The Dye Transfer Process

through the eyes of a professional

By Bob Pace

In Collaboration with Rick Warner and Lee Vierling

Photo by Rick Warner

Rick Warner, Technical advisor

Lee Vierling, Video Production

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Foreword

The Dye Transfer process has been regarded as the foremost color process of all time because of it's ability to be manipulated in many ways and the fine colors produced by clean aniline dyes.

The history of the Dye Transfer process is filled with stories about it's shortcomings and it's problems. But when all is said and done, it still remains the most comprehensive color process to date.

My reasons for writing this book and producing this video are simple. I want to make sure that somewhere there is a professional accounting of "how the process works".

Most of the professional advertising Dye Transfer Labs are experiencing a shock because of the fact that electronic scanners are here. They are here to stay. Fortunately, the "art" photographer is also here to stay.

The Dye Transfer process is one method of making quality color prints that can be the prime goal of the art community. Until now, the black and white photographer has been regarded as the fine artist in photography, and deservedly so.

However, the awakening color photographer has had to work with Type C prints or Cibachrome. Both of these materials are fine, but are not in the same league as a Dye Transfer print. The ability of the Dye Transfer process to be manipulated for the best possible print is legendary.

The photographic artist now has the ability to create mind boggling impressions with this "tool" called Dye Transfer.
The choice of contrast, color balance, and density control for emotional impact, are finally in the hands of the qualified Dye Transfer printer.

My main desire is that those of you who have purchased this book and video will soon be able to produce the kind of prints that will set you apart from the rest of the photographic art world.

Good luck,

Bob Pace

Acknowledgments

The credit for the fact that we finished a video and this book belongs to two very hard working individuals, namely Rick Warner and Lee Vierling. Without the help and dedicated hard work of both Rick and Lee, I would have had to make the video on 8 mm film and the book would have been mimeographed. Their high demands have made this effort worthwhile.

Before I give thanks to the entire United States color community, let me say thanks to my wife and partner, Mary. Without her understanding of me, and knowledge of the Dye Transfer process, I would have been at a loss. Mary was, and still is, instrumental in any sucess that I may have had. Mary has been patient with me and my endeavors for these many years.

Thanks to the many competitors and clients who always pushed me to do better work. The first two individuals who placed my thinking cap on properly, were Ed Evans and Glen Petersen of the once quite well known color lab called Evans and Petersen. They taught me how to see and think photographically.

Some of the clients that I have worked with were also instrumental in my becoming a quality color printer. The work that my lab turned out for the many famous advertising accounts for over 45 years was because of the trust and confidence that these companies have had for our abilities.

Some of our clients would demand a specific "look" in a print. We would sometimes have to "invent" a new system in order to accomplish our task.

And almost last, but not least, are the hundreds of subscribers and students that have given me their input with the many questions that I had to answer.
It is because of these students, and others, that I have decided on this venture.

I hope this book and video will answer some of the questions that you may have about this most incredible color print process.

And finally, thanks to Kodak for introducing such a fantastic process to the world.
And thanks to you, the people who have purchased this video and book.

Biographical Notes

Bob Pace, Professional Dye Transfer printer.

Bob has been in the photographic color field for almost 50 years.

In 1948 he joined the most inventive color lab of it's day (Evans & Petersen) and began making carbro prints, and then dye transfer prints, for some of the most prestigeous photographers and advertising agencies in New York City. He eventually opened his own lab in 1951.

After serving some of the major advertising accounts in New York City for 7 years, he decided to open a branch in Los Angeles. Two years later he consolidated all his efforts in Los Angeles. For almost 50 years, Pace Color served the advertising community. The names of the advertising accounts that were serviced by Bob Pace are legend. The world's first dye transfer strip-in was also produced by Pace Color.

He has also organized, supervised, and taught a class in Dye Transfer at the California State University in Los Angeles.

In 1984 he retired from the rat race of the advertising field, and decided to teach. A small, but very professional lab was built in Victorville, CA., and Bob Pace has been teaching and writing about color printing ever since.

His aim is to teach the Dye Transfer process to present and future photographers to make premier color prints for fine art photography, quality portraits, and commercial advertising applications.

Rick Warner, Technical Advisor.

Rick was a commercial photographer, lecturer, training program coordinator, and technical sales representative during his 32 year career in the Professional Photographic Division of the Eastman Kodak Co.

He was influential in the production of Kodak Elite B&W Paper for the fine art photographer.

He is a graduate of the Rochester Institute of Technology where he also taught classes in Dye Transfer printing and commercial photography.

He has also taught color printing classes at California State University in Los Angeles.

Rick is an active photographer and is a member of the American Society of Magazine Photographers.

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Introduction to the Process

The Carbro Process was the only professional process in existence in the early part of the 1930's.

It is true, that in the old days, many technicians made beautiful prints by the seat of their pants, so to speak.

The Carbro man who knew from experience what a good set of negatives looked like was considered to be the best technician around.

He didn't have to know about H&D curves or anything about the sensitometry or densitometry of photography. He could just **"feel"** when it was right.

On the other hand, there were many scientists who would work with film and developers and were able to improve the science of photography, but they never got involved with the **"art"** of making a color print.

The Carbro printer made black and white prints (called bromides) that represented the 3 primary colors. The Carbro technician became the leader and backbone of the whole color field. This is before color transparencies were to engulf the field..

No one could argue with the Carbro color printer if his print didn't quite match the original scene. Since the prints were made from "in camera" direct separation negatives, we had no transparency with which to compare it.

It was a marvel to see a good Carbro man look at a set of negatives and sense some imbalance and make the corrections in the bromides, and again later, in the combining of the pigments.

But now we're in the age of instant color printing with all sorts of video analyzers to help even the least experienced or knowledgeable to make acceptable color prints. Maybe not Carbro, or Dye Transfers, but color, never the less.

For some people, the only drawback to the making of Dye Transfer prints is that it seems extremely complicated when compared to any other type of photographic color printing process. And this is so.

There are many facets in producing a Dye Transfer print.
The following pages will explain in detail just "how" and "why" the process works.

Dye Transfer History

The Principals of Color Photography were known as far back as 1875, but it was not possible to produce a full color print at that time. More knowledge was required in research and development in emulsion technology, color theory, and dye chemistry to make a color printing process practical.

In 1879, **Thomas Manley** invented the **Carbro** print process which used colored and tanned pigments which could be placed on paper with all three separated color images registered by eye and by hand.

This process had limitations since only one print could be made at a time, with very little in the way of controls to alter the final image.
A brand new print had to be made, starting from the very beginning and repeating all of the time consuming and tedious steps in order to make any color or density changes.

The immediate forerunner of the Dye Transfer process was the **Technicolor** process which had it's beginnings back in the early part of the century. The motion picture "one shot camera" and the rest of the process, was invented by Dr. Kalmus. His early attempts in color photography were made as early as 1914.

In 1921 when the original "Phantom of the Opera" was made, a short 5 minute sequence was filmed with this new "one shot" motion picture camera. It pictured the star, Lon Chaney, dressed in a flowing red robe and wearing a death mask, flowing down the large staircase in the Paris Opera House.
The effect was startling.

When I saw the film again recently, it received a strong round of applause. The audience sensed that they were watching an important moment in the history of color photography.
In essence, this was a **Dye Transfer Process.**

In the ensuing years, the process and the dyes were perfected to such a point that clarity of the process would become legend.

The images were photographed through a single lens, and then the image was split through three semi-transparent pellicles, which diverted the image through three separation filters and onto the three reels of panchromatic film.

There was little need for masking for contrast control, because the negatives were shot and processed to the correct gamma.

Dye Transfer History

However, what about masking for color? Did you ever see a "bad" Technicolor movie? Hardly ever.

The masterpiece "Gone With The Wind" which is 50 years old, still looks as if it were shot yesterday.

The **"Kodak Wash Off Relief Process"** was introduced in 1937 using a nitrate based matrix film for the matrix.

The original matrix developer formulas and even the dyes were manufactured by DuPont. We lab technicians had to mix our own dyes from dry powders and boil them to make sure that they were mixed thoroughly.

Registration was a real problem because all of the films available were either acetate or nitrate based and would not retain their size, and also the fact that no precision registration equipment was available at that time.

The current Dye Transfer process was a natural improvement over the old "Wash Off" process.

Prior to 1946, Bob Speck and Louis Condex invented and perfected the chemistry and dyes for this new process, and joined the Kodak family. The procss was formally introduced in 1947 as the **"Kodak Dye Transfer Process."**

The advantages of this new and improved process were that a wider range of separation negative densities could be utilized. The variable degrees of contrast control were finally possible in each of the matrices, dyes, and right up to the final transfer of colors.

The dyes for this process are manufactured by Kodak and are available in liquid form and in various sized quantities. These dyes are very stable and have a long life. They are considered as archival in quality.

This is a premier choice color print process that should be used by fine art photographers, commercial advertising, quality portraiture, and any other application where quality, versatility, and permanence are required.

Overview

A Simple Explanation

How Does the Process Work?

A color print, using analine dyes, made by the imbibition process, where the emulsion of a specific film (such as matrix film) will absorb the specific dyes.

The diagram on page 6 shows how the process proceeds from a transparency to the final print.

This imbibition process is one where fluids (in this case, dyes) are picked up and transferred by a colloidal system of a gelatin relief image on film to make a paper print.

It begins by making three negatives from the original transparency by exposing them by contact, through a set of red, green and blue filters. These filters are especially made so that they will separate the three colors with as little overlapping of any of the other colors as possible. These are known as **separation negatives** by separating and recording all of the red, green, and blue brightnesses of the transparency on each one of the red, green, and blue separation negatives.

Three Matrices (positives) are made from the three separation negatives. These matrices, which represent the additive primary colors, are made, either by contact exposure or through an enlarger, from these original three separation negatives, and then are processed, and eventually transferred, by contact, to a sheet of specially prepared gelatin coated photographic paper. The number **"three"** is the key. All the colors of the rainbow can be reproduced with just these three colors: **Cyan, Magenta and Yellow.**

How Are These Matrices Produced?

An enlarger is usually the instrument needed to make these matrices, however, if your negatives are large enough, you can use a contact system instead.

These matrices are exposed and identified and then processed in a tanning developer which results in a positive gelatin relief image, produced by the fact that silver has been sensitized, and now has the unique capability of absorbing dyes in the same proportion as the thickness of gelatin.

These matrices are then placed into trays containing the positive complimentary dyes needed to make the full color print.

These three colored matrices are then transferred, one at a time, by hand and in register, to a sheet of silverless photographic paper.

This final print is the **Dye Transfer print.**

What Causes the Dyes to Transfer to the Paper?

The dyes transfer to the paper because of an imbalance in pH.
The dyes are acid in content, and the paper conditioner is alkaline in content.
The net effect is that the high acid contents flow towards the high alkaline condition.

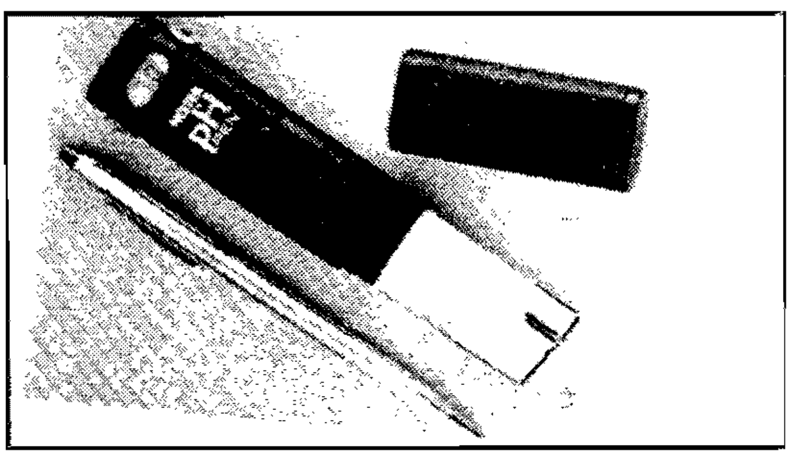
The paper is soaked in a paper conditioner in order to prepare it for the transfer. **The difference in pH** is what causes the dye to transfer to the paper. The paper conditioner should have a pH of 6.5.

If the pH should change during a transferring session, you can add small amounts of a 10% solution of Triethanolamine to increase the pH, or 28% acetic acid to decrease the pH.

If the paper conditioners pH is too acid, the dyes may not bleed, but the transfer time will be lengthy. If the pH is too alkaline, the dyes will transfer quickly, but it may also bleed.

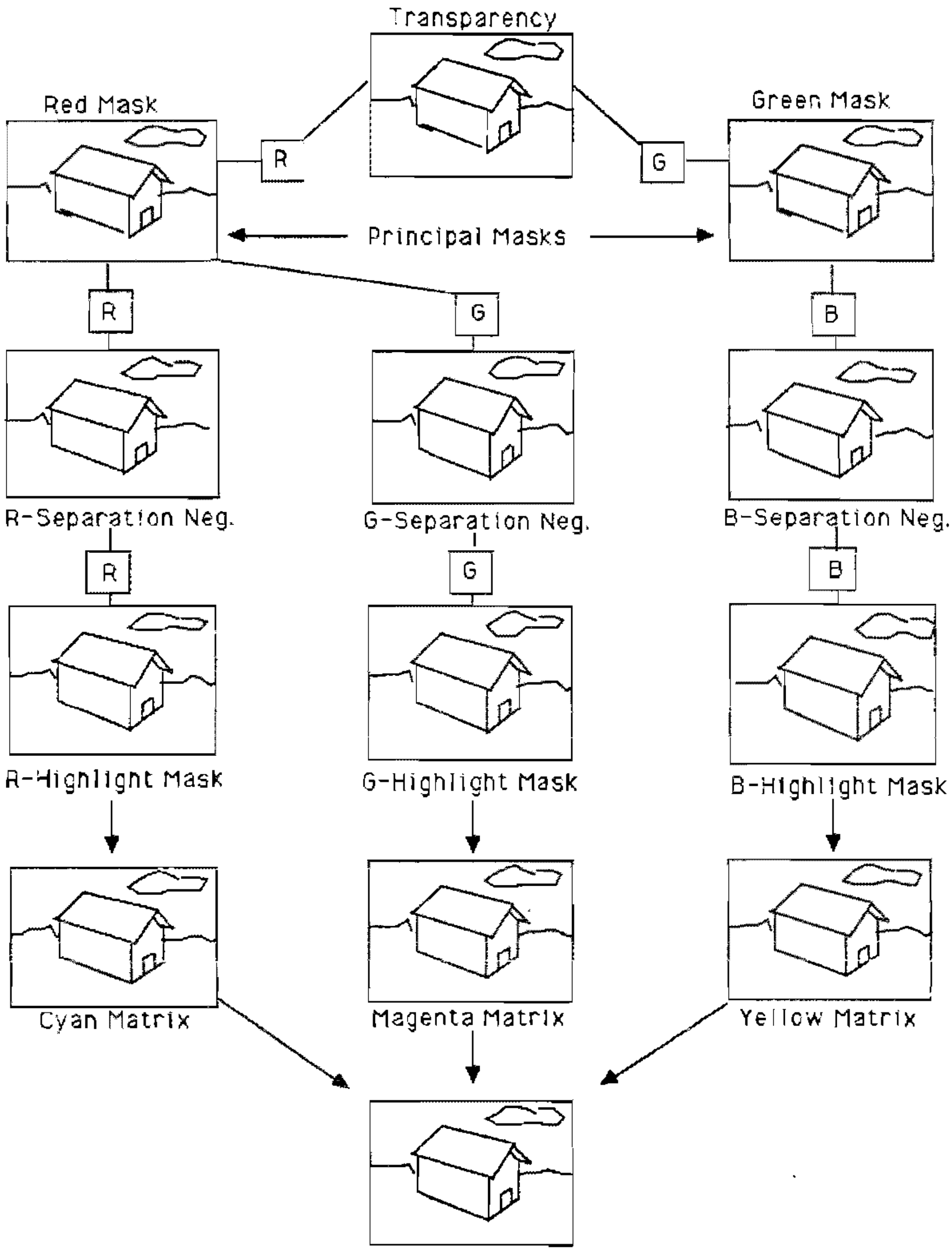
The correct pH should be 6.5 for the paper conditioner.

A good pH meter can be purchased for less than $100 from **Edmund Scientific, Barrington, N.J.**



Overview

A Diagram of the Steps



Dye Transfer Print

Overview

Why should we go through the trouble of making a complicated Dye Transfer print, when there are so many other ways to make a color print?

The question is a fair one.

It only takes 6 minutes to process an Ektacolor Type C print. It takes about the same time for an Ektachrome or Type R print, or any other process that has most of the controls decided for you.

The answer is "Control" in making the print.

No other process will do what the Dye Transfer process is capable of doing.

Here is a list of the many ways to make improvements on a specific image.
You can control or change the contrast, density, or color balance, in any direction at the same time as well as making strip-ins by combining several images to make one print.

We all know that in simple color printing (such as Type C), we can make a print warmer or colder, and lighter or darker, without too much fanfare.

However, in Dye Transfer, we can make a print contrastier, normal or flatter, either overall or in any one or two colors.

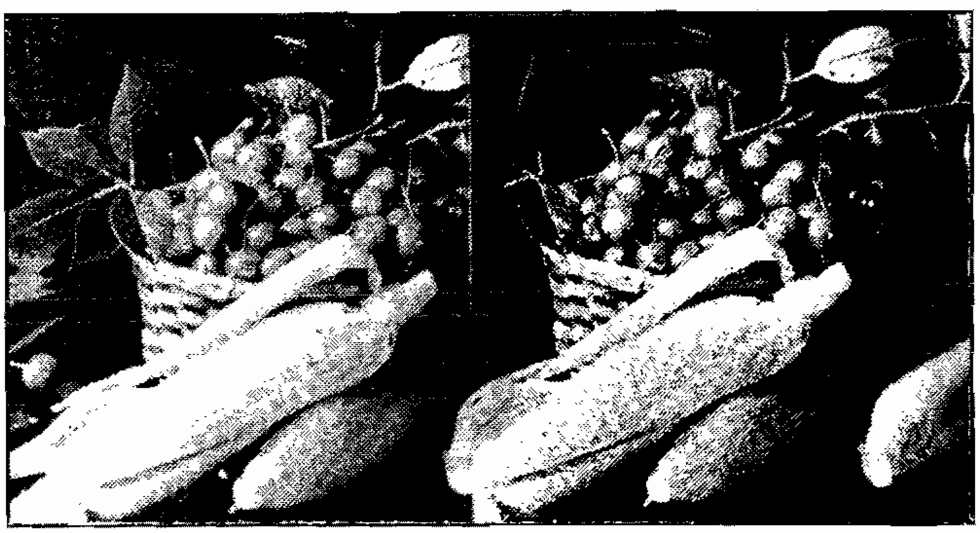
Different Densities

Low **Normal** **High**

Different Contrasts

Low Normal High

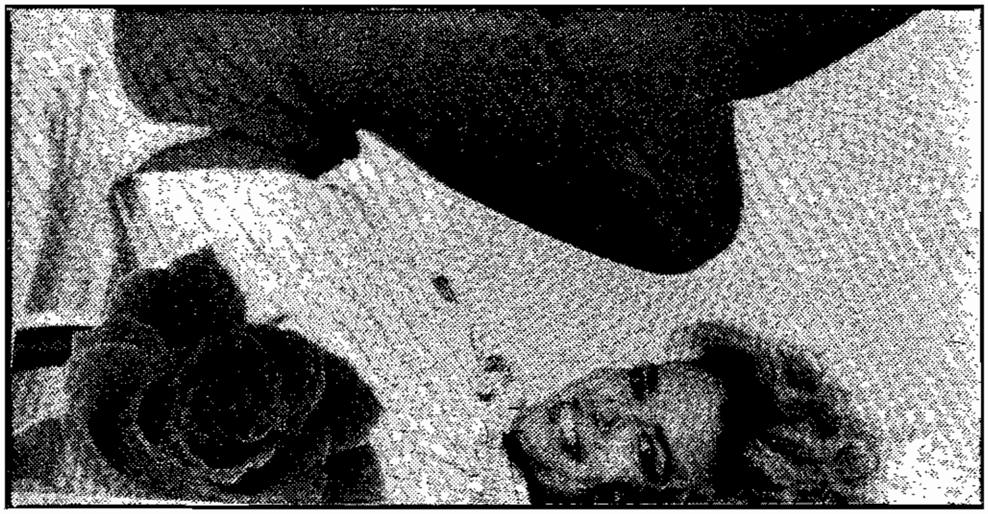
Change Local Color and Density



Straight Print Added Color to Corn Kernels

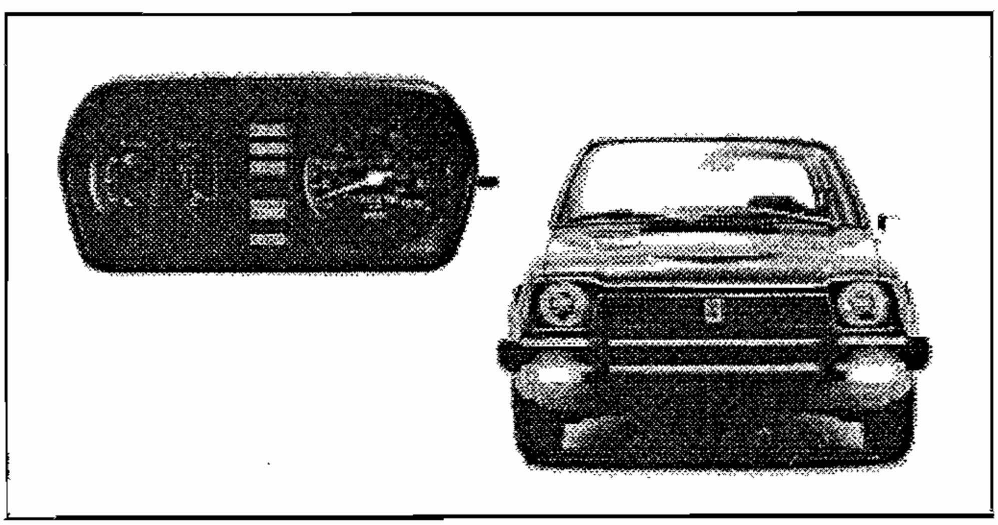
Overview

A strip-in can be done with any other process, but it is easier to match contrasts and color balances with the Dye Transfer process than with any other process.



2 Piece Strip-In

Placing two images on one sheet is not difficult. However, placing the images so they fit the right position and achieve a soft edge will make them look plausible and not artificial.



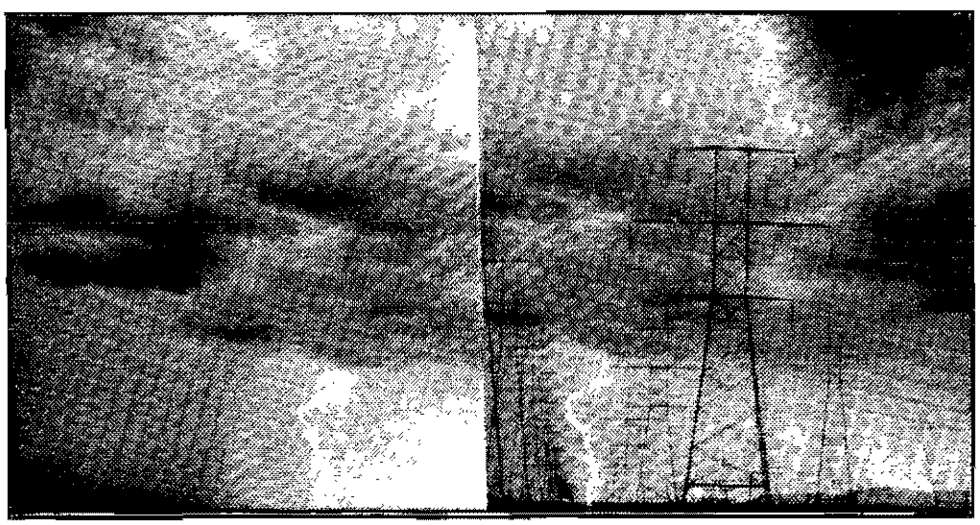
2 Piece Photo Composition

Overview

A strip-in print requires much more than control of contrast and color balance. Many sets of separation negatives, friskets, and matrices were made, and then assembled into one print.

37 Piece Strip-In

This next print is a simple matter to achieve with the Dye Transfer Process, but would raise problems with any other print process. Doubling the exposure would not work properly. Doubling the transfers will. We simply double transferred the power line towers over the scenic image.

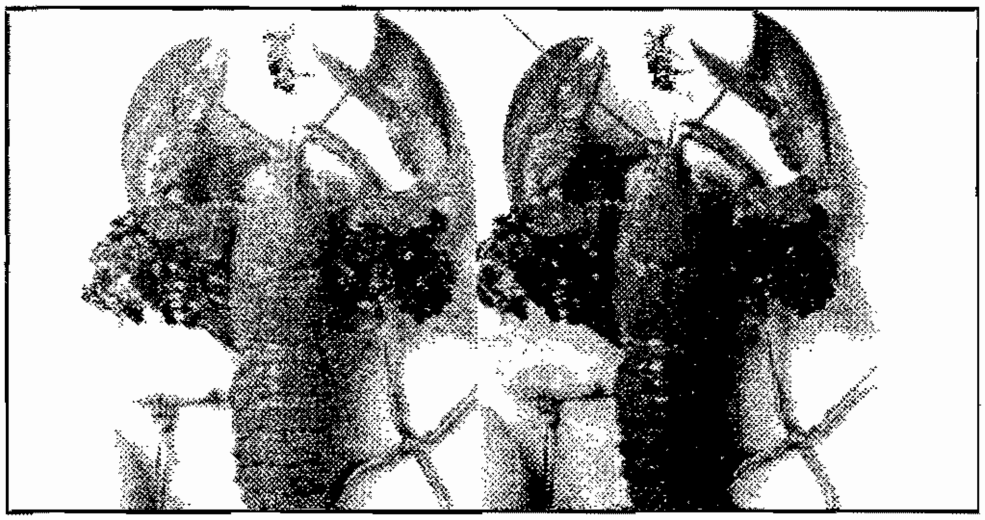


Double Image Transfer Staged Print

Overview

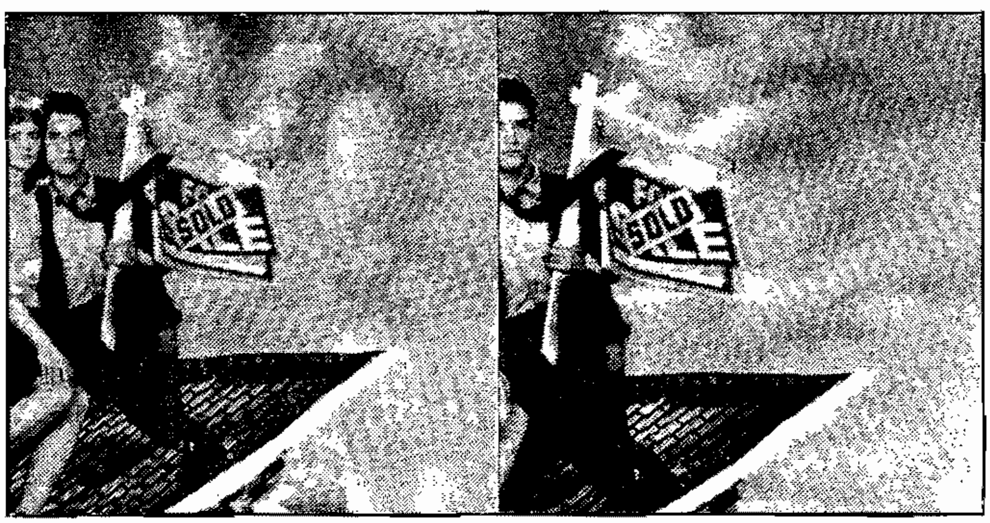
The Diversity of the Process

Making a print richer in color and density is almost impossible to achieve with any other process, except the Dye Transfer process. One can transfer one or more colors more than once in order to achieve a much greater density and contrast level. It may be hard to see in this black and white version, but it is very evident in the video.



