375 a week. \$97 is deducted for taxes, \$13.50 is deducted for insurance, and \$20 is deducted for the investment fund. What is her net income?

2. Bill's net income is \$375 a week. \$65 is deducted for taxes, \$7.50 is deducted for union dues, and \$9 is deducted for health insurance. What is Bill's gross income?

MATH APPLICATION

MULTICOLOR SCREEN PROCESS PRINTING: MIRRORS (Cont'd.)

Some workers are paid weekly (once a week). Others are paid biweekly (once every two weeks).

Multiply the weekly rate by 2 to find the biweekly rate.

Divide the biweekly rate by 2 to find the weekly rate.

Try these: Calculate the income of these workers.(show work)

3. Pedro's net income is \$400 a week. \$78 is withheld for taxes every week. What is Pedro's biweekly gross salary?

4. Sarah's biweekly gross income is \$700. Her biweekly deductions total \$212. What is her weekly net income?

Some workers are paid on an hourly rate. Multiply the number of hours worked by the rate of pay per hour to find the gross income.

Try these: Calculate the income of these workers.(show work)

5. Joshua earns \$5.20 an hour. He works for 35 hours one week. What is his gross income?

6. Victoria earns \$7.20 an hour. She works 40 hours a week. What is her gross income?

7. Emily earns \$4.50 an hour. She works 30 hours a week. Emily is paid biweekly. What is her gross income?

8. Al earns \$6 an hour. He works 20 hours a week. He is paid biweekly. \$5.85 is deducted each week. What is his gross biweekly income?

QUIZ
MULTICOLOR SCREEN PROCESS PRINTING: MIRRORS

Student Name

True or False:

- _____ 1. Hand cut stencils are available in both lacquer and aqua based emulsions.
- _____ 2. Pressing hard on the stencil knife will cause embossing, which will prevent the stencil from adhering to the screen.
- _____ 3. When printing more than one color, additional stencils (one for each color) will be required.
- _____ 4. To insure that proper registration is maintained, registration marks are placed on the art original, the stencils, and the reproduced print.
- _____ 5. The image area is removed, or cut away from the stencil.
- _____ 6. Blockout fluid can be used to mask a screen.
- _____ 7. You can also block out a screen with paper tape, masking tape, or kraft paper.
- _____ 8. Small mistakes (open areas) cannot be fixed once a stencil is adhered to the screen.
- _____ 9. Squeegees should be held at a 45 degree angle when forcing ink through the screen.
- _____ 10. Used ink should be washed out of the screen in the sink, so the old ink can be disposed of properly.