Straight Print **Double Transfer**

Here is an idea of just what a fine retoucher like Alan Williams of Los Angeles can do to make it look **"real"**. Notice that the sky has been extended, a three piece strip-in the printing, and then blended together by a skilled retoucher.



Before **After**

Overview

The longevity of a print is important if the image is important.

The dyes used in the Dye Transfer process are made from Analine materials and are long lasting.

However, even more important is this:

The separation negatives and the matrices will last indefinitely, because black and white silver images when fixed, washed, and stored properly, will last for many years.
How is that for longevity?

The purpose of this book and it's accompanying video is to show you what this process is all about, and how to make a **Dye Transfer Print** step by step.

It is not magic. It just looks that way.

Techniques and Procedures You Will Learn.

1. An overview and advantages of the process.

2. The equipment and supplies needed.

3. How to calibtrate your own enlarger to control contrast.

4. How to make a balanced set of color separation negatives with a predictable and repeatable procedure to obtain the correct density range for quality prints.

5. Why and how to make enlarged or contact color separation negatives.

6. How to determine the required printable mask percentages, exposures, and development with predictable and repeatable procedures.

7. How to make split filter exposure masks for more exciting color.

8. How to add brilliance and sparkle to a print with highlight masks.

9. How to size and calculate the correct exposure for a balanced set of matrices.

10. How to fine tune the color balance and density of the final print using professional "tricks of the trade".

11. How to use liquid film carriers, and their advantages with small transparencies.

12. Special topics and techniques such as: Average Density, Subject Failure, Split Masking, Corrective Measures, and Isolation Color Correction.

These topics will instruct you how to make high quality professional Dye Transfer prints for: **Fine Art Photography, Quality Portraits, and Commercial Advertising Applications.**

1. Equipment & Supplies

Now that the process has been simply explained, let me describe and list some of the necessary equipment.

The need for a densitometer is essential.

It is an instrument that the serious Dye Transfer color printer, or anyone else who is interested in the technical aspects of the photographic field, should be familiar with. If you are unwilling to use a good densitometer, you will never be able to make accurate density measurments.

A **densitometer** is a must. It must be accurate and repeatable. I have had success with the **Macbeth** and the **Speedmaster**. Both of these are excellent.

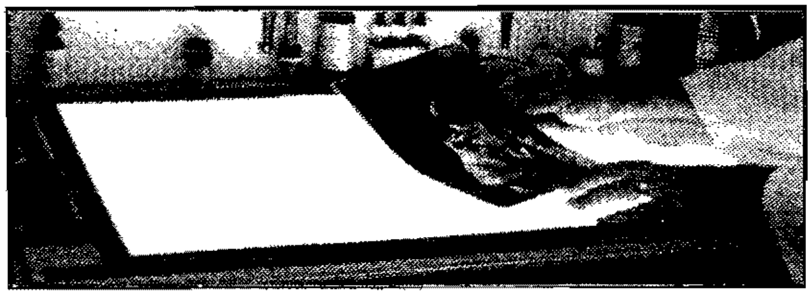
Some densitometers are capable of both **transmission and reflection** readings. You will only need the transmission type. Some come with both status "A" and status "M" filters. All you will need is the status "A" filters used to read transparency densities.

There are many others on the market. Some of these sophisticated units cost thousands of dollars, so shop carefully for a good densitometer.

An **on-easel analyzer** reads the enlarger light on the easel. Purchase one that is reliable and repeatable.

Without a **light table,** I doubt if you could ever make a quality finished print. **Transparency illuminators** are also a must, but a light table is even more of a necessity.

This table will be used to examine transparencies and negatives. You will constantly be using the table to prepare transparencies for enlargement. The color balance, complete spectrum and brilliance must be accurate.



Bob's Light Table

Is a 5000K light source all you need?

The proper viewing light box is a very important thing to have when making any kind of color print.

In the late 1930's, when I started in this color print adventure, the use of a light box was almost a joke.

The only professional color print produced during those early days was the Carbro print. A viewing light box was not necessary because there wasn't a transparency to look at.

But later, when transparencies began to appear on the professional scene, viewing light boxes came to life. Every conceivable kind of illumination was used and most of it was wrong.

There were viewers that used blue bulbs, even though they were incandescent, so someone, at least, thought of having something closer to daylight than just a warm incandescent bulb. Another light box consisted of 5 blue bulbs.

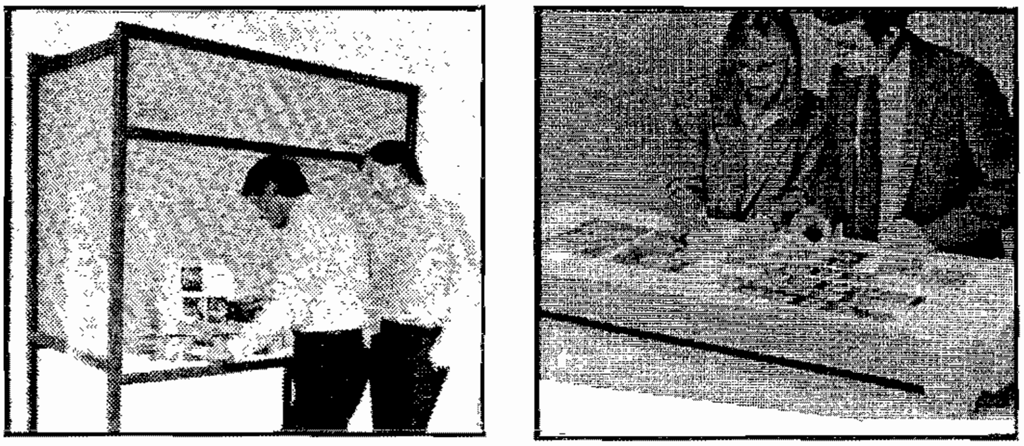
Another box that was adequate for looking at x-ray films was also pushed into the color field by just saying it was "accurate".

So much junk was allowed to infiltrate the color transparency viewing systems, because a standard was yet to be established.

Kodak had a light box that used a warm incandescent bulb, and had a large sheet of blue glass that cooled the color quality of the light for improved transparency viewing.

Then along came **the Macbeth Co.,** a firm in Newburgh, N.Y., with a clean, lightweight, and easy to maintain light box that used something new; **a color corrected flourescent tube.**

This tube has the apparent full spectrum that is needed to view transparencies. And they managed to get it to burn at 5000 Kelvin, which had now become the standard for the whole world.



Macbeth Viewing Equipment

So, transparency viewing systems have finally arrived at the proper place, correct? **Not by a long shot!**

The light source that you use, **to view the finished print,** also has to be considered.

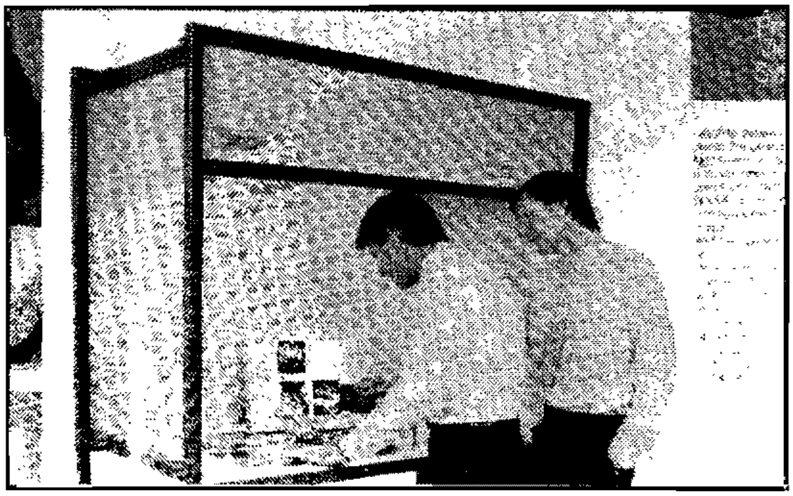
The light sources in an office building will change constantly as you are walking down the hall or going from one room to another.

Sometimes, in the past, my prints would not pass inspection, because of the light source in which the print was viewed.

In the Dye Transfer field, with so many ways to improve or change the "**look**" of a print, we have an opportunity to really give a client what he really wants, but only **If we know what he wants.** This requires a viewing system for the prints that is accurate and considered "**standard**".

Along came **The Macbeth Co.,** again. This time with a viewing booth that produces the same color light as their light box and has a fixed light level.

Their box is easy to assemble and most of the advertising agencies use this box to view, not only the color prints that they buy, but the lithographer's proofs as well.



Macbeth Print Viewing Booth

Has this now solved the problem of print viewing light source? No, not by a long shot.

My experience has shown me that most art buyers are not as concerned with matching the color and density of the transparency as much as they are concerned with the overall impact of the print, which includes color balance and contrast.

Remember, the job of an art director is to make sure that the ad he is responsible for is outstanding. He will usually change the color balance and the contrast of a print to meet what he perceives as the correct effect for an ad.

The **transparency Illuminator** light source requirements are:

A 5000 K
B. 90 + CRI (color rendering index)
C. Brightness Intensity of 1400 + or - 300 candles per sq. meter
D. Even uniformity over the entire viewing surface

My light box was made using MacBeth tubes and making sure that the luminosity matched that of a professional unit.

All the light box you will ever need is a light table, if the color quality and light intensity is correct.

1. Equipment & Supplies

Bob Pace's Magic Box

Before I explain this unique system, I have to explain why this system was "invented".

If you have been making prints for important clients, as I have for many years, one of the most frustrating things to have happen to you is to have a job turned down because the client felt that the print was off color balance or density.

Some of the reasons for these problems with clients are the light sources; both the light box for viewing the transparency and the light source for viewing the print.

First let me give you a picture of what it was like before Macbeth designed and built their own transparency iluminator light box and print viewing booth.

There were at least ten different kinds of light boxes made at one time. Each one had it's own color temperature and light intensity level. If a transparency looked good on any one of these boxes, the chances were that it would not look as good on any of the others.

Viewing the print was, and still is, even more of a problem. The age of the bulbs seems to be the reason for many differences.

Every office had flourescent tubes, incandescent bulbs or daylight of some sort or a combination of all of these. The possible combinations for viewing the transparency and the print were almost unending. All of the professional printers had to deal with this problem.

I once received a transparency of a famous country western star to make a print to be retouched and used for a record album cover. His hair looked green and his flesh tone was grey. What could I do to solve this problem?

Well, outside the window of my lab, I had a piece of sidewalk that had been painted a magenta or reddish color. I held up the transparency to this colored background and the flesh tones came back to life and the entire transparency looked fine.

I proceeded to make a Dye Transfer print using this magenta sidewalk as a color guide. I was a champion for a day because the client really loved the print.

1. Equipment & Supplies

The same thing can be accomplished by adding filters to a transparency but the added filter density will cause unexpected problems.

We have been using dichroic light sources for many years making prints. Here is a unique system to make color balance corrections on transparencies that I have used sucessfully for the past 20 years.

How to build and use this magic box.

I purchased a dichroic light head for a small Omega enlarger. I took the wiring apart and consolidated the entire unit in a small box. I could get at the controls and it was portable.

The next step was to match the color balance and the light output of a Macbeth light box. I recorded the numbers of the cyan, magenta, and yellow color values on the dials.

I then placed a transparency on this light box and studied it's color balance. I found that if I warmed up the transparency by adding a bit of magenta and yellow filtration to the light source, the whole transparency looked more pleasing.

I kept placing different transparencies on this **"magic light box"** and found that no two filter settings were exactly alike. I eventually placed over 100 slides on this light box and even though all of them were adjusted to look the way I would like to see them printed, no two had the same filter settings.

The numbers on the different colored knobs were marked in 1 cc unit of color correction. If I had to add 10 cc units of magenta and 15 cc units of yellow, all I had to do was **add** this correction to my filter pack in the enlarger when making a **Type R print,** or **subtract** this color correction when making a **Type C print.**

Here is an example:

On my "magic box" to match the Macbeth 5000 K light source, it required these color dial settings:

Cyan	55
Magenta	85
Yellow	95

1. Equipment & Supplies

Here is how you use this information:

We placed a transparency on this 5000 K light box and adjusted the color balance until we were pleased with the results.

The new color dial settings are:

Cyan	55
Magenta	95
Yellow	115

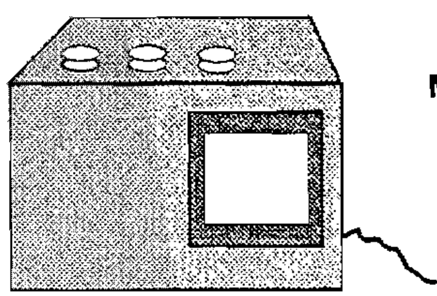
The difference in filtration is:

Magenta	+10
Yellow	+20

We add or subtract this difference in filtration to our filter pack in our enlarger depending on whether we are making a Type C or Type R print as I explained earlier.

If you wish to apply this system to Dye Transfer prints, just add or subtract the filter differences using logarithmic calculations with your TI-30 calculator to change the matrix balance by changing their exposures. This color change correction will produce a Dye Transfer print with the same color balance with which you viewed the transparency on the "magic" light box.

Remember, all light boxes will differ in light quality because of the age of the lamp and the condition of the light box.



My "Magic Light Box"

A portable light box made from an Omega 2x3 inch enlarger Dichroic color head.

1. Equipment & Supplies

Quality equipment is necessary for quality prints.

Any quality Dye Transfer lab equipment must include one of the following: A contact print frame, a vacuum print frame, or a vacuum platen.
These three devices can be made or purchased.

You must get a perfect image-to-image fit. There must be no air spaces at all.

Condit Mfg. of Sandy Hook, Conn. sells a contact frame, complete with pins and a punch.

Kodak also sells a contact frame complete with the pin system that matches their punch.

Making a contact platen is not difficult. However, Condit makes a great piece of equipment, a vacuum platen. It is well made and will assure you of total contact.

If you want to spend the rest of your days trying to register masks, negatives, and matrices, instead of concentrating on what makes for a spectacular print, then don't worry about registration equipment. But, if you are serious about quality, make sure that your equipment is the best that you can afford.

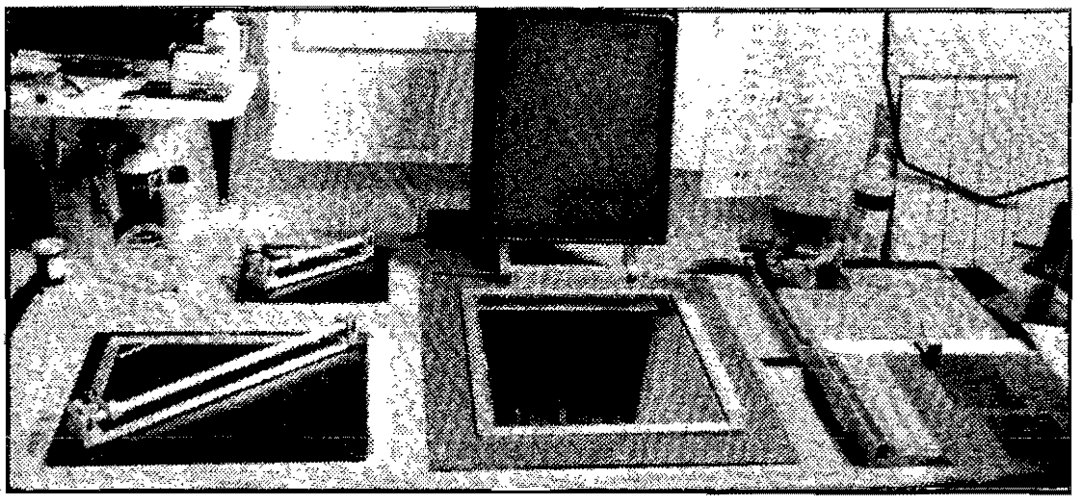
Certainly, there are a few things that you can make yourself.
A paper punch that is normally used for producing holes in paper can be converted to use as a film punch.

The pins can be purchased from various sources, such as graphic supply stores and graphic arts camera manufacturers. The Carlson Co. makes great punches and pin systems.

Some of the punches will produce more than ten holes. The pin system will match the punch very accurately. This will insure you of a perfect fit.

However, the problem with this kind of pin system is that the holes are the same size and will only work if your material is kept dry. If anything gets wet and starts to expand, then you will need most of the holes to be elongated so as to prevent film buckling when the film size changes.

1. Equipment & Supplies



Bob's Contact System

A contact frame can be operated using squeeze pressure, or a vacuum system. I like the vacuum system because it pulls the films together with complete certainty.

Every lab has it's own system because each owner is an individual with his or her own ideas on what works best. I have never seen two labs with exactly the same operating procedure or exactly the same equipment.

Exposing Light Sources

You must have an accurate, incandescent, full spectrum, color quality light source that is absolutely repeatable. Use incandescent lamps that are rated 3200 K.

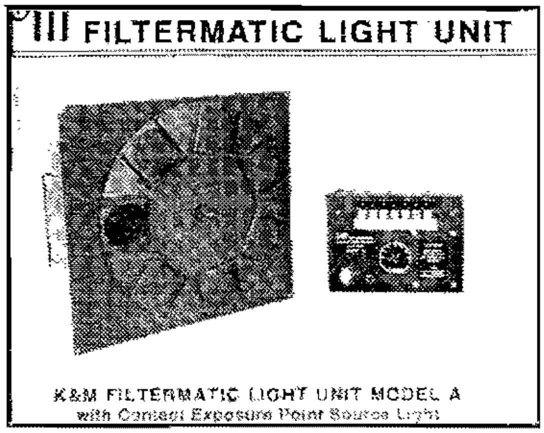
The means that you must have some kind of electrical voltage stability. A **voltage stabilizer** is a must.

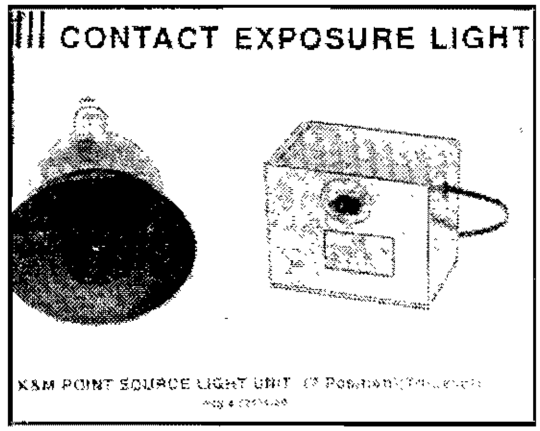
If you work with a portable contact print frame, make sure that the frame occupies the same table space every time and is in alignment with the exposing light source in order to obtain consistant results. The light source can be anything from a simple household lamp to a quartz halogen lamp.

I personally prefer a point light source. I use a 100 watt, 20 volt lamp that requires a voltage step-down transformer which is adjustable to control intensity.

1. Equipment & Supplies

A Company called **K & M** in Florida produces a sophisticated set-up using the same **point light source** with different voltage settings and an electrically oper-tated **filter wheel** which is very convenient to use. The light source can be mounted above the work table or below it. It is a matter of personal convenience. Most graphic arts supply dealers sell K & M products.





K & M Equipment

The need for professional equipment is paramount.

If you want to spend the rest of your days trying to register masks, negatives, and matrices, instead of concentrating on making a spectacular print, then don't worry about registration equipment. This is one reason for getting the correct profes-sional equipment.

But, if you are serious about quality, make sure that your equipment is the best that you can afford.

There are a few things that people try to make in order to cut corners and save expenses. A paper punch that is normally used for punching holes in paper could be converted to use as a film punch, but you will pay the price with poor registra-tion.

Pins and punches that are made for the lithographic field are usually made to the same circular size and allows no room for expansion, as does the Condit system and is therefore not recommended for the Dye Transfer process unless the holes can be elongated.

1. Equipment & Supplies

The main reason that color films change size so easily is beacause they are coated on an acetate base, which is not as stable as Estar film base. The slightest change of humidity in the air will cause the acetate films to change size.

This is the main reason for purchasing the correct professional equipment for your applications. When you consider the amount of time that will be spent in making masks, negatives and eventually, matrices, the amount of money spent on quality equipment will pay for itself.

If you plan to make Dye Transfer prints from different size transparencies, you will need different size film punches and pin registration systems so that the masks and separation negatives can be punched accurately with the proper pin spacing.

There are a few kinds of professional punches available. You can use a Kodak Matrix punch, but unless you are working with oversize film, you must tape on a film leader tab of the same thickness as your transparency and punch the leader for the registration.

The film punches that I use are made by Condit Mfg. in Sandy Hook, CT.

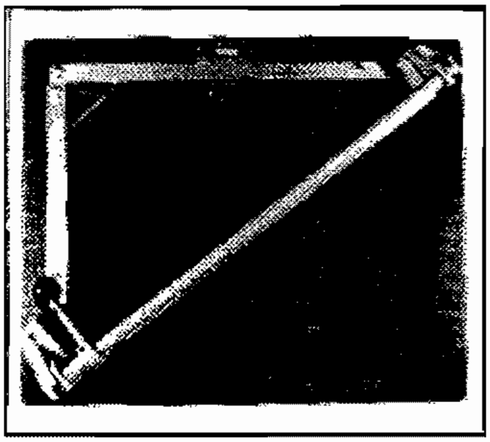
Condit Mfg. makes the various film punches in different sizes and different configurations. Some of the punches produce the holes on one side of the film. I prefer a diagonal system so that I can easily spot a change in film size.

The reason I like the Condit system is that the holes and pins are small, only 1/16th of an inch in diameter, and can be placed in the outer border edges of a sheet of 120 film.

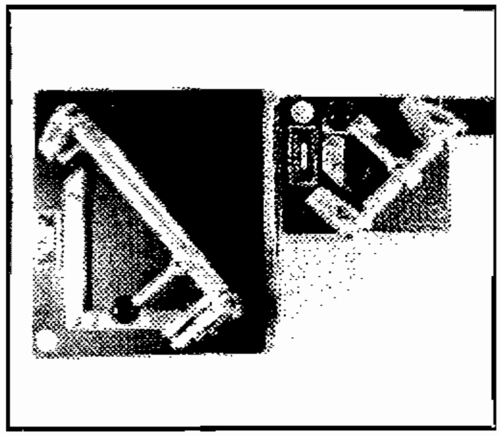
The contact system that you use must have a pin system that will match the holes produced by the punch, to within .001 of an inch. The holes will be about 1/16th of an inch in diameter and spaced apart to fit the punch perfectly.

Most of the pin systems have the holes drilled in glass and the pins cemented in place. They must fit perfectly, otherwise the effort of making an accurately registered print will be in vain.

1. Equipment & Supplies



8x10 Film Punch



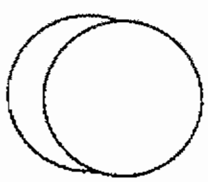
2 1/4 and 4x5 Film Punches

The pin spacing must match the pin holes produced by the film punch.

Here is a method of finding whether or not your transparency has changed size due to changes in humidity. Punch a clear sheet of Estar based film. Place it on one pin only. Swing the other end of the film with the hole in it close to, but not touching the other pin. Tape the un-pinned end of the film to the glass. Cut off a small triangle corner of the film that is taped to the glass.

This triangular piece of film with the punched hole should remain there to check the size of other transparencies.

Now, place a transparency that has been punched, on one pin and swing the other end over the taped triangle corner of film to see if the two holes match.



A difference in the hole position indicates out-of registration.

1. Equipment & Supplies

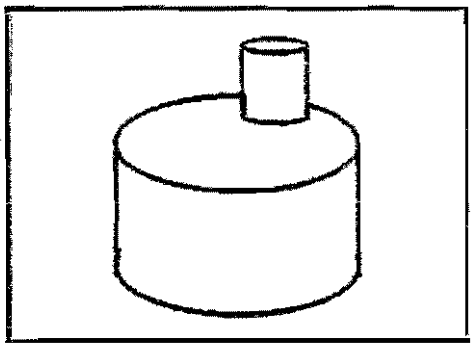
Alignment of Registration Pins
Film Registration Notcher

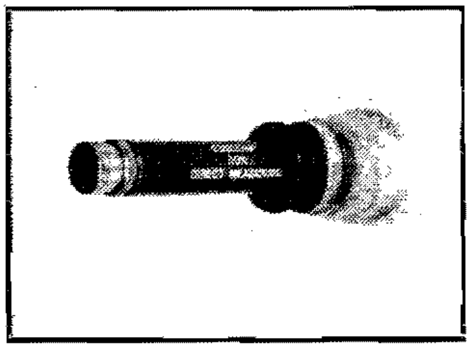
The contact system that you use must have a pin system that will match the holes produced by the punch, to within .001 of an inch. The holes will be about 1/16th of an inch in diameter and spaced apart to fit the punch perfectly.

Most of the pin systems have the holes drilled in glass and the pins cemented in place. They must fit perfectly, otherwise the effort of making an accurately registered print will be in vain.

The pins supplied by Condit are made so that the cement can be loosened with heat, and the pin, which is on a concentric base, can be turned to either increase or decrease the space between the two pins.

Alignment of Condit Registration Pins



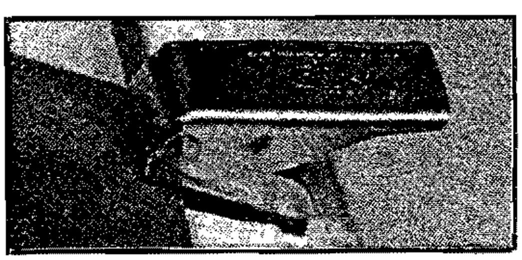


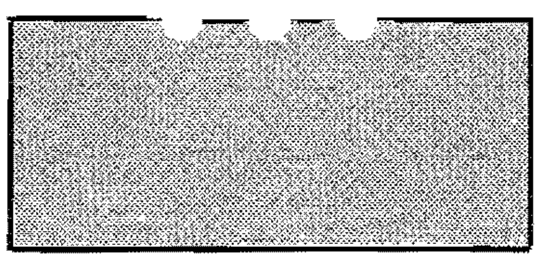
Condit's Concentric Pin **Edmund Scientific 50 X Microscope**

I use a 50 power microscope to measure the distance between the pins and make sure that it is within .001 of an inch.

A simple film Identification Notcher.

Some means of identifying the film in the dark is also a must.
Instead of using a scissor and cutting corners of the film in order to identify it, I use an inexpensive single hole paper punch and make little half moons in the edge of the film, which makes it much easier to find the correct sheet of film in the dark.





1. Equipment & Supplies

Needless to say, a quality **timer** capable of settings to within a 1/10 of a second is very necessary. I have used the **Omega**, and the **Gralab** timers and they are excellent. There are others on the market that are also good.

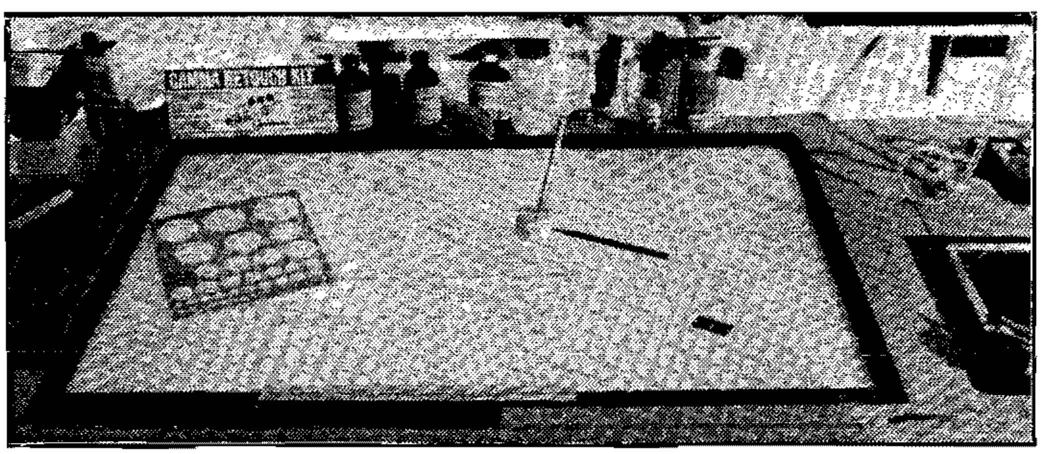
The only thing to be aware of is this: **Do not electrically overload your timer.**

If the timer has a capacity of 600 watts and you have a 1000 watt lighting system, use a relay system and protect the timer from burning up.

The timer should also be connected to the enlarger through a voltage regulator or stabilizer.

Working Tools

You will need things like triangles, masking tape, silver tape, black tape, opaque, cocine, razor blades, X-Acto knives, pens, pencils, note pads, graph paper, a small scientific calculator, clothespins, grey scales (3 step and 21 step), brushes for spotting and retouching, Spotone retouching fluid, and tools for cutting out friskets for making hold-out or burn-in masks, magnifiers, film cleaner, toweling, tissues, and any other tool that can be used in this process.



This light table is also used when loading your separation negatives into the carrier in order to make sure that the separation films and masks are oriented in the same direction, and that they are clean.

Without the correct equipment and tools of the trade, making Dye Transfer prints would be a difficult job.

Some of the chemicals needed for processing.

We must choose the correct developers for our separation negatives, masks, and matrices. There are many kinds of developers and fixers made by various manufacturers. You can choose whatever pleases you.

I use the following processing chemicals.

To process principal masks, use 25cc of **Kodak HC-110** concentrate to 1 liter of water, at 68° F.

To process separation negatives use 30cc of **Kodak HC-110** concentrate to 1 liter of water at 68° F.

To process highlight masks use either **Kodak HC-110,** 25 cc per liter of water , or **Kodak D-11** undiluted, both at 68° F.

Use Kodak Rapid Fixer for all separation negatives, principal masks, and highlight masks.

Use the **Kodak C-41** process fixer (non hardening), for fixing the matrices.

Use a **1% acetic acid** as a stop bath.

The chemistry for processing the matrix film is **Kodak Tanning A and Tanning B Developer.**

Later in this book you will find formulas for the tanning developers.

The various films used in producing separation negatives and masks are as follows:

Kodak Super XX Film, Kodak Pan Kodalith Film, and Kodak Pan Masking Film.

Other films can be used, but these are the materials that I use, and with which I have had years of experience.

1. Equipment and Supplies

These are the essential materials and chemistry that are necessary for producing quality prints from transparencies, with predictable results.

Other chemicals needed for fine-tuning the color balance and density of a print will be discussed in Chapter 11.

Grey Scales

I use two sizes of grey scales. The **Kodak Q-6C**, (3 step grey scale) the **Kodak Photographic Step Tablet No. 2, (21 Step Tablet),** or the **Stouffers (21 Step Tablet).**

Sharp Cutting Separation Filters

The filters used in exposing masks and separation negatives are the **F29 (Red) , the N 61 (Green) , the 47B (Blue)** and for working with Kodachrome **(K 14 process) use a 25 (Red).**
These are available from any Kodak dealer in 2" or 3" square gelatin filter sizes.

Enlargers

The **enlarger** choice is one of preference. I don't know of any enlarger that wouldn't work. The main thing to consider is the availability of the registration equipment needed for the enlarger.

The **brand** of enlarger to choose is really up to the reader. Do you want the smooth even light source that will produce clean prints, or would you rather have a condenser enlarger so that the detail is almost etched into the print material.

There are reasons for making a choice. For instance, if you are printing women's heads for cosmetic ads, then a diffusion enlarger would be the best for you. On the other hand, if you are printing nuts and bolts, or automobile ads, then a condenser might be the better choice. However, with the systems you will learn about from this book and video, it really doesn't matter which enlarger you choose.

Every enlarger has the potential to produce a specific contrast with any given material. However, without a densitometer, it would be impossible to determine the densities of the grey scales and come up with any accurate conclusions.

1. Equipment and Supplies

Before I get into the system, here is what I read in a photo magazine, recently:

I read a letter sent to an editor of a photo magazine and the question was asked: **"Is it true that a condenser enlarger is sharper than a diffusion enlarger?"** The answer was: "There isn't any difference. Ansel Adams used a diffusion enlarger and his work is not what you would call unsharp, is it?"
The answer is totally in error.

Making a print with 2 or 3 times enlargement, compared to 15 or 20 times enlargement, will tell you immediately which system is **"sharper"**.

However, the choices of enlargers are many.

During the 1940's, there was a "feud" between two great photographers, Martin Muncasi and Phillipe Halsman, about "sharp versus soft" images. The photo magazines had fun showing the different viewpoints of each photographer. Both were right with their viewpoints.

The choice of enlargers really depends on what kind of results you want. The diffusion enlarger is great for portraits or tabletop set ups, or any kind of photographic work.

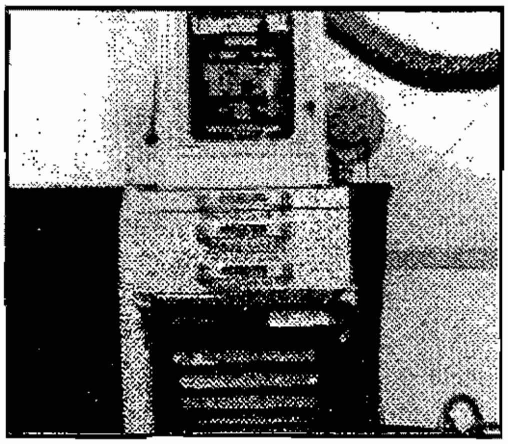
Quality B&W printing is fine with a diffusion type enlarger. Ansel Adams used a diffusion enlarger most of his life. In fact he used a cold light source because of his concern with the **"Callier Effect"**. The images he worked with were usually on 8x10 film, so the kind of enlarger wasn't critical, as far as sharpness was concerned. Even a 30x40 print was only a 4 x blowup. He was more concerned with evenness.

Once you make up your mind on what system you will use, you will still have a choice of many brands.

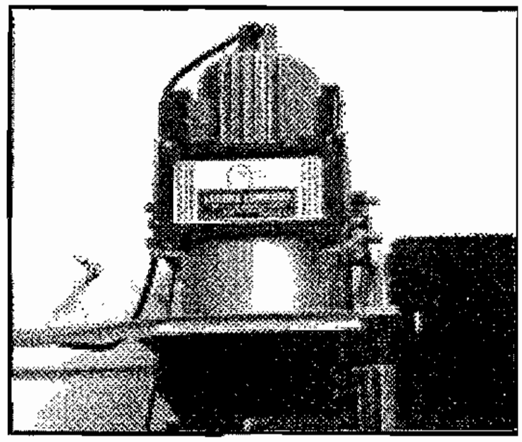
Once you make that decision, there remains the question of size. The size to make your prints is not important, but the size that you will make your separation negatives is the first consideration.

If you want to make extremely large prints, then consider a horizontal enlarger. Durst or Devere both make a superb enlarger with every kind of light source and filtering system.

1. Equipment and Supplies



Vertical Durst Enlarger



Omega D2 Enlarger

Some of the enlargers are motorized. This is a luxury that really isn't necessary because once you start making matrices for a Dye Transfer print, and a size is determined, your enlarger may stay in that position for quite some time.

The **Durst** enlarger is one of my favorites because it is so well built. The rigid columns make it ideal for good registration without resorting to too many locking gadgets.

The Durst condensers are well made and will cover the negative precisely, thereby allowing you to utilize all of the available light. The enlarger is also capable of being turned horizontally, enabling one to make extremely large blow-ups. The various light sources enable you to choose between condensers, diffusion, or dichroic color heads.

The **Elwood** enlargers, which are not being produced any longer, but were made in great quantities at one time, are still used by many labs, mainly because of their price, and the availability of the registration carriers made by Condit Mfg. But you had better be prepared to throw away the light source built into that enormous silvered dome. It is very uneven.

The **Fotar** is also very well made. It is probably the best buy for the money in large enlargers. The manufacturer will supply any light source that you desire. The fact that the enlarger is solid and rigid is very important. Any enlarger should be able to be easily handled and a joy with which to work.

1. Equipment and Supplies

As far as price is concerned, it's hard to beat an Elwood enlarger. Remember to discard the light head and make a simple box, 14x14 inches sq, and 16 inches high, with four 500 watt enlarging lamps screwed into it's top. Line the inside of the box with metal mirrors. Place a sheet of flashed opal glass to diffuse the light at the bottom of this box, just above the film plane.

To make sure of evenness, place an easel meter on the easel and read across the entire width and length of the light coverage on the easel. A good light system will hardly move the needle.

You can get enlargers and light sources from the **Condit Mfg Co. in Conn. and the Lens and Repro Co. in N.Y.** In fact, Repro Co. can even sell you an enlarger light head that was invented by **Glen Petersen of N.Y.** (formerly Petersen Color Labs). This head has four 375 watt quartz lamps around the perimeter of a spun aluminum white dome, which lights up evenly and smoothly, producing the most even light source I have ever seen.

The main thing to look for, other than the light source, is whether or not the enlarger can be fitted with the registration carrier that will take the size film you intend to use. This is the most critical pre-requisite for purchasing any enlarger for the Dye Transfer process.

Can you make your own devices for registration? If not, then you must find the right person or company that can modify your enlarger.
One solution may be to call a graphic supply house first, and get a recommendation from them as to what would make a good system.

However, since I have been through the mill, for professional registration equipment I would recommend **Condit Mfg, in Philo Curtis Rd, Sandy Hook, CT. 66482**

Enlarged separation negatives require a special enlarger

There are quite a few choices of enlargers. The kind of light source, and availability of registration equipment is very important.

If you decide on a condenser enlarger, make sure the condensers are the right size and that they are free from defects.

1. Equipment and Supplies

The enlarger lens in any kind of system should be the best that you can afford.

My favorite enlarger is the Omega D2, with variable condensers.
I can use this enlarger to make separation negatives from very small originals, from a 16mm to a 4x5 original.

The color filters can be placed where they belong, between the image in the carrier and the light source.

All of the necessary registration equipment for this particular enlarger is available from Condit Mfg. I know I keep mentioning Condit Mfg. and this may sound like a commercial for them, but I know what they are able to do. If you can design a system and can find a machine shop to make the things you need, then do it.

When you are planning to make enlarged separation negatives from small originals, such as 35mm, and 120 films, then I would recommend that you use a condenser enlarger to make enlarged separation negatives. The reason for this is **image detail.**

It's easy for the detail in an image to disappear because of lack of sharpness caused by flare or diffusion. Larger originals do not suffer this loss. However, this means that the enlarger must be easy to handle, easy to clean and keep clean, and above all, **be very rigid.**

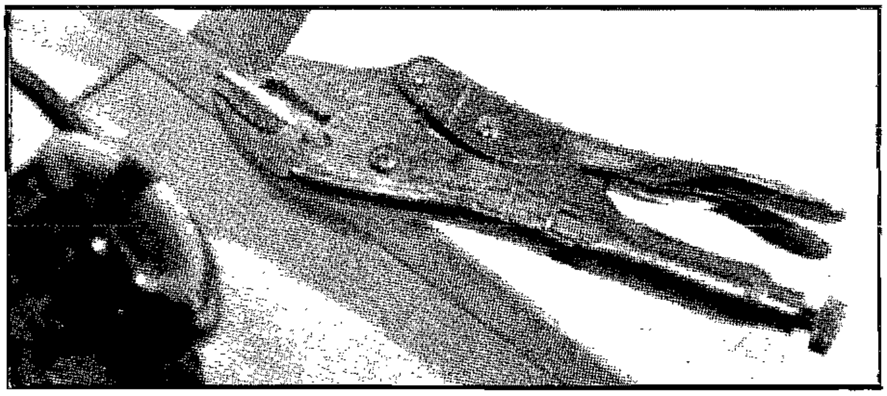
The newer enlargers made by Omega and Saunders are very good. The new breed of 4x5 enlargers from Durst are the best that I have ever seen. They even come equipped with their own registration system. The system isn't as easy to work with as Condit's, but it does work well.

I prefer to make my separation negatives as large as possible on 8x10 separation negative film. You could, of course, make the negatives on 4x5 film, but I have the larger system and it does produce better results. I will then use my 8x10 enlarger to make the matrices.

My 8x10 enlarger happens to be an old **Durst Laborator 184.** It uses condensers and is equipped with a "pulsed zenon" light source with 6000 watts of light.

1. Equipment and Supplies

The small enlarger should also be fitted with a locking device which keeps it from moving and makes it rigid. I keep my small 4x5 Omega from moving by attaching an aluminum bar to it's film carrier area, and fastening the other end to a piece of angle iron using a **"vise grip tool"** as the locking device.



The Vise Grip Locking Device

The light source for the separation enlarger can be a diffusion type, but I prefer a condenser system because it will produce sharper edge effects and a set of crisper separation negatives.

If you are concerned about dirt specks and dust, read on, and you will learn how to eliminate dust and dirt marks on the negative when a condenser enlarger is used.

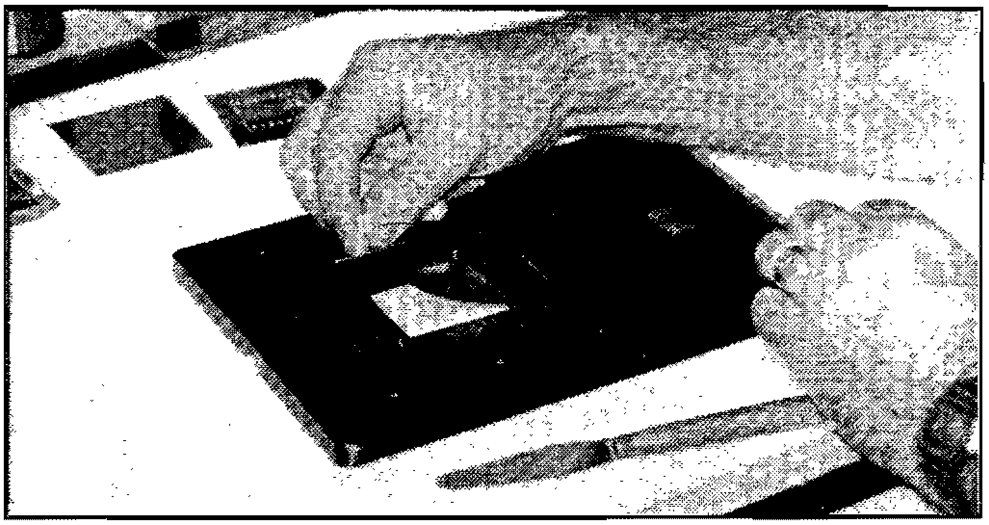
You will also need a small diagonal punch for the small transparencies. I use two different sizes. The 4x5 is used for 120 film sizes and the 2 1/4 sq. punch is used for the 35mm transparencies.

The enlarger could be fitted with either a point light, a single enlarging lamp, or a group of lamps for the light source.

The point light source is a system that produces extremely sharp separation negatives. I will go into this at great length later in chapter 8. I have used the point source for over thirty years and I will tell you how it works.

I personally prefer a condenser system using a 250 watt bulb.
You will also need registration carriers for the smaller enlarger. These carriers can be purchased from competent machinists who specialize in producing registration equipment, such as Condit Mfg. in Sandy Hook, Conn.

1. Equipment and Supplies



"Oil" Registration Film Carrier.

An explanation of how to use this oil registration film carrier will be found in Chapters 7 & 8 when the procedures for making enlarged separation negatives from small transparencies are detailed.

2. Enlarger Density Range

It is important to understand what causes things to go wrong and learn how to correct them.

Printing Variables

There are fluctuations in temperature, electrical voltage, emulsion speeds, lenses, age of lamps, chemistry mixing, water quality, and many other things that can make accurate predictions sometimes impossible.

The differences in enlargers is probably the most important thing to understand.

Your enlarger, and the role it plays in making masks and separation negatives is the first thing to evaluate in this, or any other photographic process.

All enlargers will produce a certain amount of contrast with a given photographic material. A diffusion type will produce less contrast than a condenser type. But, how much less? It depends. **The main variable is the enlarger, which is often overlooked.**

In order to make accurate masks you **must** know the maximum density range your enlarger is capable of printing.

There are diffusion and condenser enlargers, cold light sources, warm incandescent light sources, point light sources and many combinations of the same, and the lens alone will contribiute to the dilemma of variables.

How do we know what density your enlarger can print?

Here is the procedure to determine the printing density range of **your** enlarger:

The first thing that I do is to compare the matrix film exposure to black and white printing because that is basically what Dye Transfer printing is all about.

The first piece of equipment that you must discuss and investigate is the **enlarger that you will be using to make the matrices.**

2. Enlarger Density Range

This may be the tail end of the process, but this is where your first concern must be focused.

Your enlarger **will produce a specific amount of contrast** with a given photographic material and a specific development standard.

If you were to make a black and white print with your enlarger, you could use a variable contrast paper and make most negatives fit the density range that pleases the eye.

The point that I am making here is that the contrast is first influenced by the enlarger.

Other things also influence contrast, but the enlarger is the first place to look.

If you were forced to use only a number 2 grade paper, and you had the option of remaking the negative, you would soon make few new negatives by finding the proper contrast range that the enlarger required to make a good print.

The fact that the enlarger produces a given contrast range, with all other things remaining equal, is in our favor.

We can tailor-make our separation negatives.

We can produce separation negatives that will fit the contrast range of the matrx film properly.

The next problem and hurdle to cross over, is the enormous amount of contrast that the average transparency contains.

The density range is so great that if you attempted to make separation negatives directly from the transparency, the results would be much too contrasty. You will have had to reduce the films' gamma of development to such a point, that colors would lose their saturation and the print would look muddy.
The only way to reduce the contrast of the original transparency without losing the color saturation is by "masking".

2. Enlarger Density Range

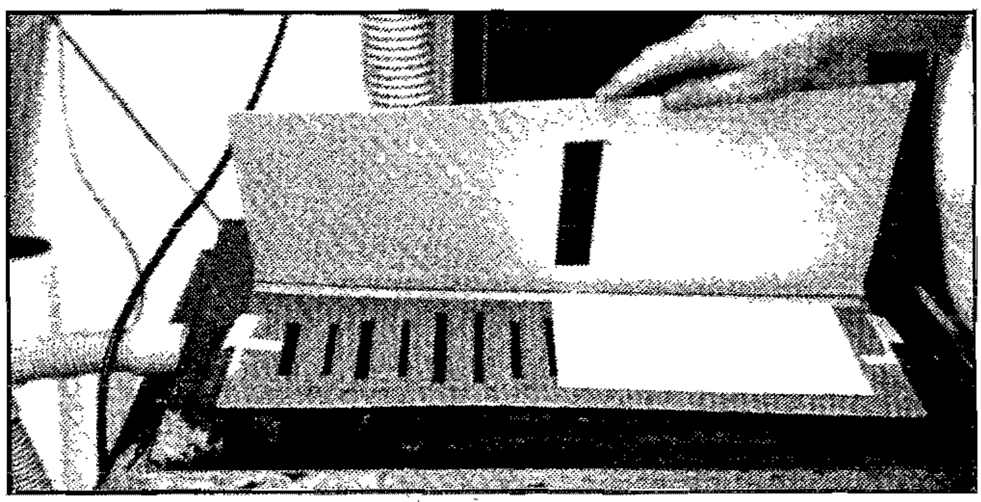
How do you find the contrast range of the enlarger, or the useable density range?

Mount a 21 step film grey scale (Kodak, or Stouffers) into a sheet of opaque paper or film and place it in the enlarger.

At this point, in a red 1A safelight darkroom, punch an 8x10 sheet of matrix film, emulsion down, so that you can place the film on the registration pins. Use the enlarger to size the image of this 21 step grey scale on the easel so that it is about 7 inches long.

Then make several different exposures of this grey scale onto the sheet of matrix film through the base side. When you vary the exposures, you will insure some success in getting one exposure that looks normal.

You can move the matrix film by using a step and repeat exposure jig, so that you can fill the film with a series of different exposures.



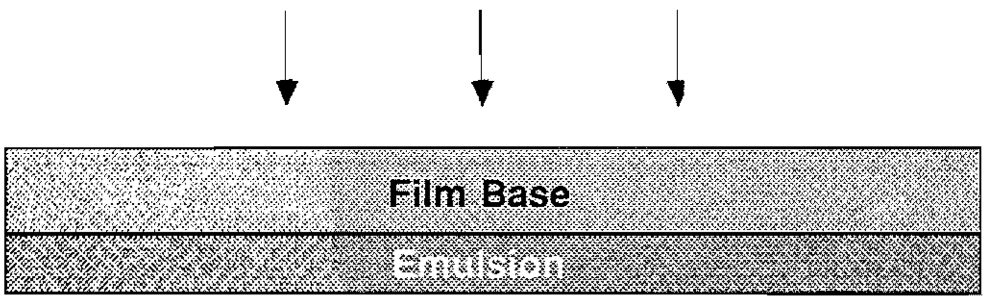
A Step and Repeat Jig.

2. Enlarger Density Range

Exposing Matrix Film

Expose the matrix film through the base so the exposed emulsion will adhere to the film base after processing.

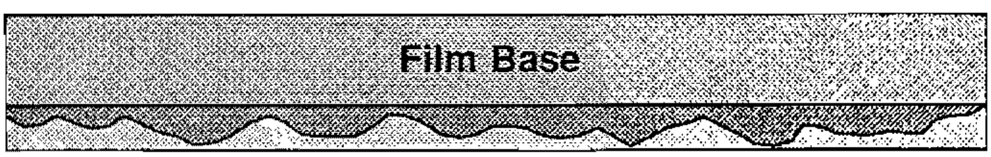
Exposing Light Source



Developing the Matrix Film

The next step is to process this one sheet of matrix film in Kodak Tanning A and B Developer. Follow the processing instructions carefully.

In an 8x10 tray place 300cc of tanning B solution at 68° F.
In a small graduate place 150cc of the tanning A solution.
In the dark add the tanning A to the tanning B in the tray.
After 10 seconds of mixing the two solutions, add the matrix film to the tray and agitate gently from side to side, emulsion up, for 2:30 minutes.



Developed Emulsion

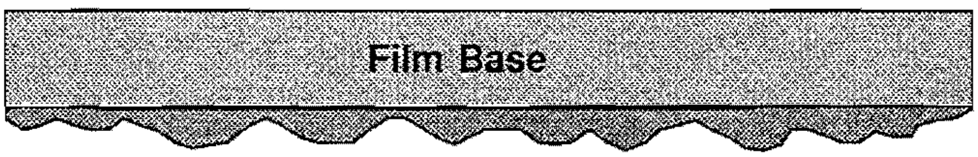
2. Enlarger Density Range

Fixing and Hot Water Rinsing Matrix Film

Then place the matrix film into a 1% acetic acid stop bath (500cc) for 45 seconds.

Then place the film into a tray of C 41 non hardening fixer for one minute.

Hot water rinse the film, emulsion up, until all traces of dissolved gelatin are gone. Then hang to dry.



Gelatin Relief Image After Fixing and Hot Water Rinse

While the matrix is drying, mix up a gallon of **Kodak Paper Conditioner.** Rinse a sheet of **Dye Transfer Paper** in hot water for 5 minutes then add the sheet to the tray of Paper Conditioner. Let it soak for 20 minutes.

When the matrix has dried, place it into a moving tray containing cyan dye, emulsion up. Let it soak for 5 minutes.

Now, remove the matrix film from the cyan dye and let it drip until you can count the drops and place it in the first of two rinse trays containing 1% acetic acid.

Rock the tray for one minute. Then place the matrix film into the second tray of 1% acid rinse which is a holding tray. Time here is not critical.

Remove the paper from the tray of paper conditioner and place it on the transfer table. Carefully position the matrix film on a set of register pins and use the roller to roll the matrix film in contact with the paper, emulsion to emulsion, which will transfer the cyan dye.

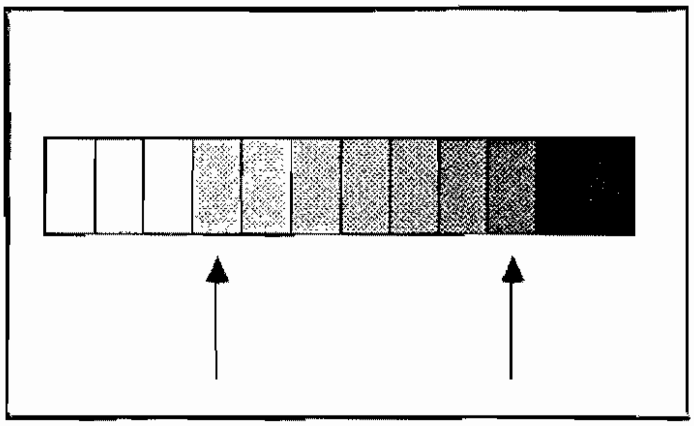
2. Enlarger Density Range

Matrix Film Contrast Test

When the transfer has been completed, remove the matrix film and examine the result.

Place the print in a well lighted area. It needn't be dried. Examine the print by looking at it through a **Red 29 Filter.**

Try to find the area at the highlight end of the cyan grey scale, where the whites just begin to show detail. Then examine the dark area of the cyan grey scale and find where the density starts to lighten from the darkest cyan density.



Cyan Test Print Grey Scales

Mark the two selected areas of the Cyan Printed grey scale.

Find the exact same steps on the **original grey scale**.

Use a densitometer and read these two areas on the original grey scale and subtract the highlight reading from the shadow reading.

The result will be the **density range** that **your** particular enlarger needs in a separation negative in order to produce a print with details in both the shadow and the highlight areas when using matrix film.

This density range is unique to your very own enlarger, film, chemistry, mixing, dilution, water, agitation, air, temperature, light source, and almost any other thing that could influence matrix contrast.

2. Enlarger Density Range

Summary of Steps

Here are the summary of steps to find your required enlarger density range.

1. First make a series of enlarged exposures of a 21 step grey scale onto a sheet of matrix film.

2. Process this sheet of matrix film in Kodak Tanning A & B Developer.

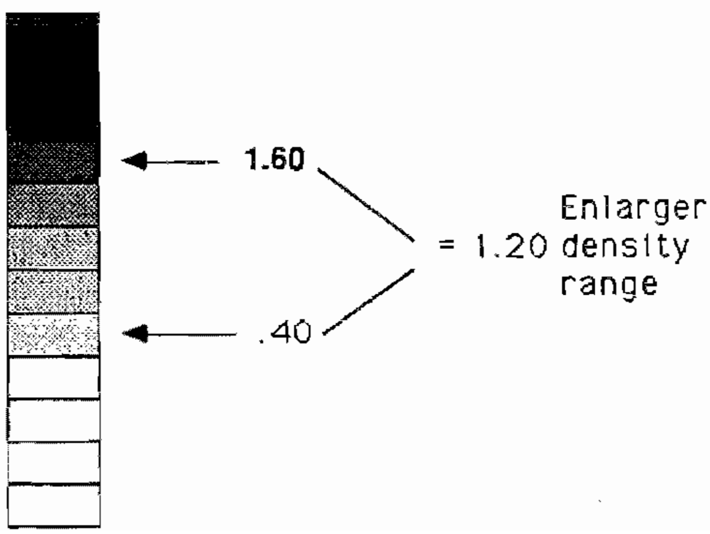
3. When dried, dye this sheet of matrix film in cyan dye, and then transfer the grey scales to a sheet of dye transfer paper.

4. After transferring, examine cyan print through a Red 29 Filter.

5. Find the two areas at the top and bottom of the cyan grey scale where detail just begins to show. Mark them.

6. Find the identical points on the original 21 step grey scale and determine the required density range of **your enlarger** by reading them with a densitometer.

This density range is the required amount needed to produce a full scale print from all the separation negatives when using matrix film.



3. Principal Masks

What is masking?

One form of masking is achieved by making a positive or negative image on a sheet of film made from your orginal transparency, either by contact or enlargement, and then superimposing the mask image in register onto the transparency image to change it's contrast level.

Before any kind of processing takes place, you must understand why masks are made and how to determine the proper contrast levels for each and every transparency.

The method of masking that we are most concerned with in the Dye Transfer process is a mask that will reduce the overall contrast of the original transparency.

A contact exposure is made through the transparency onto a sheet of low contrast black and white panchromatic film. A good film for this purpose is **Kodak Pan Masking Film.**

The mask film is processed to an exact contrast level, and when dried, is added back in register to the original transparency. This will result in the original transparency having lower contrast. **Read this again because it is important to understand this statement.**

At the same time, **color filters** can be used to influence the final outcome of the print, since making a mask through a color filter will allow you to help brighten a color or to saturate it.

Remember, any color filter used will darken that color and it's components, and lighten the opposite colors and their components in the final print.

Here is an example: A **Red filter** used to make the **mask** will

Darken	Lighten
Red	Cyan
Yellow	Blue
Magenta	Green

One Stage Masking

Most transparencies require a mask because they are too high in contrast for most print materials. Without masking, the print would lose details in the highlight areas as well as the shadow areas of the print.

Let us use some hypothetical density numbers and solve the contrast problem of "**how strong a mask should be**" in order to compress the **transparency density range** in order to fit the **enlarger density range.**

Let us do an actual demonstration using only mathematics as our way of solving a problem.

A transparency with a shadow reading of	2.85.
A highlight reading of the same transparency	– 0.45
The density range is	2.40
The required enlarger negative density range is	– 1.80
The **difference** is the amount between the density range of the **original** and the density range of the **required enlarger density range**	.60

Divide the "difference" (.60) by the transparency D.R. (2.40) = .25 gamma.

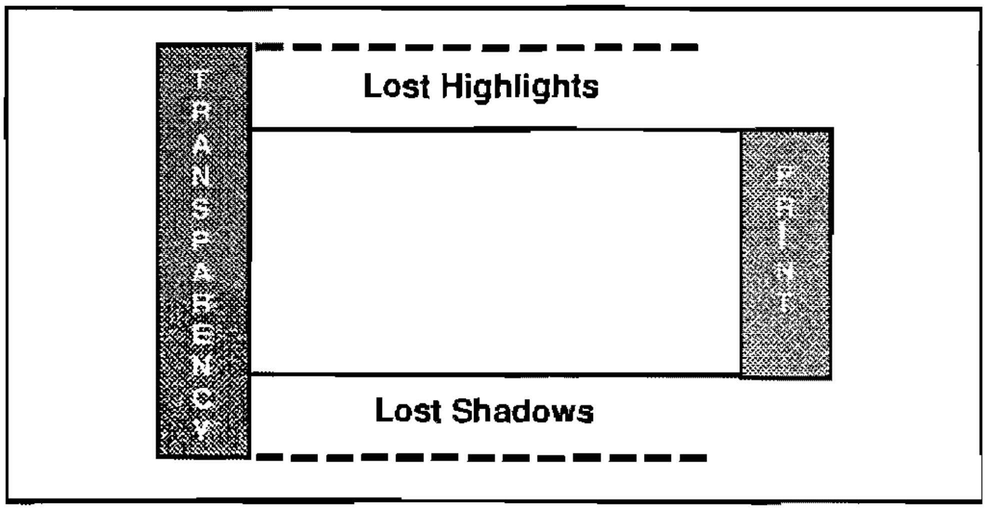
$$\frac{\text{The Density Difference} \quad .60}{\text{Transparency Density Range} \quad 2.40} = .25 \text{ gamma or } 25\%$$

This means that if we were able to make a mask that had a contrast range of 25% of tho original transparency and add this mask back to the original transparency when making the Type R print, we would get good detail in both the shadows and the highlights by compressing the density range of the transparency to fit the contrast range of the Type R material.

Making a mask and then immediately being able to use it is considered a one step operation. This above example is **"one stage" masking"** One stage masking is all that is required when working directly with any material that is directly exposed for a final print without the need for any additional steps. These materials are considered **"final materials"**.

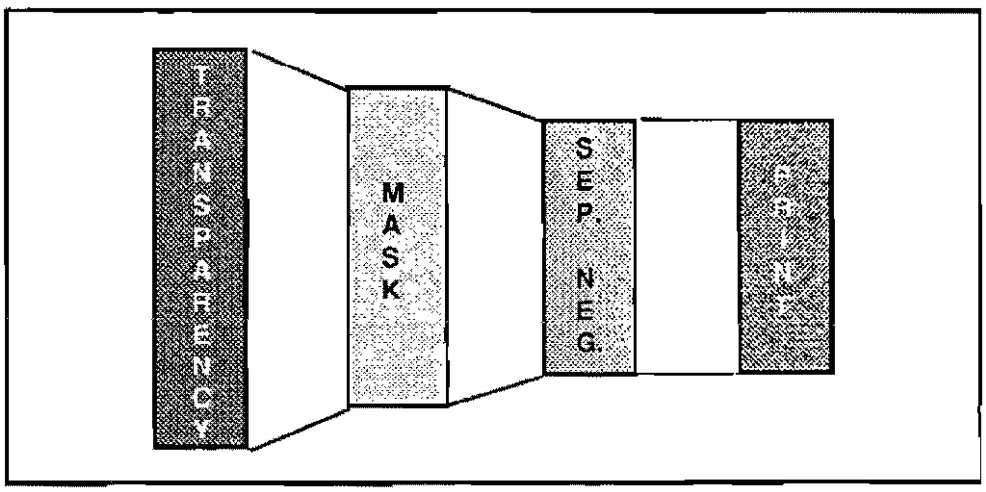
3. Principal Masks

No Contrast Control



This illustrates that the high contrast range of the transparency **will not fit** the density range of the print, thereby losing important highlight and shadow detail in the transparency and producing a poor quality print.

With Contrast Control



This illustrates how the high contrast range of the transparency has been **compressed** by the mask and the development of the separation negative to retain all the highlight and shadow detail of the transparency in the print.

3. Principal Masks

Absolute repeatability is the key to sucessful printing.

All that is required, is that you have absolute repeatability and accuracy with time, temperature, chemistry, agitation and electrical voltage.

Two Stage Masking

Let's assume that the density range requirements of your enlarger, when making matrices, is 1.20. This means that any time you are going to make a dye transfer print, the matrix film will need a separation negative with a density range of 1.20 in order to produce a full scale print.

How do you take a positive transparency that has a density range of 2.45 and reduce it to a separation negative density range of 1.20? **It is done in two stages.**

This is the essence of CONTRAST REDUCTION

The first obligation that you have is to **reduce the overall contrast to a specific point by masking,** then to even **further reduce the contrast of the separation negatives** when you develop them to a gamma that is less than 100%. Developing film to a gamma of 1 means that although the exposures would be valid, when developing to a lesser gamma, the exposures would have to be adjusted.

Let us go through the procedure once again, just to re-enforce this point.

To begin with, you must know the density range of your transparency.
When making the masks for separation negatives we have an additional step to consider.

We now are reasonably familiar with the method of determining the contrast mask requirements for any final stage material, such as type R or dupe transparencies and even Cibachrome prints.

But when you make a set of separation negatives you must know the **gamma** to which you plan to process your separation negatives.

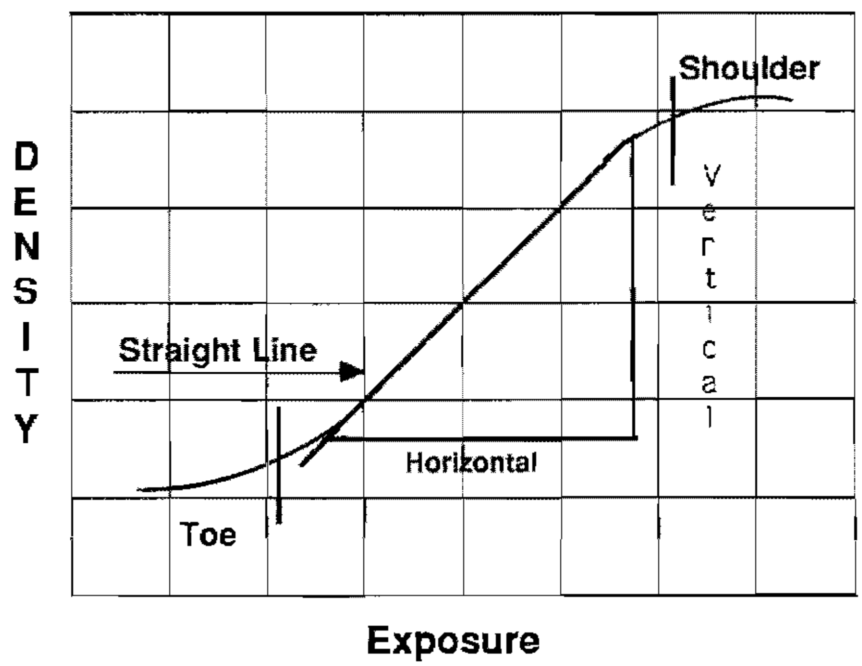
What is gamma?

Gamma is a measurement of the slope of the straight-line section of the characteristic curve of a given photographic material under specified conditions of development.

Gamma is a measurement of the relative amount of contrast achieved in a sheet of film by developing.

This means that if you develop your negatives to anything less that 100% gamma, you must make an adjustment to your exposures for this proportional difference.

How Gamma is Determined
(Gamma also means percentage)



$$\text{Gamma} = \frac{\text{Vertical Distance}}{\text{Horizontal Distance}}$$

This is the universal method used to determine gamma.

Why must we choose a specific gamma?

All films have a limit to which they can be processed. After a certain point, the highlights stop developing while the shadows keep developing. This will completely destroy the curve shape of the negative material.

The different development times for the three separation negatives usually means that the blue filter separation negative had to be developed longer than the red filter and green filter separation negatives. Sometimes quite a bit longer.

If developed too long, the blue filter separation negative would actually flatten out at the highlight end. This is commonly called **"chemical fog."**

This **"fog level"** occurs at different stages with different film and developer combinations.

The blue filter separation negative is used to determine just how far we could develop this sheet of film without this chemical fog density destroying the negative contrast. I found that at gamma .80 the blue filter separation negative hit the fog level. I dropped the gamma to .75 and found that it worked. So I chose gamma .75 for a safety factor.

The next step is to find out just what the density range of the **C**ombined **M**ask and **T**ransparency **(CMT)** should be, before negatives are exposed and processed to this .75 gamma aim point.

Let's start with the enlarger.

To establish a **Key Reference Number** for the **CMT** that will be used in our calculations whenever we make masks and separation negatives, we must divide the chosen gamma into the required separation negative density range to obtain the necessary **CMT.**

This is the **key number** used in **all future calculatiions** when **making masks** for the Dye Transfer Process.

3. Principal Masks

Combined Mask and Transparency
Establishing the Correct Gamma

My method of producing accurate separation negatives starts with making the masks to the correct contrast before I expose separation negatives. When the masks are combined with the transparency, I will have the correct combined contrast range. My separation negative exposure and development times are almost fixed and will require little adjustment.

My theory is simple. I try to bring the density range of the combined mask and transparency **(CMT)** as close as I can to it's correct aim point so that when I process the separation negative to a gamma of .75, they will result in a set of separation negatives that will have good detail in the shadows and highlights.

In conclusion, the simple fact is, I am bringing the transparency to it's proper contrast range by:

1. Reducing the contrast by masking.

2. Developing the separation negatives to a gamma of less than 100%.

Here is an example:

$$\frac{\text{Required separation negative density range of } \mathbf{1.20}}{\text{Develop the separation negative to a gamma of } \mathbf{.75}} = \mathbf{1.60}$$

In this example, our **<u>Key Reference Number is 1.60</u>** for the required **CMT density range.**

No matter what the density range requirements of **your** enlarger happens to be, you can determine in advance what the correct combined mask and transparency **(CMT)** density range for **your system** is, to make a balanced set of separation negatives.

3. Principal Masks

Here is an example of how to use this CMT system:

Transparency density range of	**2.40**
Combined mask and transparency (CMT)	**-1.60**
Density difference is	**.80**

$$\frac{\text{The density range difference} \quad \mathbf{.80}}{\text{The Transparency density range} \quad \mathbf{2.40}} = \mathbf{.33 \text{ gamma or } 33\ \%}$$

The mask should be developed to **.33 gamma.**

In Summation: This system will allow you to make separation negatives to the correct density range every time without resorting to raising or lowering the contrast of the separation negatives and possibly producing chemical fog or other undesirable effects.

Making a time-gamma chart

This is the **key** to unlocking any mystery about determining how to make the correct masks for each transparency.

In most early literature about masking for the Dye Transfer process, you will find reference to making only one mask, usually through a magenta filter, and later, two masks were recommended. All of the publications recommended that a 25% mask strength be used for every transparency.

Who determined that 25% was the correct amount? I don't know, but in my opinion, using any fixed percentage is a mistake because all transparencies have different density ranges.

Here is an example, and a reason, for my concern.

If you were to separate a transparency that was composed primarily of a white shirt against a white background, and made a 25% mask in order to make separation negatives, you would never produce a print that had separation in the highlight end of the scale, namely, the white shirt and the white background.

3. Principal Masks

On the other hand, if you had a transparency that consisted of a view of New York City's canyons of Wall Street, photographed from the air, and the entire picture resembled a high contrast "Kodalith" in color, do you think a 25% mask would be sufficient to open up the important shadows? **I think not.**

The main purpose for making a principal mask is to reduce the overall contrast of the transparency.

The common system, for many years, was to make two masks, one using the red filter and one using the green filter. This is considered a general masking system that has been used for years, and is still being used by many labs throughout the world.

More realistic colors are a by-product of using two or more color masks to make a set of separation negatives.

How the principal masks are used.

The red principal mask is combined with the transparency when exposing the **red filter separation negative.**

The red filter principal mask is also combined with the transparency when exposing the **green filter separation negative.**

The green filter principal mask is combined with the transparency to expose the **blue filter separation negative.**

This masking system is **supposed** to increase the saturation and cleanliness of certain colors. All this system **really does** for the color of a Dye Transfer print is to increase the saturation of the reds and yellows and lighten the blues and greens, not "color correct".

The **Isolation Color Correction Masking System** in Chapter 14 describes a more accurate color correction system that really works.

3. Principal Masks

Split Masking

For more critical work and higher quality prints, I strongly recommend the split masking procedure where you will obtain more color control and color brightness.

This is a procedure where part of the exposure of the principal mask is made using one color filter and the rest of the exposure is made using another color filter.

Here is an example of one kind of split mask:

Mask #1. **Used in making the Red filter separation negative**
Red filter exposure 60%+ Green filter exposure 40%.
This means that the Red filter received 60 % of it's normal exposure and the Green filter received 40% of it's normal exposure.

Mask #2 **Used in making the Green filter separation negative**
Red filter exposure 90% + Blue filter exposure 10%.

Mask #3 **Used for making the Blue filter separation negative**
Green filter exposure 75% + Blue filter exposure 25%.

This combination of splitting the masks will allow the reds and warm colors to print brighter, and also allow the blues to be slightly cleaner, while eliminating some of the yellow in flesh tones.

There are as many combinations as you can imagine. Some of my friends and competitors have made and used as many as 100 masks on one set of separation negatives.

Usually, **three principal split masks** will do an excellent job on the majority of Dye Transfer prints that you will make.

3. Principal Masks

The method of determining just what percentages should be used comes from experience.

For instance, if a person was wearing a delicately colored yellow jacket and had a fair and warm flesh tone, I might make **mask # 1** as 80% red and 20% green. This would allow the warm colors to print with less cyan in the warm areas, and not become too garish. This mask is used to make the red separation negative.

On the other hand, if a transparency showed a very colorful garden and I really wanted to exaggerate all the warm colors, I would use a 60% red filter exposure and a 40% green filter exposure for **mask # 1 only,** used on the red separation negative.

The **more green** and the **less red** you apply to this particular masking system, will **brighten all the warm colors in the print.**

On the other hand, if you used **100% red exposure for mask # 1,** (used to make the red filter separation negative), the **cool colors** in the print would be **brighter** and the **warm colors would be more saturated and contain too much cyan density.**

If you used **100% green filter exposure for mask #1** (used to make the red filter separation negative), then the **reds and warm colors would scream out loud** and the greens would be darkened in the print.

The difference between pre-masking and post-masking.

There are two methods of masking to reduce the contrast of a transparency.

Pre-mask and post-mask.

Why is it important to know which system to use?

Making the masks first and incorporating them into the separation negatives, is called "pre-masking".

Making the masks after the separation negatives have been made is called "post-masking". These masks are **not** incorporated into the separation negatives.

3. Principal Masks

If you are making a dye transfer print from a transparency, the normal approach to masking is usually a pre-masking system. This system should be used on a transparency that has strong details in the middle and deeper shadow areas of the photograph.

Pre-Masking allows the shadows and middle tones to be opened up. There is no other way to open a shadow when making a print, short of dodging the image during the exposure.

Since the mask is a negative, the first area that will be affected is the highlight area.
These areas will be flattened out by the action of the mask, hence, one of the reasons for the need for highlight masking.

Post-Masking

When a contrast mask is made **after** the negatives have been produced, that is called “post-masking”.

Here is an example where this procedure should be used.
If a transparency of a white cat is photographed against a very light background, then the need to keep the shadows open doesn't exist. In this case, it would be appropriate to make the principal masks from the separation negatives (post-mask), instead of the transparency.
The highlight areas will be unaffected, as far as the principal mask is concerned, because the main area of masking now shifts to the shadows and not the highlights.

Direct separation negatives are made in a camera directly from the subject.

The best way to mask direct separation negatives would be to use a post-mask system. It would be impractical to place masks on register pins in a film holder and retain registration. This would require an engravers camera with built-in register system. If you own an engravers camera, then either pre-masking or post-masking will work.

3. Principal Masks

The technique that has been used by most engravers, as well as Dye Transfer labs, when shooting direct separation negatives from flat art work, has been to first examine the art work. If the shadows are more important than the highlight areas, then **pre-mask.** If the highlights are more important than the shadows, then **post-mask.**

You may ask,
"Why is masking necessary when shooting direct separation negatives?"

This is a good question.
The main reason for making masks from direct separation negatives is to produce some **color correction.**

Masking for transparencies is necessary, first, **to control the contrast,** and secondly, to produce some form of **color correction.**

There is little difficulty in developing a balanced set of direct separation negatives to the required contrast without masking. This was done with the Carbro process. It has even been done with the Dye Transfer process because direct separations can be exposed and developed to the proper contrast without masking.

The trick used by all of the Carbro printers was to make the separation negatives just a bit stronger than necessary, so that masking could be used to reduce the overall contrast and allow the color correction steps that were necessary. But, when working from a normal transparency, the contrast range is usually so great that masking is an absolute necessity for 99% of all transparencies.

My reasons for using the two different grey scales.

There is no reason why the 21 step grey scale couldn't be used to make all of the charts and also be used to make the necessary verifications. The only reason that I am explaining the use of a 3 step grey scale is to simplify the graph plotting procedure and save time.

It is absolutely necessary to use this **21 step scale** when trying to determine the contrast requirements of any enlarger. You must be able to find the disappearing grey scale steps in order for this system to work.

3. Principal Masks

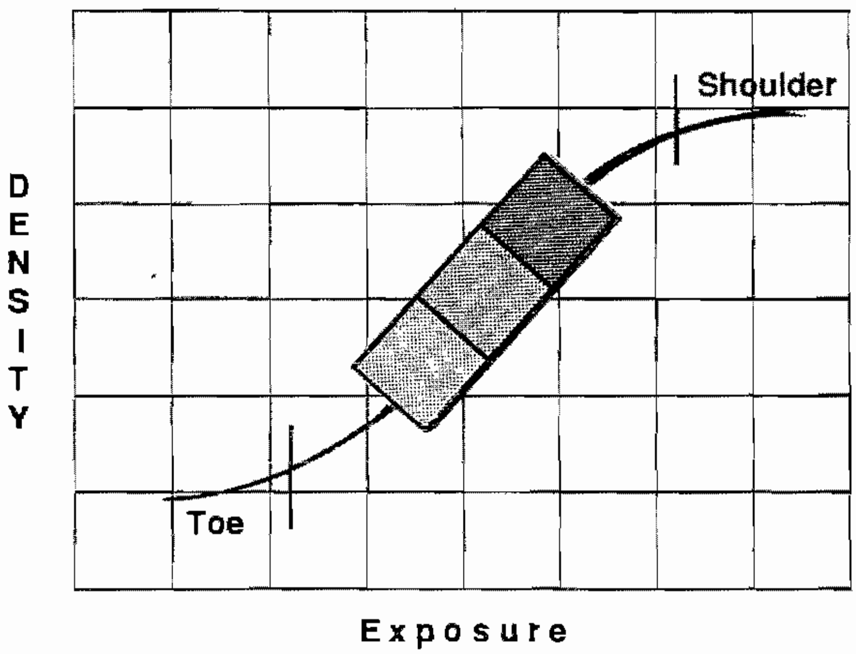
Why two grey scales?

If you wanted to, you could use the 21 step scale to plot all of the separation negatives and masks. This is a time consuming effort, but there is nothing wrong with it.

The three step grey scale Q-6C actually represents the straight line portion of characteristic curve, which is the useable part we need for masks and separation negative calibration.

How Gamma is Determined

(Gamma also means percentage)



The three steps of this grey scale represent the three densities we are concerned with in all transparencies.

The lightest step of .5 represents the **highlights.**
The center step of **1.5** represents the **mid-tones.**
The darkest step of **2.5** represents the **shadows** in a transparency.

3. Principal Masks

The three steps will allow you to determine the usable densities when making the graph, making it easier and faster to plot the numbers, and still obtain the information that is needed.

Once we establish that a specific gamma is found after processing a sheet of film, and all of the processing steps are accurate, we can be sure that any future masks made using the same exposure and development will result in the same gamma. The density range of the mask grey scale when divided by the density range of the original grey scale, should result in conclusive proof of reaching the intended gamma.

The gamma tolerance should be plus or minus .02 from the intended aim point.

The three step grey scale is also perfectly visible through the open sprocket holes in a 35 mm. transparency, as well as along the edge of an 8x10 transparency.

The 21 step grey scale is a **silver image** and is not the best scale to use in an enlarger when mounted to a transparency, because of the fact that light will scatter when exposed to silver and the readings will be erroneous. The three step grey scale is a dye image, the same as a transparency, and does not have this problem.

Other films that can be used for principal masks

Occasionally, you will have a transparency that has strong white edges against a colored background, such as a white hat against a blue sky. With **Kodak Pan Masking Film** you will sometimes get an **image edge effect.** The flared mask will deposit a dark silver flare around the hat producing a very unsightly edgeline appearance.

The way to eliminate this problem is to make the mask with a sharper film that has an **anti-halation coating** on the base and will not flare as much as the soft image Kodak Pan Masking Film which **does not** have an anti-halation coating.

3. Principal Masks

I like Kodak Separation Negative Film ,Type 1 or Type 2. You will have to modify the developer considerably in order to be able to develop down to the low end of the gamma scale.

We have made many masks with Separation Negative Film, Type 1, by diluting our HC-110 developer even more than we did for regular Pan Masking Film. We simply diluted the developer as follows:

> To the 16 oz. bottle of HC-110 developer we usually make a 7 gallon mixture for our regular masks made with Pan Masking Film.

For masks made on Separation Negative Film, Type 1, use only 8 ounces of HC-110 concentrate to 7 gallons of water. With testing for accuracy, you can obtain low contrast principal masks which will allow practical developing times with repeatable accuracy.

If you wish to use smaller quantities, mix 12 cc of HC-110 developer concentrate to one liter of water.

3. Principal Masks

Calibration Procedure

An accurate time gamma chart must be made in order to find the correct exposure and developing times to make principal masks for different gammas. The procedure to find both the exposure and developing times for principal masks is as follows:

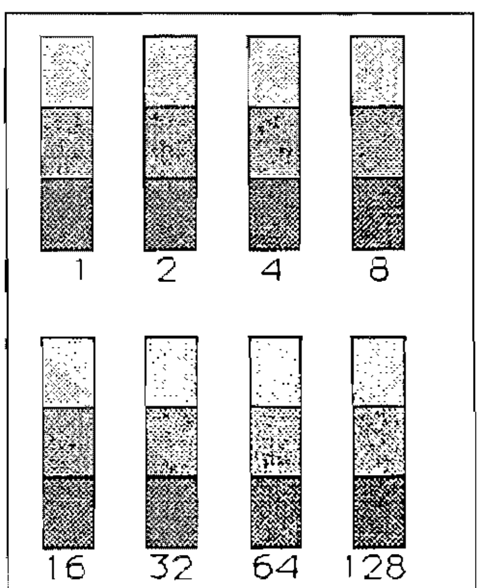
Expose, by contact, on **Kodak Pan Masking Film, a Kodak three step grey scale known as a Q-6C.** I usually cut off the color section and just use the three step grey densities.

Use a **Red 29 Filter** and a step and repeat exposing system to expose 8 three step grey scales on an 8 x 10 (or 4 x 5) sheet of film. Each exposure should be different. Start with 1 second and give all the rest 100 % increases, such as 1, 2, 4, 8, 16, 32, 64, and 128 seconds exposure series.

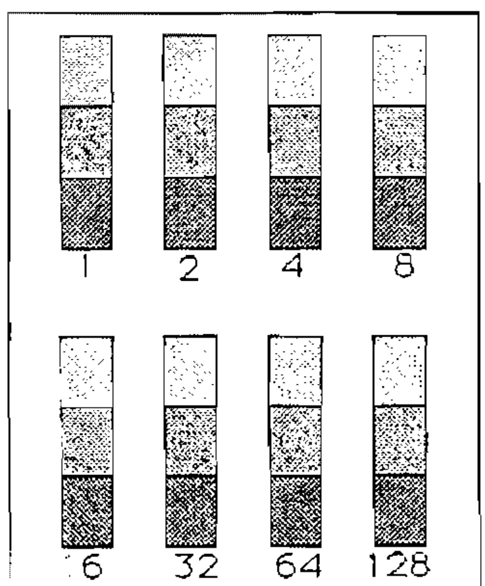
You should be able to figure out how to put 8 exposures on a sheet of film. Simply mount the grey scale onto a sheet of black opaque paper, and move the exposing film over it for each exposure.

Do this twice., so you will have 2 sets of identical exposures on two sheets of film.

Red Principal Mask Calibration



Dev. 1:30 Min.



Dev. 5:00 Min.

3. Principal Masks

Calibration Procedure

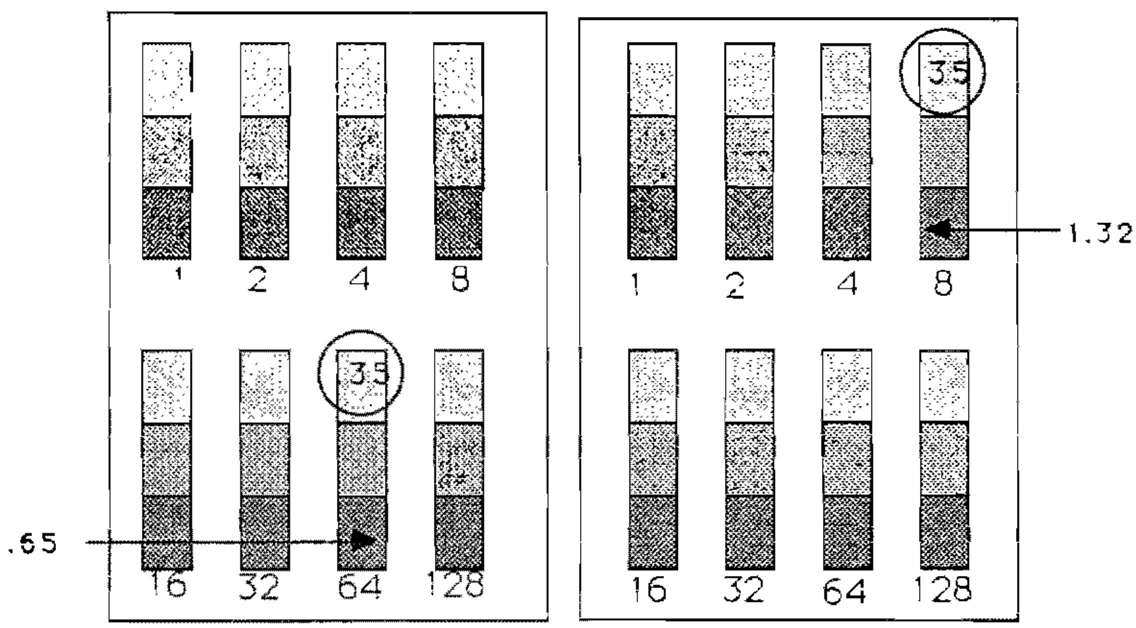
Since this is a test for principal masks, you should use the same strength developer in which the actual masks will be developed in HC-110 developer using 25cc of concentrate per liter of water.

Develop the first sheet for 1:30 minutes and the second sheet for 5:00 minutes @ 68° F.
Process these together in a tray, tank, or tube, or whatever you prefer. I've used trays and automatic processors for a long time and I have tried tubes, but I still like trays.

Whichever method you choose to use for processing your film, remember, it must be repeatable.

We now have two sheets of film with the same exposure series but processed to different development times. Using your densitometer, you should be able to find a .35 density (approx.) reading in the lightest part of the three step grey scales.

Red Principal Mask Calibration



Dev. 1:30 Min. **Dev. 5:00 Min.**

3. Principal Masks

Find the closer density reading to .35 in the red exposure tests on each sheet of film.

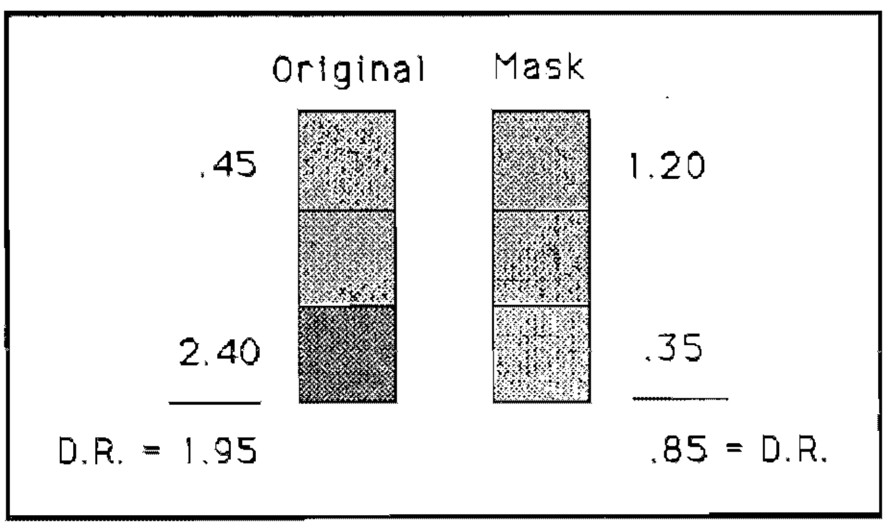
Read the grey scales for the 1:30 minute developed film and the 5:00 minute film. When you find the steps that read .35 for these two particular developing times, you will know which exposure produced that particular reading. **Mark both of these grey scales.**

Now you have two 3 step grey scales picked out for the red filter mask test, and you know the exposure and development times for each one. Read the high and low densities of both of these grey scales with a densitometer and obtain a **density range** for each selected grey scale.

Divide the mask test 3 step grey scale D.R. by the original three step grey D.R. The answer you get will indicate the gamma of development, or the percentage of the mask.

Record your answers. Here is an example of how to determine their gammas.

Gamma with Grey Scales



3. Principal Masks

Calibration Procedure
Gamma with Grey Scales

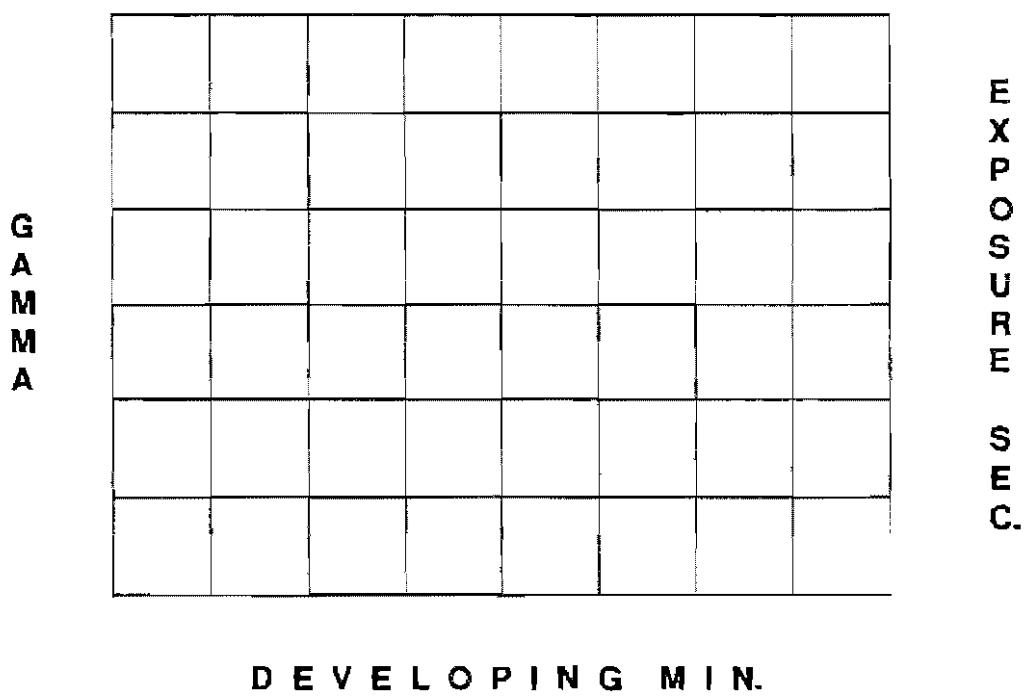
If we divide the original grey scale density range into the mask grey scale density range, the answer will tell us the gamma or the percent of the mask.

$$\frac{\textbf{Test Mask D.R.} \quad \textbf{.85}}{\textbf{Original D.R.} \quad \textbf{1.95}} = \textbf{.44 gamma or 44 \%}$$

Now, it's time to plot a time gamma graph.

This graph layout shows the developing times at the bottom, the gamma on the left side, and exposure times on the right side of the chart.

Graph Layout



The numbers used in these graphs are to help you learn the procedures so that you can make your own calibration graphs using your own techniques, equipment, and procedures.

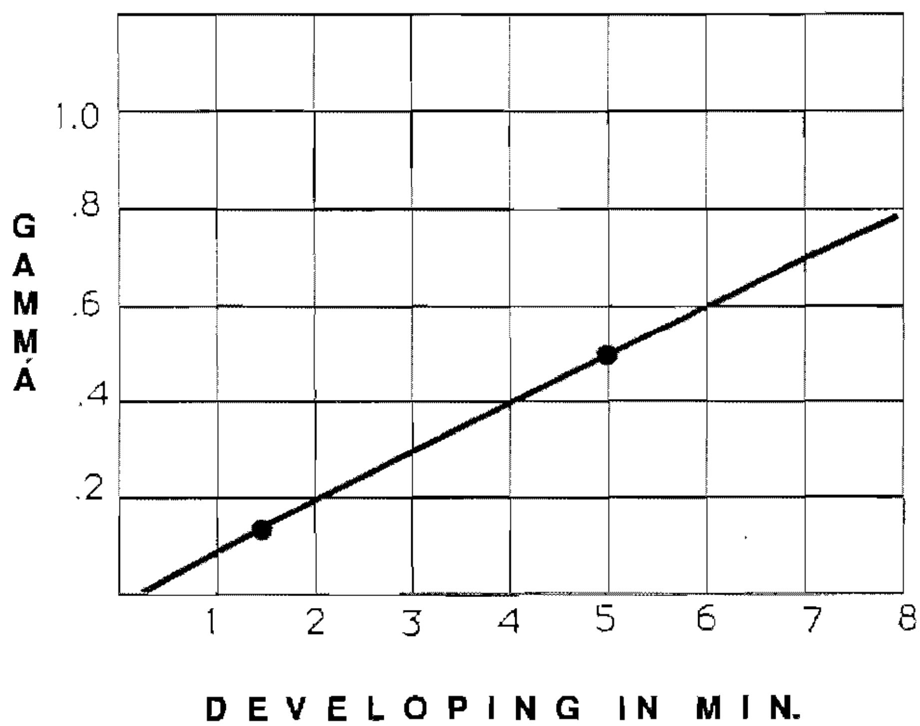
Plotting Procedure

Place a dot where the developing time of 1:30 minutes and the gamma of .15 meet.

Then place a dot where the developing time of 5:00 minutes and the gamma of .50 meet.

Now we can draw a line between the two points and the rest of the gammas and developing times will be easy to locate.

Red Principal Mask
Gamma and Development

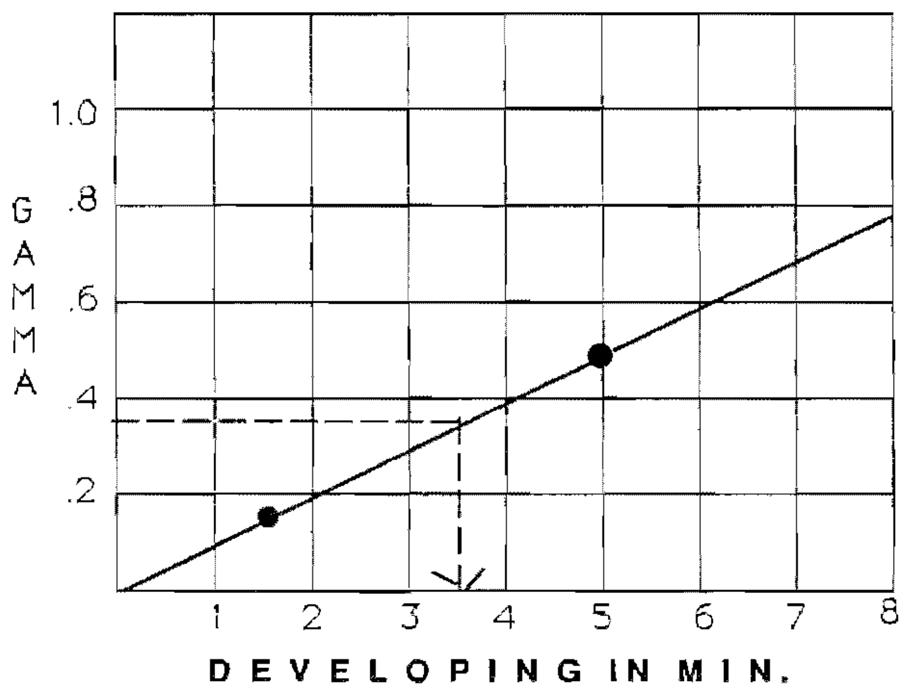


3. Principal Masks

Plotting Procedure

Now this same graph is used to find any other gamma and development time combination.

Red Principal Mask Calibration
Gamma and Development

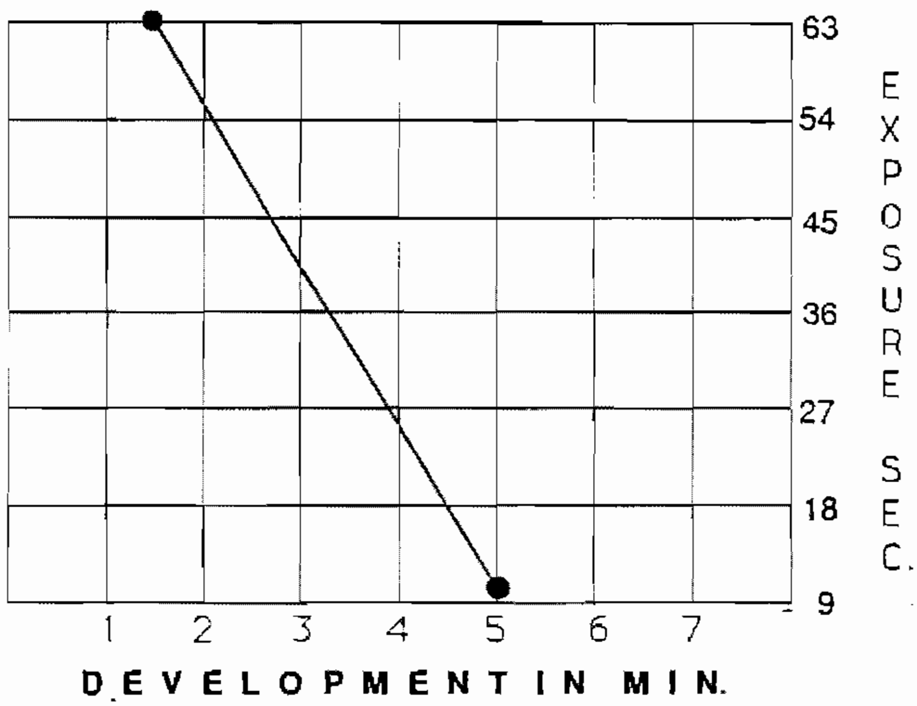


To find the development time for gamma .35, locate the .35 gamma on the left side of the graph, look to the right until you intersect the sloping line, then look straight down until you meet the development times, and there you will find the correct developing time which is 3:30 minutes.

Half of the plotting has been accomplished. To find the correct exposures for any gamma you must plot the 1:30 and 5:00 developing times and the exposures that produced the gammas in the first graph.

3. Principal Masks

Red Principal Mask Calibration
Exposure and Development



To find the correct exposure for any developing time, locate the developing time at the bottom of the graph, and look straight up until it intersects the sloping line, and then look to the right to find the correct exposure time.

Both the gamma and development graph and the exposure and development graph can be combined on one sheet of graph paper.

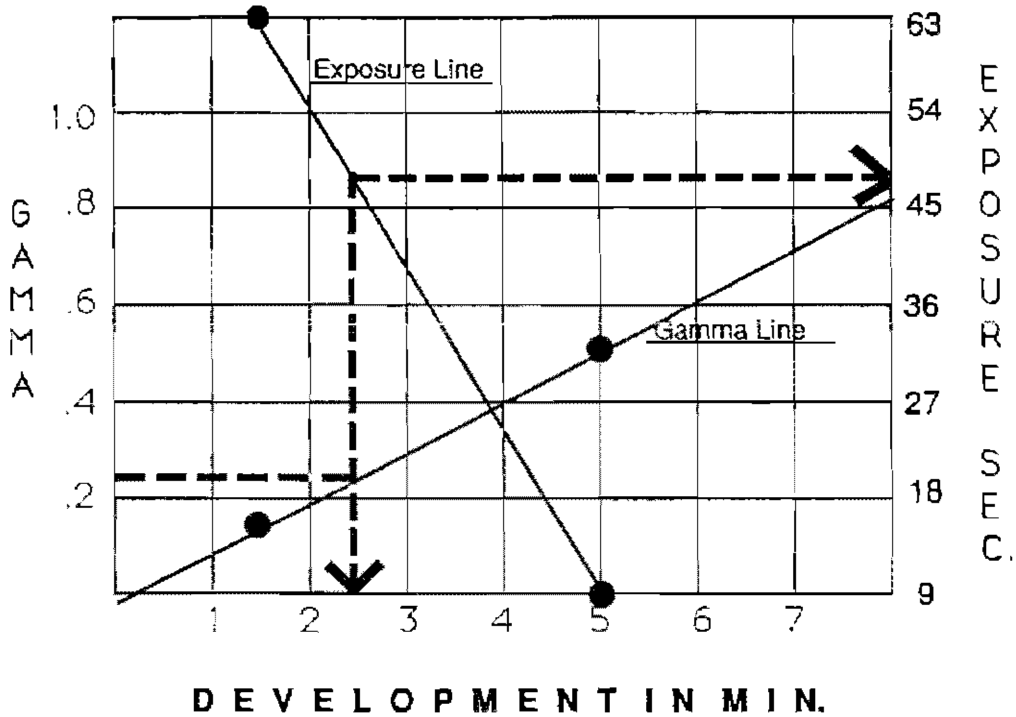
Fot teaching purposes we explained and described them separately.

The next graph will show you how they will look when they are combined.

3. Principal Masks

Combined Gamma and Exposure Graph

Principal Mask Combined Graphs



This combined graph will allow you to find all the exposures and developing times for any gamma.

3. Principal Masks

Let me repeat the steps to review the procedure.

1. Place a dot where the **gamma** and the **development times** intersect for both the 1:30 and 5:00 minute developing times.

2.. Draw a line between the two gamma dots and call this the **gamma line.**

3. Place a dot where the **exposure** and **development times** intersect for both the 1:30 amd 5:00 minute development times.

4. Draw a line between the two exposure dots and call this the **exposure line.**

You will now be able to find the correct exposure and development time for any strength mask that may be required.

Here is how to use the graph.

Determine just what gamma your transparency mask requires, then look at the left side of the graph and find that gamma.

How to find the correct developing time for a specific gamma.

Let your eye follow that line towards the right side until it meets the gamma line. At that point let your eye follow that line down to the bottom of the graph and there you will find the proper development time.

How to find the correct exposure time for a specific developing time.

Now that you know the **proper development time,** again, follow that line up until it meets the **exposure line.** Then follow that line to the right until it meets the **exposures times** on the right side of the graph.

You can now proceed and make a mask that will fit the density range requirements for any transparency.

3. Principal Masks

A red principal mask working chart can be made for all of the gammas from .15 to .50, so the development and exposure times are simplified. Any exposure and development combination can now be found at a glance.

Red Principal Mask Working Chart

Gamma	Dev. min.	Red Exp. sec.
.15	1:30	63
.20	2:00	54
.25	2:30	48
.30	3:00	40
.35	3:30	32
.40	4:00	28
.45	4:30	18
.50	5:00	9

Simply choose your pre-determined gamma, and all of the numbers are at your disposal.

However, these numbers are only used to expose the red mask. The rest of the exposures and filter combinations will follow on the next pages.

3. Principal Masks

Green Mask Calibration

More than one filter can be used to make principal masks. The number of filters is actually up to you. I would suggest that you make provisions for at least two or three. There have been occasions where some of my competitors in the Dye Transfer field have used as many as 20 different filters.

The most common filters used are the Red 29 and the Green 61.

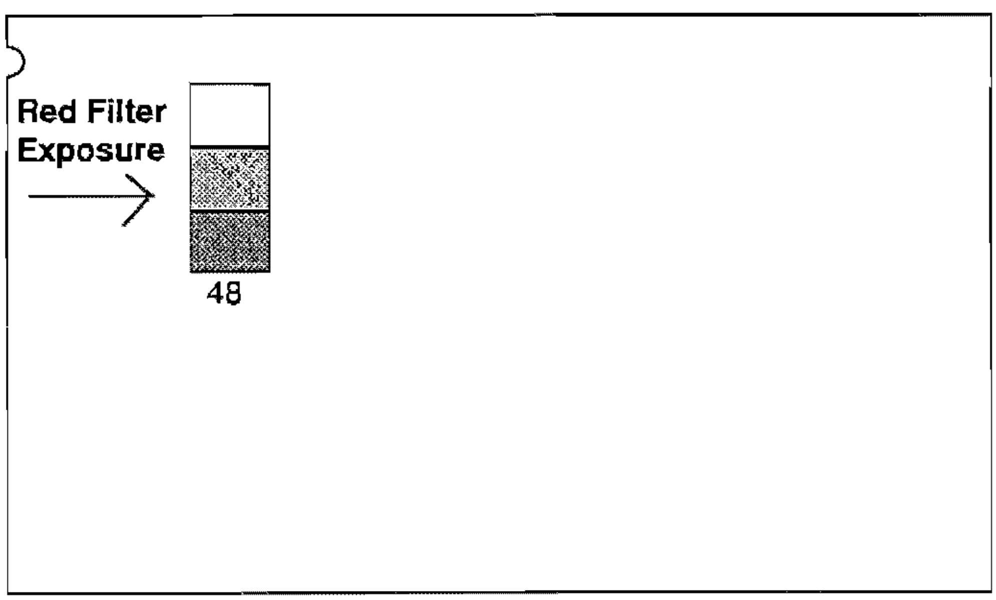
Incidentally, you will need to know the exposures for every color filter you plan to use to make principal masks. However the times for processing the different color filter masks are just about the same for the same gamma.

All you really have to do is to make new exposure tests to find the difference in exposure for each different color filter as compared to the red filter, and use an exposure factor to determine the rest of the exposures.

Here is a method to find the necessary filter exposure factors.

Green Principal Mask Calibration

Based on Red Mask Exposure



3. Principal Masks

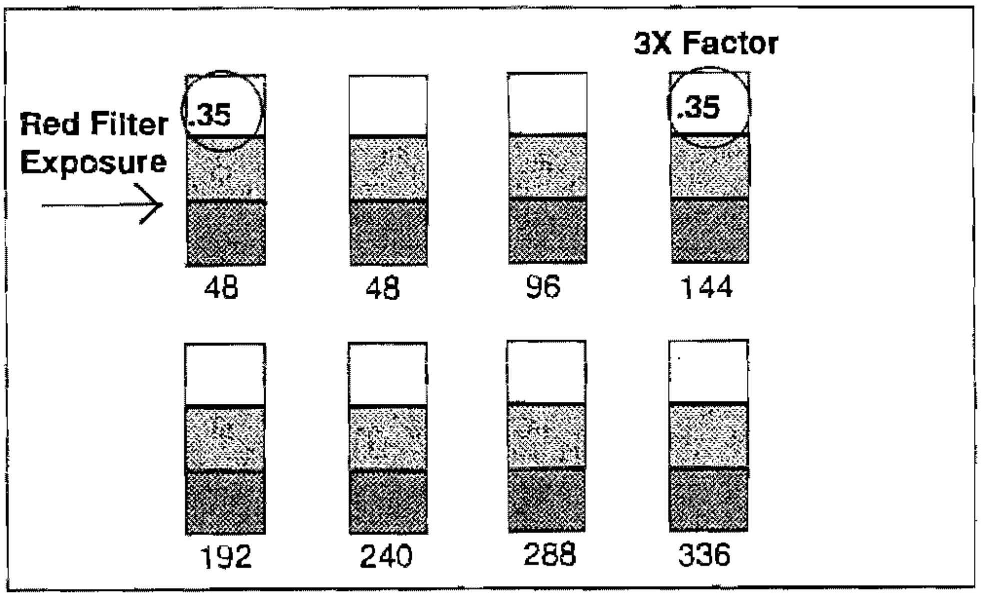
Now, refer to the red principal mask working chart on page 68 and find the Red 29 Filter exposure and development time for a **25% mask**, which is **48 seconds exposure and 2:30 minutes developing time.**

The next thing to do is to make this red filter exposure of the three step grey scale on a sheet of Kodak Pan Masking Film and place it on the film next to the notched corner for easy identification after processing. This red filter grey scale will be used as a reference to calibrate the green principal mask filter **exposure factor.**

Then make a series of green 61 filter grey scale exposures on the rest of the sheet of film.

The exposures for the green filter principal mask should be 2x to 4x longer than the red exposure. Then process this sheet for the 25% developing time of 2:30 minutes in HC-110 Developer, using 25cc of concentrate per liter of water.

Green Principal Mask Calibration
Based on the Red Mask Exposure



3. Principal Masks

Green Mask Calibration

Use your densitometer to read all of the lightest green grey scale steps to find the density that comes closest to .35.

In order to obtain the filter exposure for the green mask exposure, divide the red exposure into the selected green grey scale mask exposure.

Example:

$$\frac{\text{Green Filter Exposure } \mathbf{144}}{\text{Red Filter Exposure } \mathbf{48}} = \mathbf{3x\ Factor}$$

When making any future green masks always use this 3x factor to determine the correct exposure.

Now we can complete the working chart for both the red and green filter, gamma, exposures, and developing times. This is how it should look.

Red and Green Principal Mask Working Chart

Gamma	Dev. min.	Red Exp. sec.	Green Exp. sec.
.15	1:30	63	189
.20	2:00	54	162
.25	2:30	48	144
.30	3:00	40	120
.35	3:30	32	96
.40	4:00	28	84
.45	4:30	18	54
.50	5:00	9	27

Put this chart on your darkroom wall as a handy reference for finding the proper exposure and developing times for any gamma. **Do not use these numbers in this chart in your darkroom. You must make your own tests and charts.**

3. Principal Masks

The need for Principal Mask verification

It is absolutely essential that every mask that you produce be verified.

There is no other way to determine if the mask is correct unless you use a densitometer and make readings that are accurate and reflect the aim points that you are seeking.

If a mask is made to the wrong percentage, and you neglect to verify the mask, you will be re-making many masks by trial and error to find one that works.

It is a simple procedure to verify the mask. Read the three step grey scale in the masks you made, and determine the density range of each mask, and see if it meets your aim point requirements.

If the density of the mask is correct, the shadow part of the **mask image** (not the grey scale) should read between .35 and .40.

The density range of the mask three step grey scale should be divided by the density range of the original three step grey scale. The answer will tell you if you are within the correct gamma or percent mask. **This reading is very important.**

$$\frac{\textbf{Mask Grey Scale Density Range}}{\textbf{Original Grey Scale Density Range}} = \textbf{Gamma or Percent of Mask}$$

The tolerance of your mask gamma should be within plus or minus .02.

4. Contact Separation Negatives

Introduction
Calibration Procedures

What are color separation negatives and why are they needed?

The purpose of a set of three color separation negatives is to record, as variations in their silver densities, the relative amounts of red, green, and blue present in the original color transparency.

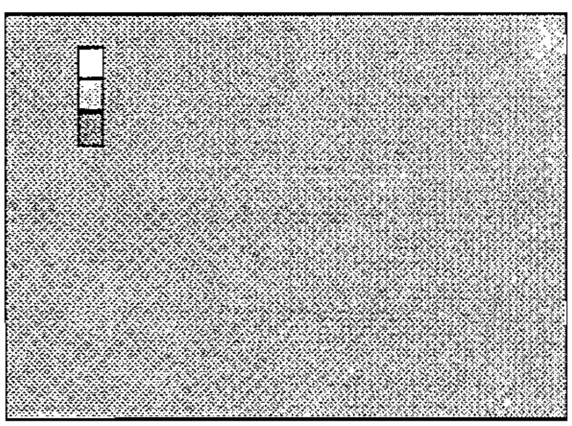
These color separation negatives are produced by using a single sheet of panchromatic film for each of the three color separation negatives, with each being exposed using the appropriate red, green, and blue sharp cutting filter to isolate each of these three colors.

However, this must be accomplished in such a way so the density ranges are captured in the proper balance. This, in essence, is the task before us.

In order to make separation negatives we must again make a **time gamma graph** so we can find the correct exposures and development times for a specific gamma.

Use a 3 step grey scale, Q-6C, cut off the color section of the scale and just use the grey scale portion. This will again be our guide as we follow the same calibration procedures which we used in making the princial masks.

Cut an opening in an 8x10 sheet of opaque material, such as exposed and processed Kodalith film, or Ektaflex paper, and mount the 3 step grey scale using opaque silver tape (3M #360) so no light escapes from the edges.



Make a 25 % mask from this three step grey scale mounted in the opaque material and after processing the mask, register it back onto the original three step grey scale which will be used for the next test series..

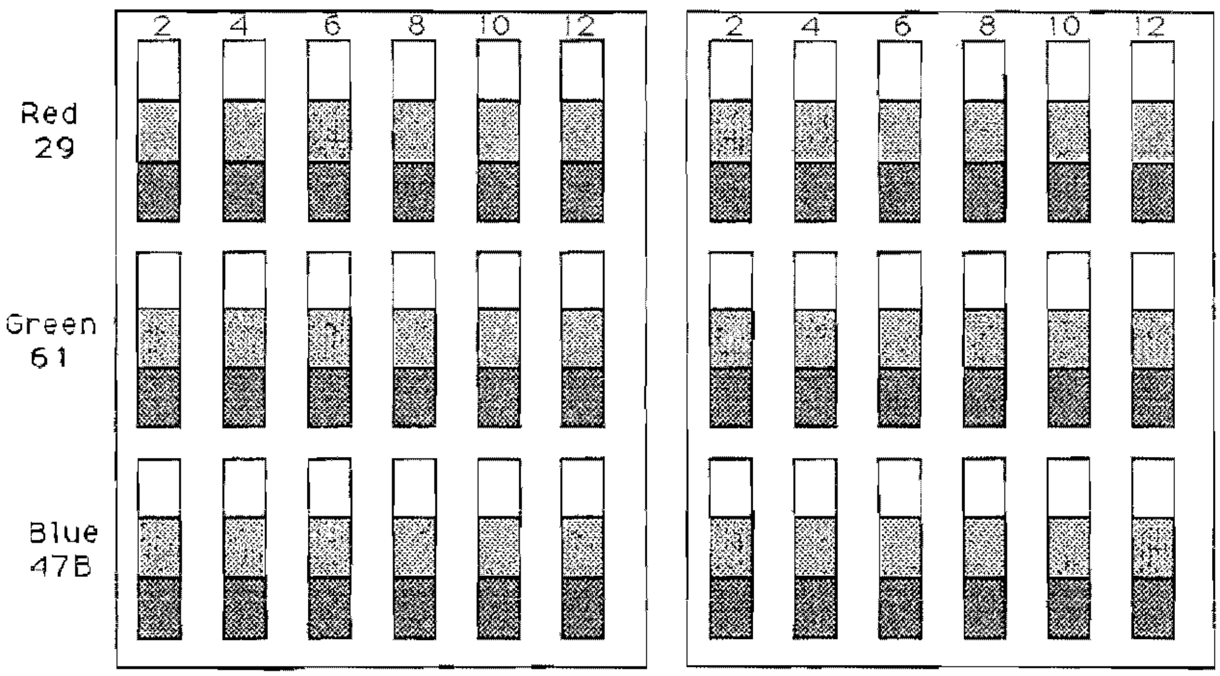
4. Contact Separation Negatives

Using the original grey scale with a 25% mask on it will give the following steps a more realistic approach, since all transparencies will eventually have to be masked.

Using a step and repeat exposure system, make a series of exposures across the top third ot the sheet of Super XX film with the Red 29 Filter, then make another series of exposures across the middle third of the sheet with the Green 61 Filter, and finally repeat the exposure series across the bottom third of the sheet with the Blue 47B Filter.

Make two identical sets of exposures on two sheets of film with increasing amounts of exposure. They should look like the illustration below.

Contact Separation Negative Calibration



Make a series of red, green, and blue exposures using 2, 4, 6, 8, 10, and 12 seconds for each filter on each sheet of Super XX film.

4. Contact Separation Negatives — Calibration Procedure

The two sheets of identically exposed grey scales are then processed by tray.

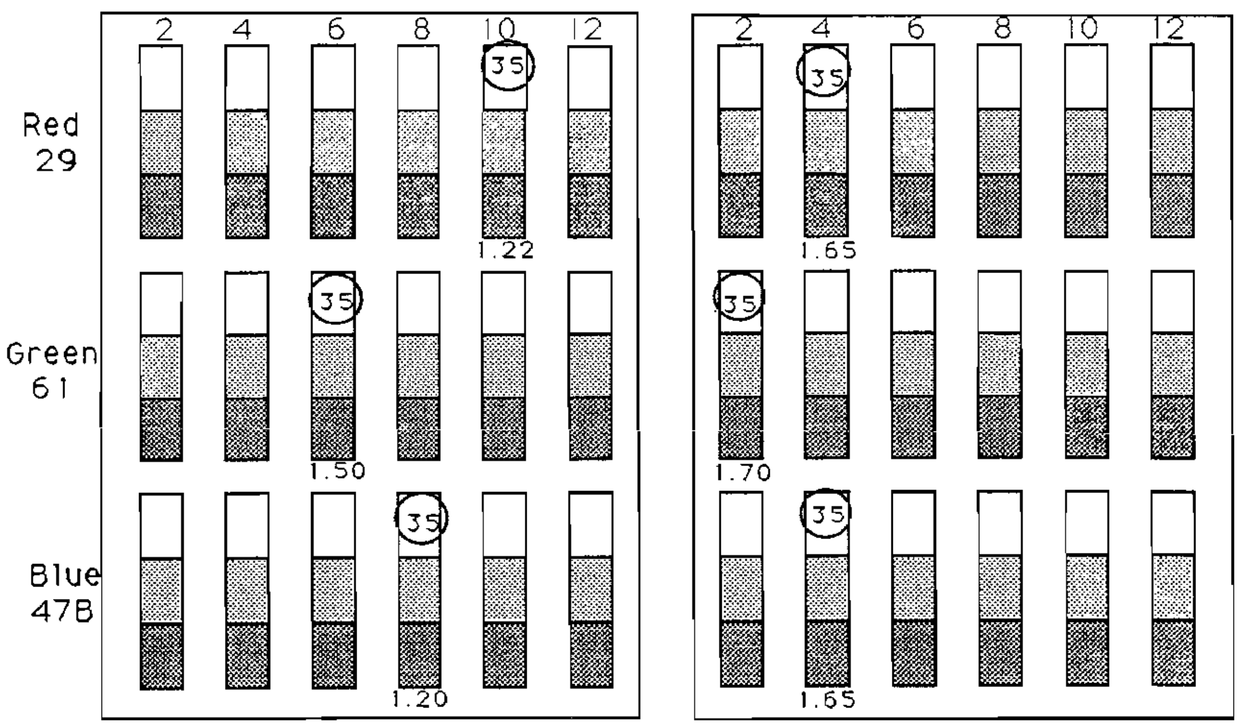
Make a mixture of HC-110 using 30cc of concentrate per liter of water to make the working strength developer.

The films are processed together in a tray at exactly 68° F using continuous agitation. If necessary, float the tray of developer in a larger tray of tempered water, to keep the chemistry from changing temperature.

Use a 1% acetic acid stop bath for ten seconds and then Kodak Rapid Fix. Don't turn on the lights for at least 45 seconds. Process these two sheets for different times. One for 4:00 minutes and the other for 8:00 minutes.

The reason for this wide gap between the two developing times is so we can find the gamma of development produced at either extreme and plot a graph.

Contact Separation Negative Calibration



Dev. for 4 Min. **Dev. for 8 Min.**

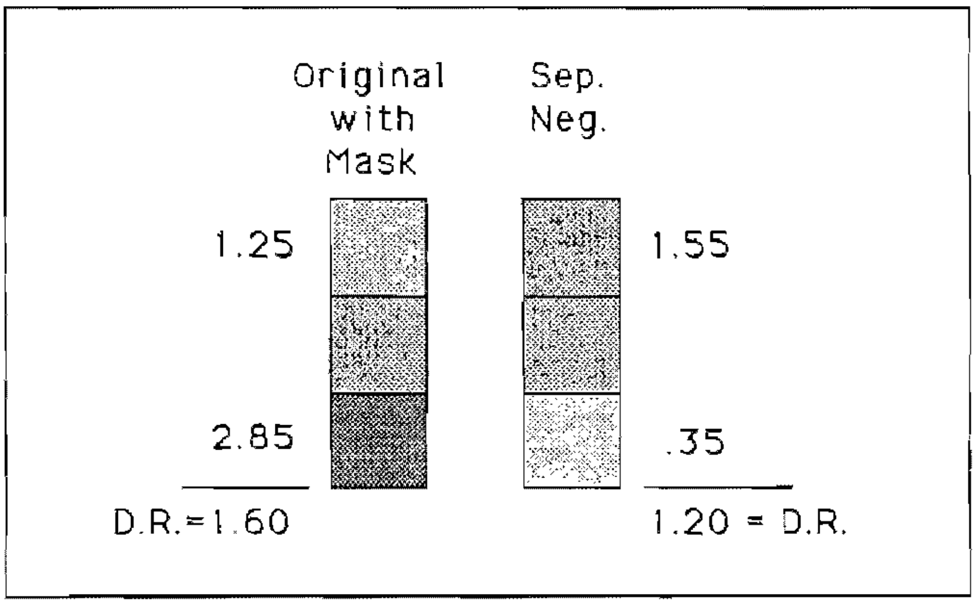
4. Contact Separation Negatives

Calibration Procedure

After processing, examine the different grey scales. The object is to find the grey scale that has a reading close to **.35** density in the lightest step of the three step grey scale in each of the rows that were exposed through the three separation filters on each sheet of film.

Once these individual grey scales are found, **record the exposure times**. Then read the high and low density steps for each of the chosen grey scales and determine the density range of each one like the chart below:

Determining Gamma with Grey Scales



If we divide the density range of the **combined mask with the original grey scale** into the **separation negative grey scale** test the answer will indicate the gamma or percent of the separation negative.

Here is an example:

$$\frac{\text{Separation Negative DR} \quad \mathbf{1.20}}{\text{Combined Original + Mask DR} \quad \mathbf{1.60}} = \mathbf{.75\ gamma\ or\ 75\%}$$

4. Contact Separation Negatives

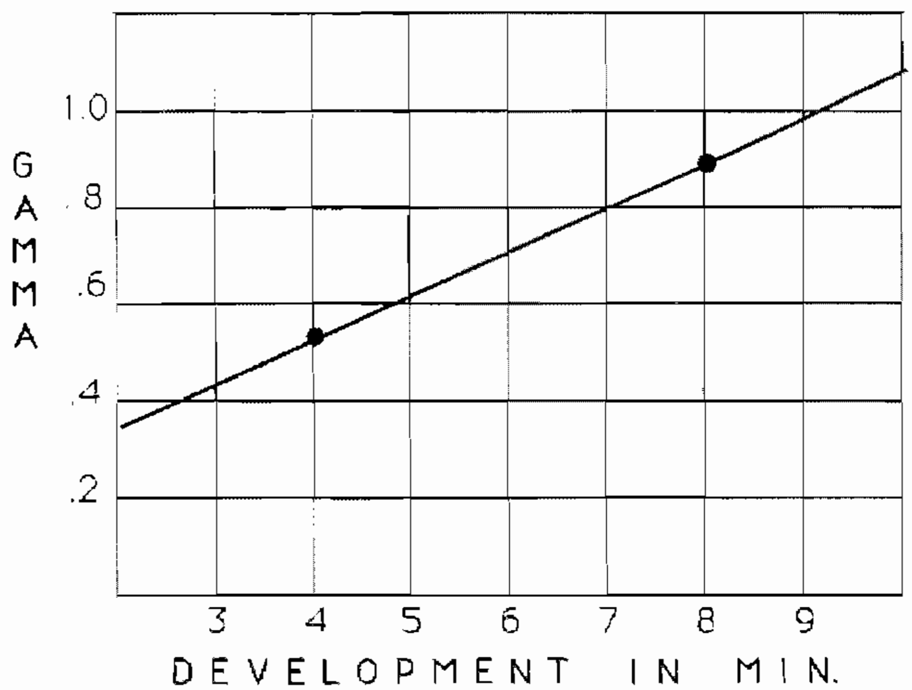
Plotting Procedure

When all of the pertinent information has been gathered, you should now have the **gamma numbers**, the **development times**, and the correct **exposure times** for all the selected grey scales made with the three color filters from each sheet of test separation negative film.

Make a pair of graphs for each individual color separation filter.

Start with the Red 29 Filter test.

Red Separation Negative Gamma and Development



The object here is the same as it was when we made the graphs for our principal masks.

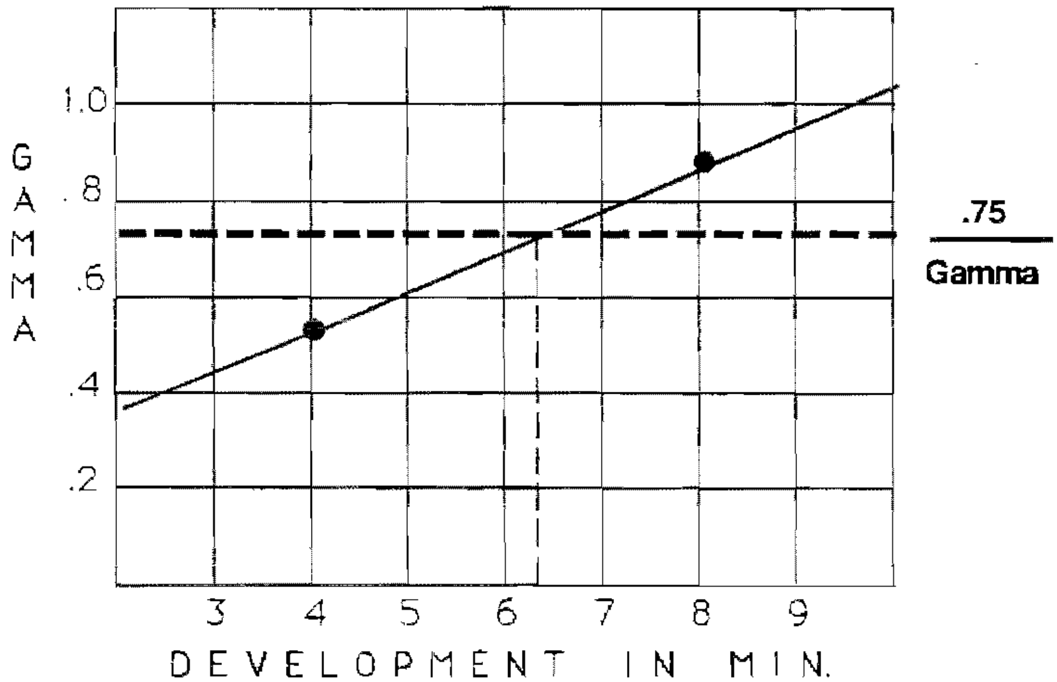
We must place a dot on the graph where the 4:00 minute development time and the gamma it produced coincide on the graph.

A dot is also placed where the 8:00 minute developing time, and the gamma it produced, coincide. Then draw a line between the two dots.

4. Contact Separation Negatives

Plotting Procedure

Red Contact Separation Gamma and Development



Examine the above chart. The 4 and 8 minute gammas have been plotted and marked. Now, the developing time for any gamma between the two marks can be easily found.

The only gamma we are concerned with is .75. because we do not want to develop any further than this in order to avoid chemical fog on the separation negative.

According to our chart, the developing time is **6:20** minutes to achieve a **gamma of .75** on the red separation negative.

The next step is to find the correct exposure time for a gamma of .75.

We already know the exposure time for the 4 minute development time, it was 10 seconds. The 8 minute developing time exposure was 4 seconds.
These were for the red separation negative test grey scales.

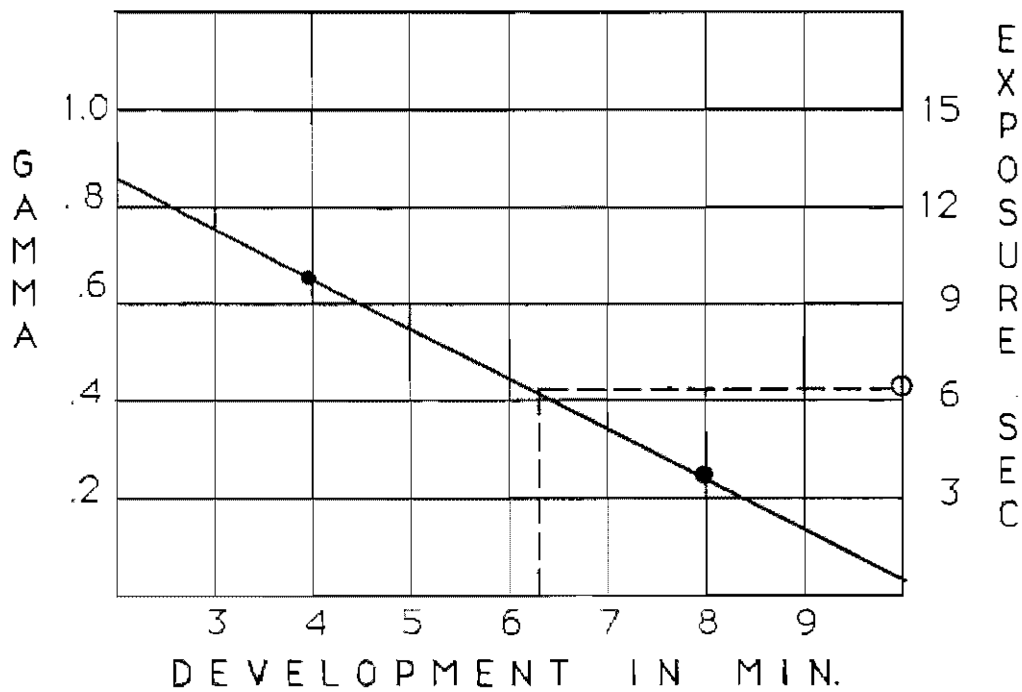
4. Contact Separation Negatives

Plotting Procedure

The following graph will describe the method I recommend.

You can make another graph that looks exactly like the previous one, except the development and exposure times will be plotted in a different direction.

Red Contact Separation Negative Exposure and Development



The two exposure times are located and plotted on the 4 minute and 8 minute developing lines. A line is drawn between them. Now, any exposure can be found for any developing time.

Since we are only interested in finding the exposure for **gamma .75,** all we need to know is the correct developing time **of 6:20.**

Locate 6:20 on the bottom developing area and draw a dotted line up to where it meets the exposure line and look to the right exposure side, and the answer is **6.5 seconds.**

4. Contact Separation Negatives

Test Your Understanding

This is an excercise for you to test yourself to see if you understand the princi-pals that have just been explained. When you understand these principals you will be able to make good Dye Transfer prints.

From the information we obtained from the two test separation negative grey scale films developed for 4 minutes and 8 minutes, we obtained the following information. Use this information to make calculations and plot graphs to fill in all the blanks below.

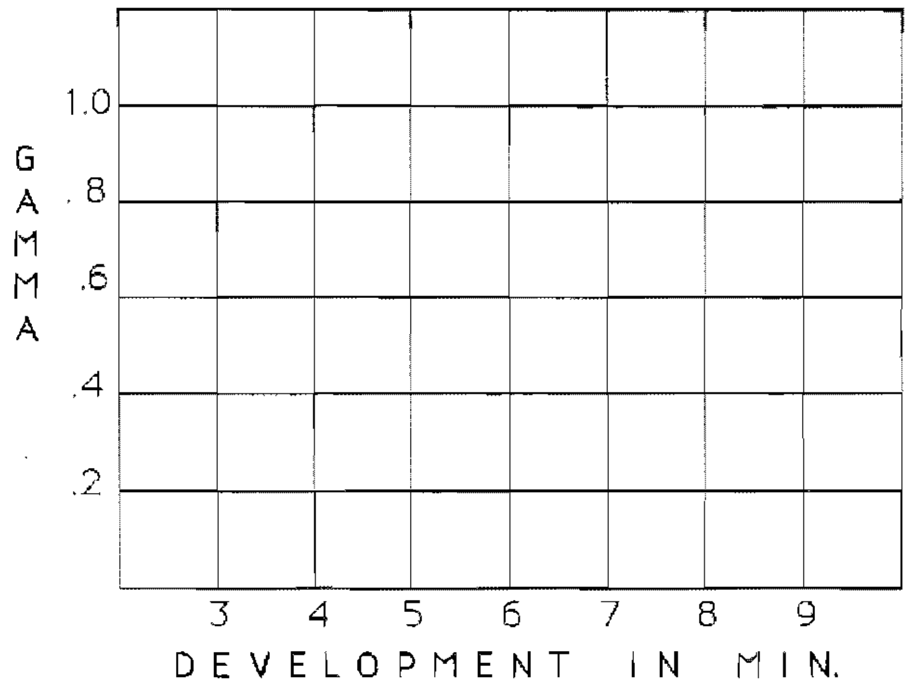
Do you know the answers?

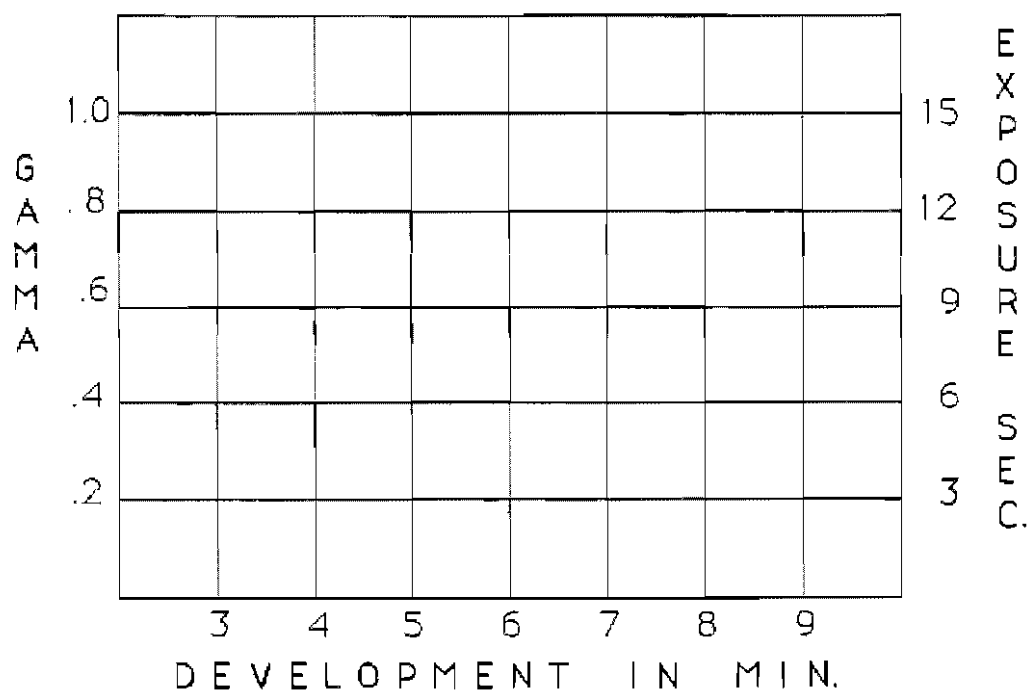
	Red Sep. Neg.		Green Sep. Neg.		Blue Sep. Neg.	
Dev. Time	4 Min.	8 Min.	4 Min.	8 Min.	4 Min.	8 Min.
Exp.Time	1 0 Sec.	4 Sec.	6 Sec.	2 Sec.	8 Sec.	4 Sec>
Low Density	1.22	1.65	1.50	1.70	1.20	1.65
High Density	.35	.35	.35	.35	.35	. 35
Density Range						
Combined original grey scale and mask density range	1.60					
Gamma						
Dev. for .75 Gamma						
Exp. for .75 Gamma						

4. Contact Separation Negatives

Practice Plotting Grids

Do not write on this page.
Make copies of this page and use the copies to practice plotting your graphs.





4. Contact Separation Negatives

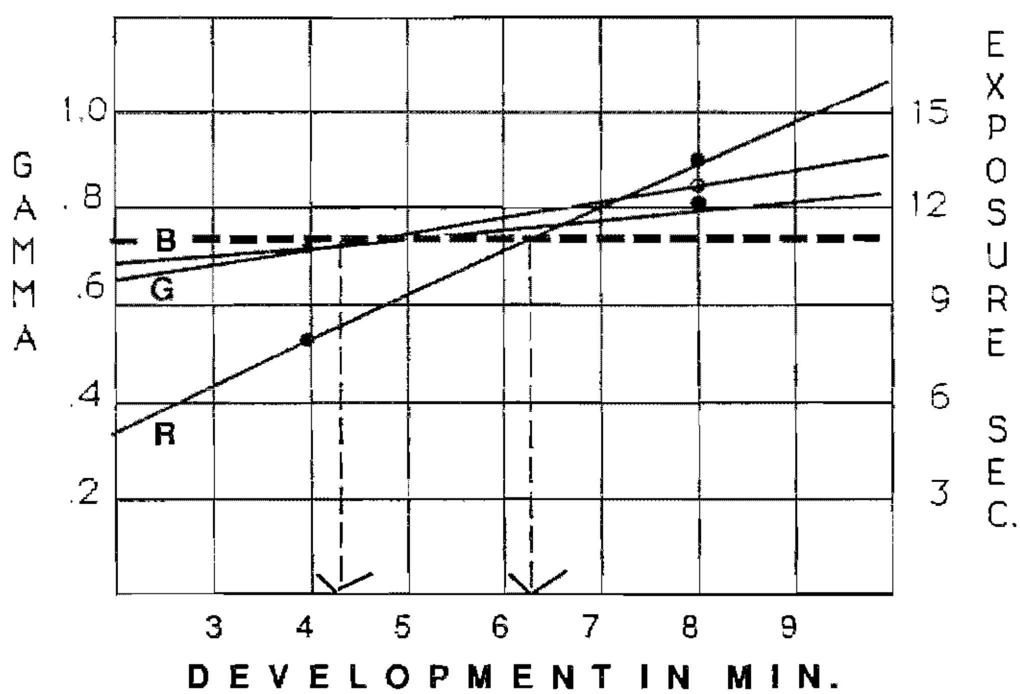
The next step is to expose the separation negatives.

The film I prefer to use is Kodak Super XX. It has excellent color response, a long straight line, and develops quite easily. However, any panchromatic film that has a long straight line can be used.

Before we expose our negatives, we must remember why we had to change the exposures for the masks.The reason is the difference in the **average density** of the original transparency. (More about "Average Density" in Chapter 12). Every transparency is different and has it's own average density. Some are lighter, and some are darker, which may require you to change the masks or the separation negative exposures from their normal exposures..

By making the **same kind of graphs** for the separation negatives that we made for the principal masks, we will be able to obtain the exposures and development times for.75 **gamma.**

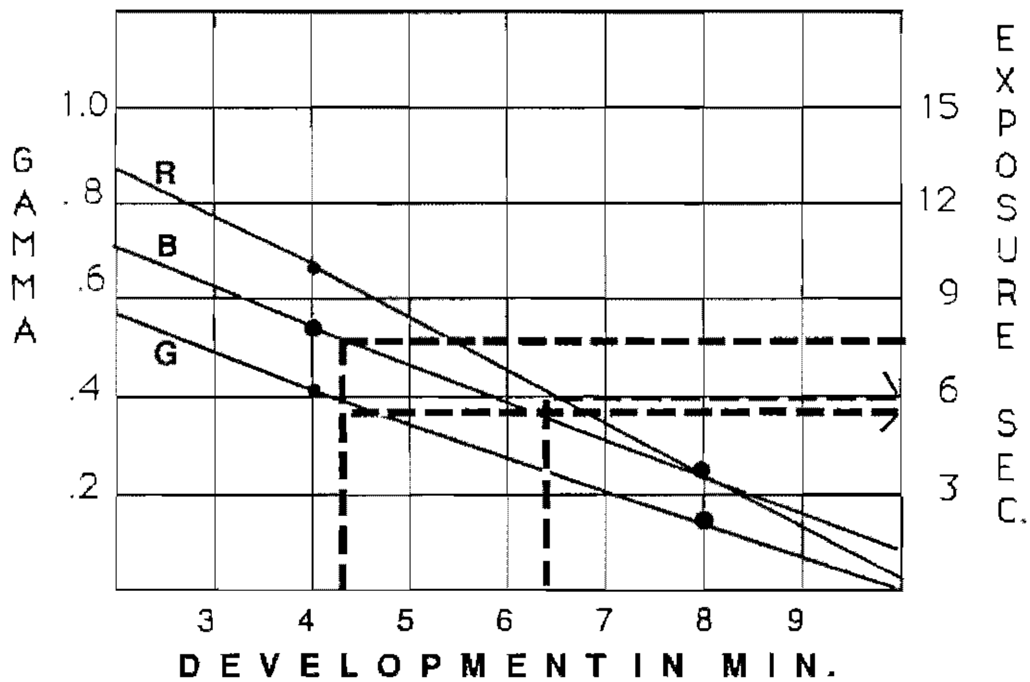
Separation Negatives
Dev. for .75 Gamma



4. Contact Separation Negatives

Plotting Procedure

Separation Negatives
Dev. for Gamma .75



A simplified working chart made from the two previous graphs makes it easier to find the correct exposure and developing times for .75 gamma. When you make your own chart, hang it on your wall for easy reference.

Filter	Exp.	Dev.
Red 29	6 Sec.	6:20 Min.
Green 61	5.5 Sec.	4:20 Min.
Blue 47B	7.5 Sec.	4:20 Min

Remember, these exposure and developing times are fictitious, and are based on a fictitious set of graphs.

4. Contact Separation Negatives

Making the separation negatives by contact

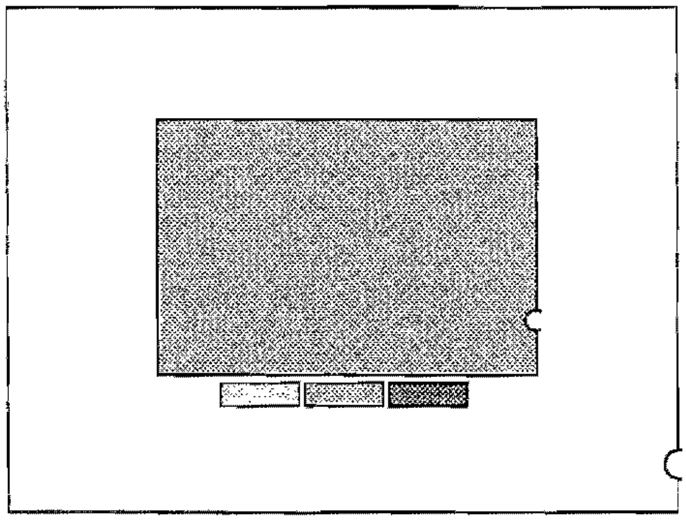
The first thing to do is to prepare the transparency for making the separation negatives. Since I use an 8x10 contact system, and an 8 x 10 enlarger to make the matrices, it is important that I mount any transparency smaller than an 8 x 10 into a sheet of 8 x 10 film of the same thickness as the transparency. I use a 7 mil thickness for all sheet film transparencies.

This becomes an advantage.You can also insert the 3 step grey scale alongside the transparency to be used as a guide, and also to calibrate the separation negatives.

I make my matrices using an 8x10 Durst enlarger, diffusion type. This enlarger is equipped with a registration film carrier, and can be solidly braced to avoid any movement.

It is important to mount the transparency in the center of this sheet of 8x10 film so that you use the center rays of light, which have more even illumination then the edge rays of light in your enlarger.

Use polyester silver tape. (3M # 850) to tape the transparency into position. This tape will not dissolve or run when using film cleaner, and it is also very thin and water proof. Place this tape on the base side because when we expose the separation negatives by contact, the transparency will have nothing on the emulsion side and make a more perfect contact with the film to be exposed.



4. Contact Separation Negatives

Color Orientation
Film Orientation

Use a contact printing frame, vacuum platen, or an enlarger projected light source, and then by contact, expose through the three colored separation filters, Red 29, Green 61, and Blue 47B, one at a time, onto three separate sheets of Kodak Super XX Film. These separation negatives will contain the separate primary color records of the transparency when they are processed.

The **red separation negative** will control the amount of **cyan dye** in the print.

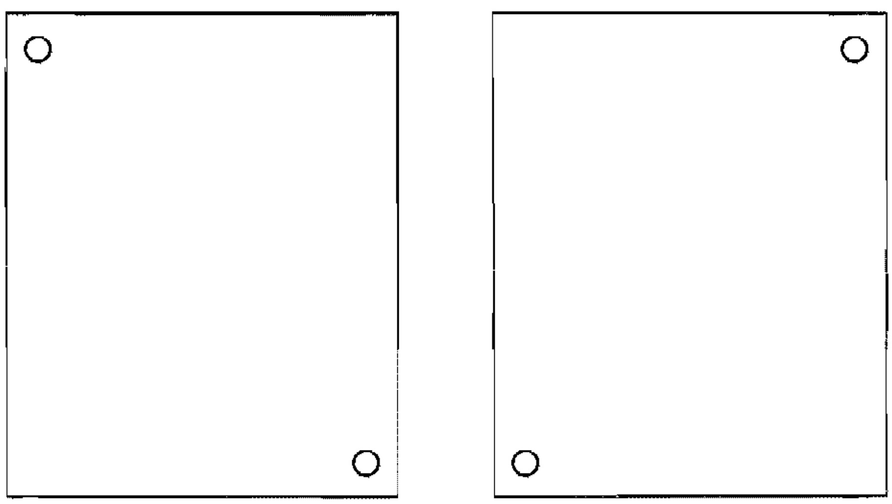
The **green separation negative** will control the amount of **magenta** in the print.

The **blue separation negative** will control the amount of **yellow** in the print.

These three negatives are the main ingredients used to make a Dye Transfer color print. There are many other steps involved in the making of these negatives, and they will be explained as we go on.

You will also need 2 sets of pin register glasses with opposing pins set in the glass. The reason for these two pin glasses is so the images will be facing the right direction when exposing the principal masks and separation negatives.

Registration Pin Glasses



Normal Pin Glass **Reverse Pin Glass**

4. Contact Separation Negatives

There are variables that control the film orientation when exposing principal masks and separation negatives.The film orientation depends on the type of registration equipment used and the direction of the light source.

These are the following combinations and how they are used.

1. The light source below using diagonal pin registration.
Punch the principal mask film and transparency **emulsion up.**
Expose the mask on the reversed pin glass **emulsion down.**
Punch the Super XX Film **emulsion down.**
Expose the Super XX Film on **normal pin glass emulsion down.**

2. The light source above using diagonal pin registration.
Punch the principal mask film and transparency **emulsion down.**
Expose the mask on the normal pin glass **emulsion up.**
Punch the Super XX Film **emulsion up.**
Expose the Super XX Film on **reversed pin glass emulsion down.**

3. **When using parallel pin registration** the direction of the light and the position of the film registration is not important. The reason for this is because the pins are the same size and in the same position.

Kodak makes a parallel pin registration punch and printing frame. Carlson also makes a parallel pin registration system. **Condit makes both the diagonal or parallel pin registration systems.**

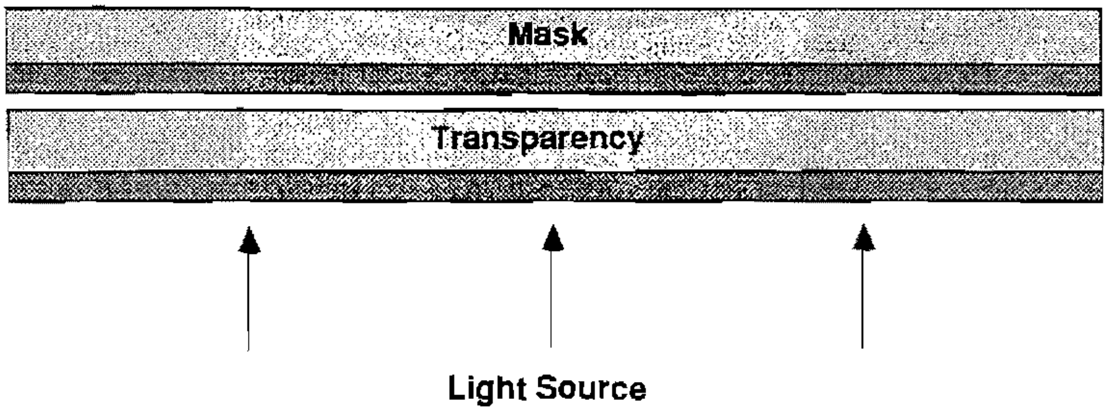
The important thing to keep in mind is that the images must be oriented in the same position during the entire exposing procedure.

If the film's emulsions are not oriented correctly, you will have a film base thickness between two emulsions which will leak light between them and scatter the light onto the separation negative and produce an image edge effect.

The next two diagrams will show you the film orientation when exposing the principal masks and the separation negatives.

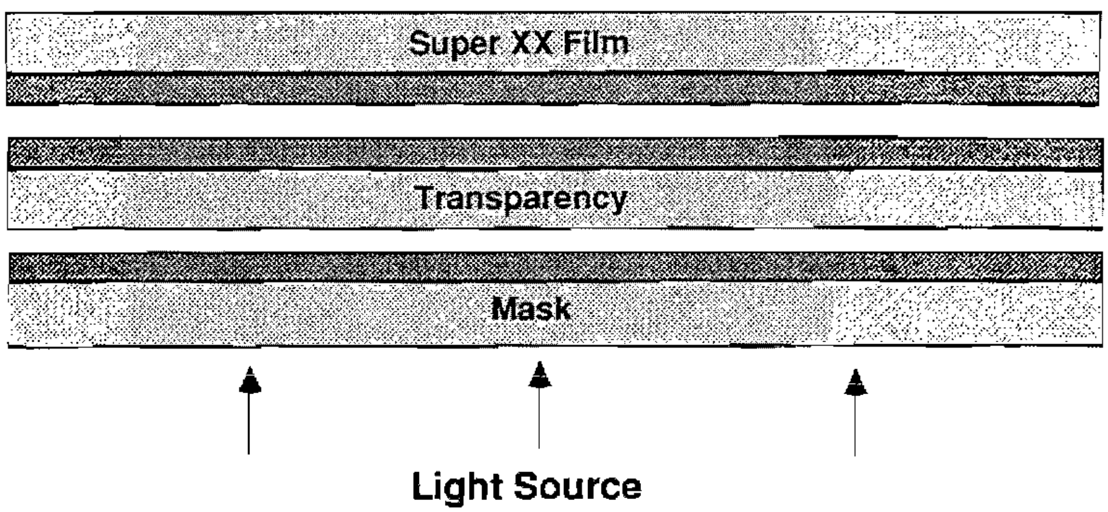
4. Contact Separation Negatives

Film Orientation to Expose Principal Masks



The above illustration shows the correct position of the transparency and Pan Masking Film emulsion's orientation when exposing the masks.

Film Orientation to Expose Separation Negatives



This illustration shows the correct position of the mask, transparency, and the Super XX Film when exposing the separation negatives.

4. Contact Separation Negatives

Light Sources
Registration Equipment

The light source can be any incandescent lamp. You can use a point source, or a small 75 watt household lamp, a quartz halogen lamp, or a projected light from an enlarger lamp house. Never use flourescent or cold light grids because they do not contain the full color spectrum which is necessary to make separation negatives.

Condit has a great system with the color filters in a wheel with "waterhouse" stops built in. This system sits on top of the work bench, faces downward at an angle to a mirror, which reflects it back up again to the printing platen, thereby lengthening the distance the light has to travel, giving it, somewhat, the effect of a point source.

The drawback to any contact system is the Newton Ring problem.

There are a few ways to solve this problem. You can use the dry pumice powder that has been used by all of the lithographic field for years. The powder is placed in a small squeeze bottle. Shake the bottle, then spray a tiny amount in the air, and when you think all of it has dropped to the floor, pass the glass or film under this almost invisible cloud and enough pumice powder particles will have been deposited on the surface to kill most of the surface tension. These particles work as a spacer between the film and the glass to eliminate Newton Rings.

If you try this with 2 1/4 film you might get away with it. Don't waste your time trying it with 35mm. You will have very visible chunks of pumice in your print, unless you are making very small prints.

We have been successfully using **"Arid Extra Dry Deodorant"**, unscented.

You can also place a sheet of fixed, washed and dried, **Kodak Translite** film on the glass and expose through it. You won't get the crisp sharp effect of the point source, but you will eliminate the Newton Rings. I wouldn't try making anything smaller than 4x5 with this approach.

Art supply stores sell a material called **Herculanean**. It is used by architects.This is a very fine grained sheet film material and will also help to eliminate the cause of Newton Rings.

When the readings and calculations are finished, the time has come to make some exposures.

4. Contact Separation Negatives

Expose & Process

In order to make separation negatives we must first make principal masks. We have already been through this procedure. This is only a description of the procedures that are necessary to produce a set of contact separation negatiives.

The masks are made, as I described earlier, by using the reverse pin system. This will allow the mask and negative to remain in the proper position when making the separation negative exposures.

The mask exposures are made and the masking film is identified by punching little half moon notches in one side, and placing the films in a safe box. The lights are turned on and the chemistry is placed into the proper developing system. In this case a set of three trays. **Use 1000cc of liquid per tray.**

Use Kodak HC-100 developer using 25cc of concentrate to 1 liter of water.

Use 1% acetic acid rinse for the stop bath, and finally, Kodak Rapid Fixer.

After processing these masks to their proper contrast, and they are washed, place a few drops of Kodak Photo Flo #200 into a final rinse tray and agitate the film for 30 seconds.

Then squeegee the negatives against a glass light box using a very smooth Volkswagon "bug" windshield wiper and eliminate as much water from the film as possible.

If you are squeamish about touching the film, hang the sheet films to dry from the same corners using gently moving warm air.

When the masks are dry, exchange the reverse pin glass in the contact platen with the normal pin glass.

Once the exposures are determined, place the mask and transparency, in that order, both emulsion up on the register pins. In the dark, expose each negative emulsion down through the correct mask and transparency combination with the proper filter.

4. Contact Separation Negatives

Expose & Process

If you are using a vacuum platen to make the exposures, close the platen cover, start the vacuum pump, make sure the vacuum is working to it's capacity and make the exposures. Do the same for all three negatives.

Don't forget to change the filters.

When you are finished with the exposures and the film has been identified, place the exposed material in a safe box.

Set up the developing system again. This time the dilution of developer is changed for separation processing. Use HC-110 developer and dilute the concentrate of 30cc into 1 liter of water.

Calculate your developing times for all three sheets of film and make sure that they enter and leave the developer tray in the proper order.

Process and wash the separation negatives as you did for the masks. Make sure that the agitation is consistant and the temperature is accurate.

The need for separation negative verification

It is absolutely essential that every separation negative that you produce be verified.
There is no other way to determine if the separation negatives are correct unless you use a densitometer and make readings that are accurate and reflect the aim points that you are seeking. If a separation negative is made to the wrong gamma, and you neglect to verifiy it, you will be making many separation negatives by trial and error to find a set that works.

If the density of the separation negative is correct, the shadow part of the image (not the grey scale) should read between .35 and .40.

The density range of the separation negative 3 step grey scale should be divided by the density range of the original masked grey scale. The answer will tell you if you have achieved the correct gamma. **This reading is very important.**

$$\frac{\textbf{Sep Neg. 3 step Grey Scale}}{\textbf{Original Masked Grey Scale}} = \text{gamma}$$

5. The Dye Transfer Process From Start to Finish

This is just a quick synopsis of a procedure that in reality is much more complicated.

In order to explain the various steps of making a set of negatives and prints more clearly, I will demonstrate the technique that I have used for many years.

1. **Examine the transparency for scratches and abrasions.** At this time, also **clean** or **wash** the original transparency.

2. Proceed to read the high and low densities of the original transparency to establish a density range.
   This is a normal transparency with good highlights and shadows.

3. In order to establish a **CMT** number, use the enlarger density range requirement of **1.20.**
   Choose a separation negative **gamma** of **.75.**
   Divide the gamma of **.75** into the enlarger requirement of **1.20** and the answer is **1.60.** **<u>This is the CMT</u>** (Combined Mask and Transparency)

4. **A mathematical procedure to follow:**

   The transparency density range is **2.35**
   The CMT number is **1.60**

   Subtracting the CMT from the original density range = **.75**
   Divide that difference of .75 by the original transparency density range of 2.35 and the answer is 31.9 gamma or 32%.

5. Mount your transparency into a larger sheet of film (if necessary) and add the three step grey scale.
   Refer to your own working mask chart to establish the exposure and developing times for the principal masks.
   The times arrived at are 14 sec. exposure for the red filter mask and 42 sec. exposure for the green filter mask. Both masks are developed for the same time, 3:20 minutes in our mask strength developer.

5. The Dye Transfer Process From Start to Finish

6. Use the reverse pin glass to make the exposures, then process the masks.
   Add the mask to the transparency and read the same high and low areas that were read in the beginning to establish whether or not there is a change in overall density, (more about this later)

7. Change the pin glass to the normal glass so that the film orientation is correct when exposing the separation negatives.
   Using the separation negative working chart, establish exposures for the separation negatives. **Expose and process.**

8. Proceed to make the necessary highlight masks (more about this in the following chapter). Expose and process.

9. Verify all the steps by reading the results of the principal masks and separation negatives.

10. Choose one or more methods of determining the correct exposures for the matrices. (more about this later in the book).

11. After determining the exposures for the matrices, prepare the darkroom for processing. Use a red 1A. safelight. Punch the 3 matrix fims for registration, and notch them for identification.

12. Soak the Dye Transfer Paper in the Paper Conditioner for 20 minutes.

13. Expose the matrices, in register one at a time, on a vacuum easel equipped with register pins. Prepare the darkroom for processing the matrix film.

14. Process the three matrices in fresh Kodak Tanning A and B developer.

15. Hang and dry the three sheets of matrix film, and place them into the rocking trays containing their respective dyes.

5. The Dye Transfer Process From Start to Finish

16. After 5 minutes, remove the first matrix (cyan) from it's tray, drain it thoroughly and place it into the first of two trays containing 1% acetic acid rinse. Let it rock for 1 minute then transfer it to the second tray which will act as a holding tray.

17. Remove the Dye Transfer Paper from it's tray of Paper Conditioner and position it on the transfer table, emulsion up, about 1/4 inch from the register pins.

18. Place the cyan matrix on the register pins, and proceed to roll the matrix down on top of the paper, emulsion to emulsion. Then squeegee the matrix from the center on out.

19. After 5 minutes, prepare the magenta matrix for the same procedure. When in the second holding tray, remove the cyan matrix from the transfer table and place it in a tray of fresh warm water before placing it back into it's cyan dye again.

20. Transfer the magenta in the same fashion as with the cyan.

21. After 5 more minutes, prepare the yellow and proceed to follow the same steps as with the cyan and magenta.

22. At the end of three minutes, remove the yellow matrix and place it in the same wash tray with fresh water and when drained, place it back into the yellow dye for further printing.

23. Dry the print. Except for the corrections that you will be using to fine-tune the print to your satisfaction, you are finished.

This procedure is explained to you so that you will have some idea in what you are about to become involved.

6. Contact Highlight Masks

Highlight masking

The need for highlight masking is very necessary. The principal mask material being a negative will have the heaviest densities in the highlight areas of the image and will automatically flatten out the top of the tone scale. The separation negative system also flattens out the top of the tone scale, because, as you make **principal masks** to bring your separation negatives to the proper contrast, the masks will compound the problem. Therefore, you must make highlight masks to bring that detail back.

To make matters even worse, the matrix film itself has faults. The top of the tone scale is very flat and this further aggravates the problem. This is the part of the matrix film that records the highlights, so it should be highlight masked to increase highlight separation.

What are highlight masks, and how are they made?

Highlight masks are detailed images that just capture the highlight areas of the original transparency.They are made by barely exposing the transparency, in contact (or enlargement), onto a high contrast material, such as Kodalith Pan film, or Kodak Contrast Process Pan Film, and processed in a strong developer such as Kodak D11, so that only the brightest part of the transparency is visible as densities on the film.

I have also used Kodak Contrast Process Pan Film because of it's longer straight line and greater coverage of the highlight area. However, Kodalith Pan Film works fine.

Some Kodak Dye Transfer literature recommends the use of only one highlight mask. This is a pre-masking technique that has some merits, but still is inadequate for most transparencies.

Here is how this **simple** masking system works:

A transparency is exposed emulsion to emulsion, by contact, using white light on Kodalith Ortho Film. After processing this sheet of film, it is placed together with the transparency when making the principal masks. Then it is removed when the principal masks are used to make the separation negatives. In other words, the highlight mask is "built in" to each of the principal masks.

6. Contact Highlight Masks

Pre-Masked or
Post-Masked Highlights

This is a system that works because the highlight effect is built into the process, however, it has **serious drawbacks.**

If the highlight mask is built into the system, and the masks are developed to a range of 25%, this means that the highlight mask has also been diminished to 25% of it's original intended density. Stronger masks must be made to compensate for this loss. However, this is difficult to assess properly.

Another important thing to remember is, since we are separating the transparency, using three separation filters, **doesn't it make sense to use three separated highlight masks as well?**

Highlights are not usually white or neutral in color. I make three separation highlight masks and use them as **post-masks** in the carrier where they belong. In this way I can have complete control over the original highlight area because they are not built into the principal masks.

If the highlight masks are too strong and remaking them is impractical, then a part time use of the highlight masks could be implemented. With the registration carriers that are available, we can expose any part of the normal time and split the exposure time that the highlight masks are used.

In order to know what the correct exposures are for making highlight masks, tests and graphs must be made.

Here is one method for determining contact exposures for the highlight masks.

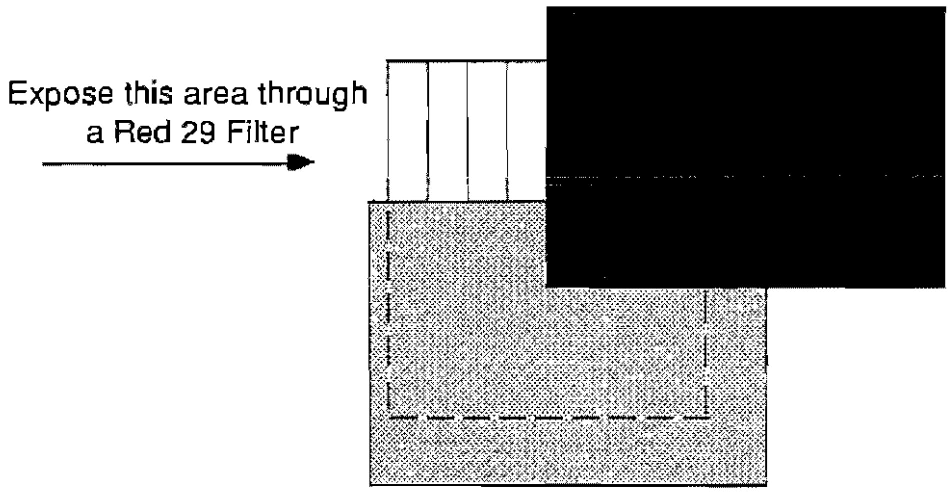
The first thing to do is to expose and process a blank sheet of Pan Masking film. Try to develop the film evenly and have the uniform density level somewhere around **.50. This sheet will represent the highlight area of a transparency.**

You can do this in room light using a very dilute HC-110 developer such as 10cc of concentrate per liter of water.

6. Contact Highlight Masks

The procedure to determine the correct exposures.

Place this sheet on the registration pins on your platen and cover two thirds of the sheet with an opaque sheet of paper.



Place a sheet of unexposed Kodalith Pan Film on the register pins, emulsion down. Using a strip exposure method, slide a sheet of opaque paper between the two pieces of film and expose a series of **short exposures through the Red 29 Filter** at a low voltage setting (around 6 volts), or a low setting if you are using F stops and an enlarger light source for the contact exposure tests.

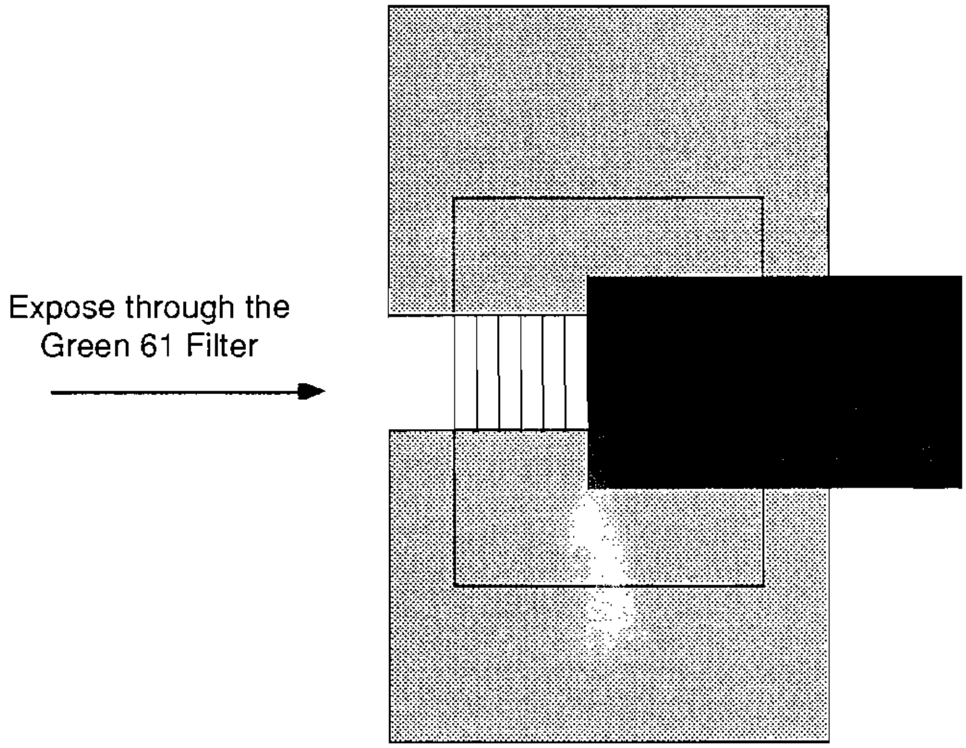
This entire test is done using only one sheet of Kodak Kodalith Pan or any other Panchromatic Litho film.

Other manufacturers make similar films with almost the same color response.

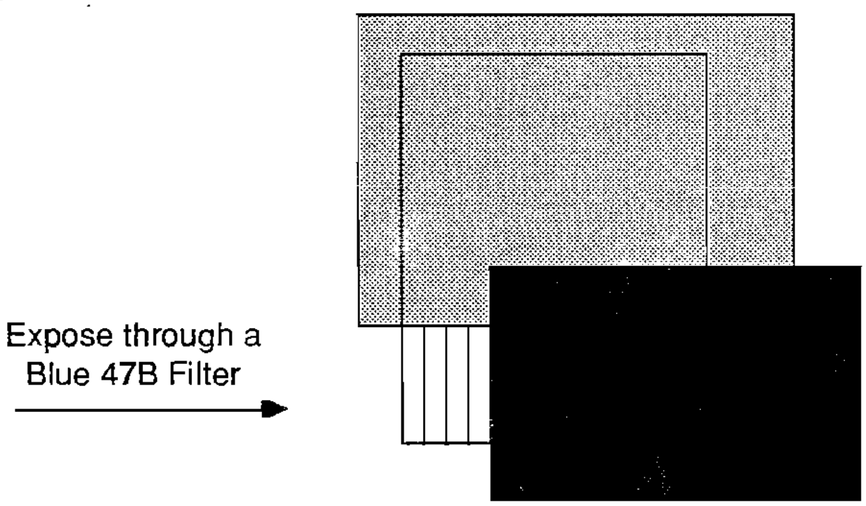
Most Panchromatic litho films have a very strong red sensitivity, therefore you must lower the light level when exposing through the Red 29 Filter. I prefer to use neutral density filters rather than changing the light level which will change the color temperature.

6. Contact Highlight Masks

Now, cover the top one third, and open the middle one third of the sheet, and **expose through the Green 61 Filter another series of short exposures.**



Lastly, cover the top two thirds of the sheet and uncover the last one third, and **expose another series of exposures on this part through the Blue 47B Filter.**



6. Contact Highlight Masks

Calibration
Logarithm

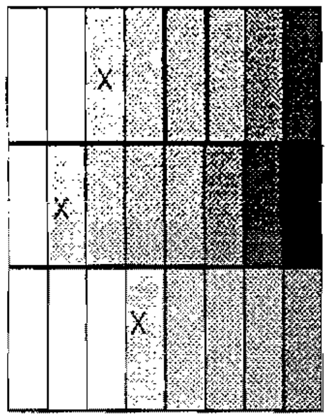
This sheet of exposed film is now processed in straight D-11 developer for 2:30 minutes at 68° F with tray agitation.

It should look similar to this:

Red 29

Green 61

Blue 47B



Using a densitometer, find which step comes as close to .35 as possible. When the steps are found, determine the exposure that each received and you will have the ratio of exposures for all three colors, for a **transparency highlight density of .50 which was represented by the fogged processed sheet of film used to make these exposure tests.**

The next step is to use your scientific calculator and determine the other steps by using the log scale. If we know the ratio of exposures for all the filters for a **.50 density of the transparency**, find all of the other exposures as follows:

Increasing density procedure

To find the exposure for the **.55** reading:

1. press the diifference, .05
2. press the button, INV
3. press the button LOG
4. press the X button
5. press the exposure time for .50
6. press the button =. The new exposure for .55 is now obtained.

Find all of the other increasing numbers in the same fashion.

6. Contact Highlight Masks

To find the lower density exposures, do the following:

1. press the diff. (.05)
2. press the button INV
3. press the button LOG
4. press the button 1X
5. press the button X
6. press the exposure time for .50
7. press the button =. The answer is the new exposure time.

When using this system to make the highlight negatives, all that you have to do is read the highlight area of the transparency and look at the chart. The chart should look like this:

Highlight Mask Working Chart

Density	Red	Green	Blue
.10	2.0	3.0	2.5
.15	2.3	3.4	2.8
.20	2.5	3.8	3.1
.25	2.8	4.2	3.5
.30	3.2	4.8	4.0
.35	3.6	5.3	4.4
.40	4.0	6.0	5.0
.45	4.6	6.8	5.6
.50	5.0	7.6	6.2

6. Contact Highlight Masks

Logarithm

This is the formula for using the Logarithm portion of your scientific calculator to determine new exposure times for different densities

Log Calculations

Increasing Density

step		step	
1	Density Diff.	1	Density Diff
2	INV	2	INV
3	LOG	3	LOG
4	X	4	1x
5	OLD EXP	5	X
6	= Answer	6	OLD EXP
		7	= Answer

Decreasing Density

The following is the procedure to make the three color separation **contact highlight masks.**

1. Using a densitometer, read the highiight portion of the transparency and record the density.
2. Using the **Contact Highlight Mask Working Chart** find the three exposures for that particular density.
3. Expose by contact, emulsion to emulsion, three individual sheets of Kodalith Pan Film through the three separation filters, Red 29, Green 61 and Blue 47B.

Process these three highlight masks in D-11 or HC-110 diluted 25cc of concentrate to one liter of water for 2:30 minutes at 68° F in a tray.

6. Contact Highlight Masks

Highlight Mask Aim Points

The finished highlight masks' densities should range around .35, but not exceed .50 on the Kodalith Pan Film. This is an optional aim point. Some transparencies may require more or less density depending on their highlight content.

You should realize that the highlights are sometimes the most important part of the entire image and we may make more than one level of highlights in order to get the proper effect or special effects. The use of highlight masks will increase the highlight structure and provide much better highlight detail and brilliance.

If your light levels are adjustable by using click stop stages, use the lower voltages at approximately 8 volts.

If you use F stops, or "Waterhouse stops", then use a small aperature.

The first method of making highlight masks by building them into the principal masks does have some merit. There are times when it is an advantage. This is a fairly good method to use when you have details such as cut glass and crystal and you don't want to lose these detailed highlights.

For our present circumstances, the highlight masks are either built into the system or made to be used later, combined with the negatives. These are either **Pre-masks or Post-masks.** When the highlight masks are made first and then added to the principal masks, the strength of the mask is diminished because the principal mask is made to a much lower contast level and the highlight image is weakened.

If you decide to make the highlight masks by the pre-mask system, the highlight density on the mask would have to be somewhere around **.60** to arrive at accurate highlight separation.

I prefer making the highlight masks separately and then adding them to the separation negative sandwich in the enlarger carrier when making the matrices. This allows complete control of the highlight structure. This is critical, in my opinion.

6. Contact Highlight Masks

The next time you drive you car on a highway, dim your eyes and look at the cars in front of you. Notice how the highlights of the glass and chrome bumpers glisten. These are **specular highlights**. These are the kinds of highlights that you are trying to preserve. Sometimes the normal highlight mask isn't enough for the effect you want. You may need a **specular highlight mask.**

What is a specular highlight mask?

Most transparencies have highlight areas that are completely controlled by the normal highlight masks. However, there are times that demand some sort of extra snap in the highlight portions of the print. A specular highlight mask is a mask that is even more detailed and crisper than a normal highlight mask. It is usually added to all the other three highlight masks when exposing the matrices.

An example:
A light skinned person wearing a white knit sweater and standing next to a freshly painted white textured wall.

Notice that all of the details I have mentioned, were really **details.**

The knit sweater would lose most of it's delicate texture, and so would the white wall. This would tend to make the print duller than you would like it to be. Not all the detail would be lost, but just enough to make the print lose it's "life".

How to make a specular highlight mask.

Use one of the three highlight negatives, (the one with the most detail) or even place two, or all three highlight masks together on your contact system, and make one white light exposure by contact, using **Kodak LPD4 Film,** or any other reversal litho material, such as **Dupont CRR4,** and process this sheet in a litho type developer, such as Kodalith A & B. Develop for 2:30 min. in a tray.

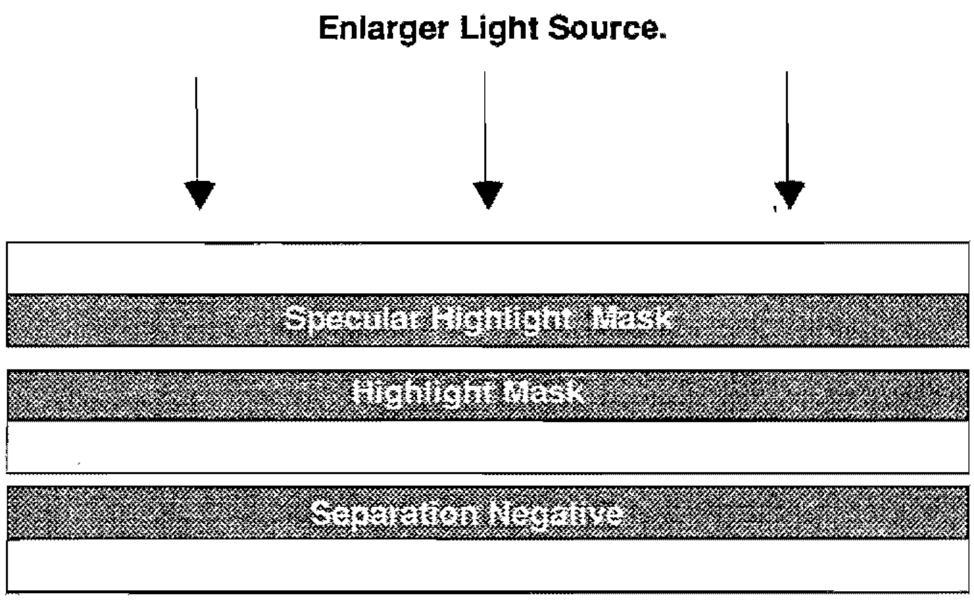
The exposure is critical. You will have to use your own judgement and make the mask just strong enough to separate the highlight of the image a bit more than normal. The resulting specular highlight mask will exhibit a very finely detailed highlight with almost pure black silver and nothing else.

6. Contact Highlight Masks

The detail that must show in this mask should cover only the very top of the scale. You are making a specular highlight mask from your highlight mask.

Add this one sheet to each sandwich of separation negatives and highlight masks when exposing the matrices. The results will amaze you. The fine whites will jump out from the rest of the print.

If your new specular highlight mask develops up too strong, it can be bleached back using a simple Farmers reducer.



Film Orientation to Expose the Matrix Film

7. Mounting Small Transparencies

Procedure

Mounting small transparencies to prevent damage.

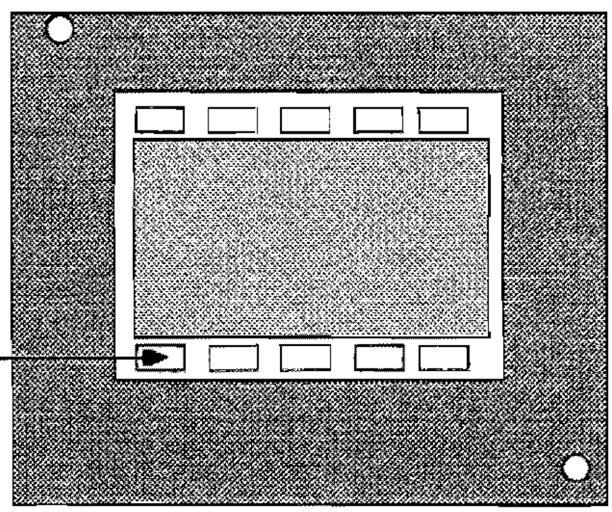
35 mm transparencies are the most vulnerable to damage.

Years ago I began working with small transparencies in a different way. I wanted to make contact masks and register them back to the 35mm transparency with accuracy.

The first thing I did was to call Condit Mfg. and asked if they would make a small diagonal punch that would place two small holes in the extreme corners of the 35mm film. I also asked them to make a pin glass with the pins in the exact position and spacing. They made the punch and pin glass and they were very accurate. However, in my efforts to remove the 35 mm film from the pin glass, I kept ruining the edge of the 35mm film. Sometimes I would get a scratch on the original and that caused quite a problem.

I was determined to make this system work. It took a while before I decided to adapt a completely new idea. I mounted the 35mm film into a larger sheet of film of the same thickness, 2 1/4 inch sq. Now I was able to handle the larger sheet of film with much more safety and ease.

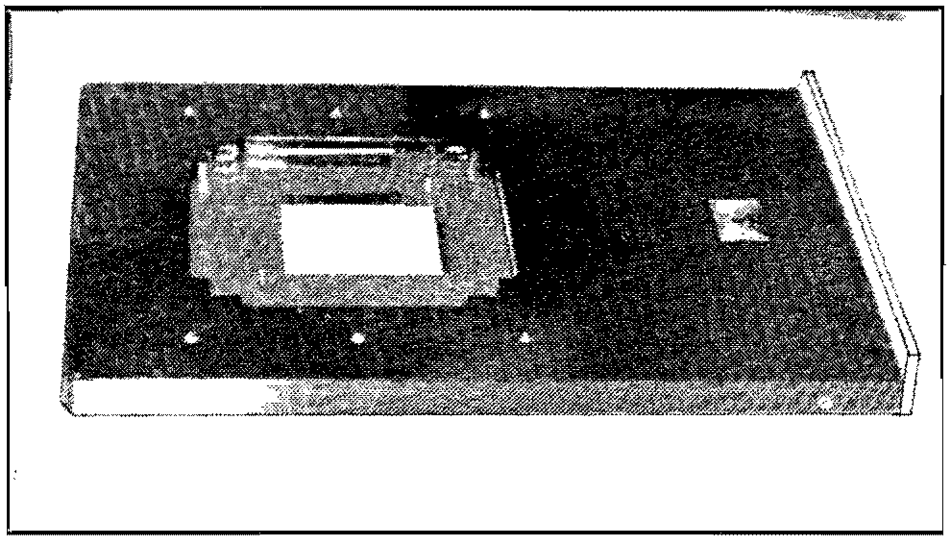
The 3 step grey scale fits perfectly behind the sprocket holes.



7. Mounting Small Transparencies 35mm Oil Film Carrier

The special punch and pin glass that Condit Mfg. made for me was even further augmented by the manufacturing of a special "oil" film carrier.

The Condit Oil Film Carrier



This special film carrier has pins built into the glass. The entire carrier is water proof and the "oil" will not leak out of it.

Punch the mounted transparency and the mask film emulsion down. Place the transparency and the mask film on a special 2 1/4 in. pin glass emulsion down, in that order. After the masks are exposed and developed, place both the transparency and mask back into the registration oil film carrier and use "oil" to eliminate any scratches or abrasions. **The main reason for the use of "oil" is the elimination of refraction which makes all the films and glass into one homogenous piece.**

This Condit carrier doubles in it's use. It fits any enlarger, including my Omega D2 enlarger, and can be used for more things than Dye Transfer.

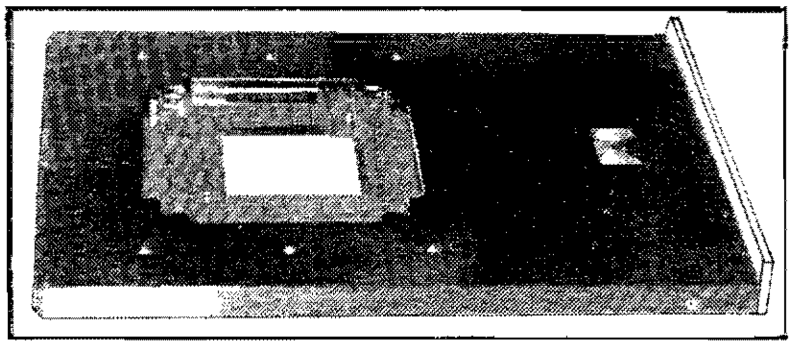
Have you ever tried to make a large Cibachrome print or a Kodak Ektachrome Print from a 35mm transparency? The contrast of either material, especially Cibachrome, is quite high and needs a contrast reducing mask in order to make a pleasing print.

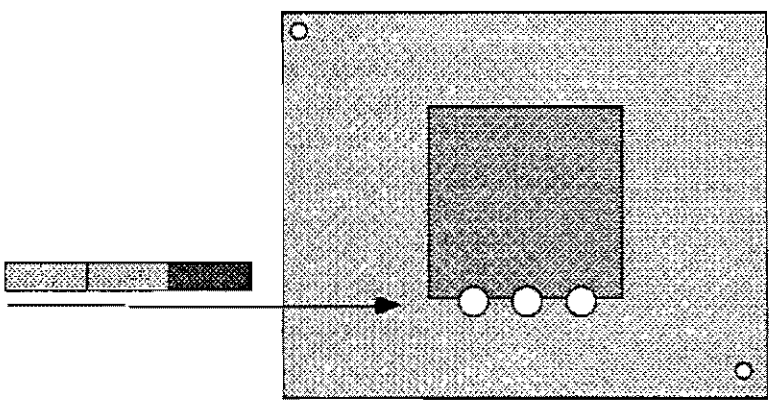
7. Mounting Small Transparencies

Mounting 2 1/4 sq. transparencies.

I believe in enlarging the 120 size originals, so I mount the original transparency into a sheet of 4x5 film of the same thickness.

Condit Mfg. made a carrier for this special purpose. The outside dimensions of the carrier are the same size as the 35mm carrier. It fits the D2 Omega perfectly, as well as other enlargers.





The120 transparency is mounted into a 4x5 sheet of film of the same thickness. The holes are punched in the border of the 120 transparency, so that the 3 step grey scale can be seen through them. Use the same 3M Polyester Silver tape to adhere the transparency to the new film opening.

This mounting system will allow you to place and remove the film without damaging the original transparency. Use a painter's palette knife to lift the film from the pins.

8. Enlarged Separation Negatives

Reasons Why?

Enlarged separation negatives.

We need to make enlarged separation negatives because, if the negatives are made by contact from a small 35mm transparency, the grain of the original transparency will be obliterated by the grain of the separation negative, which will be very evident in the final print.

If contact negatives were made, the grain of any separation film, which is not as fine as the grain of a 35mm Kodachrome or Ektachrome Film, would be very obvious.

The fact that a contact set from 35mm must be enlarged 20 times in order to make a 20x24 Dye Transfer print, is stretching the image quality right out of existence. I have made many prints from 35mm by making contact separation negatives and thought that they were great, but they were small and the grain factor wasn't as obvious.

Not too many prints were made from 35mm transparencies in the early days of color printing. Most of my expertise, and everyone else's, was in making contact separations from large transparencies.

I had just finished a few prints from some small originals. They were made by experimenting with the enlarging methods. I decided to jump in with both feet and became involved with the enlarging method of making separation negatives.

In 1951, I was asked to make a print for Voque Magazine which was going to be used on the cover. It was a head and shoulder's portrait shot on 35mm Kodachrome that was photographed by Irving Penn.

I made this particular set of separations using a Lietz Valloy Enlarger. This enlarger was a condenser type with a 75 watt photo enlarging lamp. I placed the separation gelatin filters under the lens. The carrier was glassless. The transparency, once installed in the small carrier, was not touched until I was through with tmaking the masks and separation negatives.

8. Enlarged Separation Negatives

Method 1

The masks were made by enlargement on a homemade vacuum easel and the negatives were exposed through the masks.

The highlight masks were made separately and added onto the negatives in "post-mask" procedure when the matrices were exposed. The transparency grain was almost invisible.

In 1950, well before most of the point light source and oil film carrier improvements were made in the Dye Transfer field, the detail, for those days, was incredible.

The print turned out so well that we made the covers for Vogue Magazine for the next eight years, until we moved to California.

Using the same technique, I made the first Life Magazine cover from a 35mm color transparency of Shiboin McKenna, shot by Phillipe Halsman, and the results were great, as you can see in the video.

We improved the system and made tremendous strides in helping to increase the use of small transparencies. I have been a believer in enlarged separations ever since, for small transparencies. **However, there is more than one way to make enlarged separation negatives.**

Here is one version.

This version requires making enlarged masks and placing them back on the easel and exposing through them to make the separation negatives. This requires very accurate readings with an easel meter.

When using an incandescent light source, once the basic set of exposures are obtained, the exposure times will be about the same for any transparency. If the transparencies vary from one to another, you will be able to adjust the f stop. This means that you will have control over the "average density" of the original transparency

The Highlight masks are made by enlargement and added back to the negatives when you are exposing the matrices (See the next chapter).

You can also use a diffusion enlarger or a condenser enlarger. I would strongly recommend that you use the condenser enlarger. This system will also allow you to use a point light source.

If you decide to use a point light source, then you will be forced to make your masks and negatives with the lens wide open. The reason for this is the increased amount of refraction that will occur if you stop the lens down.

A quality lens is an absolute must. Apochromatic lenses are better than most lenses because all color rays of light will be focused to the same point.

Point Light Sources.

A point light source is a very small filament which is burned at a very high output, thereby creating a brilliant light. Small lamps that use as little as 8 to 20 volts but produce a 100 watt light output are used in todays point light systems.

However, the point source produces images so sharp that every little scratch or abrasion will show up on the negative. Dust will look like black spots.

Using an "oil" immersion system will help eliminate most of the light scratches and abrasions found on all transparencies. The main purpose of using an oil bath is the elimination of those rainbows along the outside edges of any film placed between two sheets of glass called **refraction.**

The "oil" that I recommend is **Dow Corning's Silicon, # 200, viscosity 100.** I have found that this particular oil is easy to clean, and has the same refraction index as the glass in the carrier. It is available from K.R. Anderson, in Santa Clara, CA.

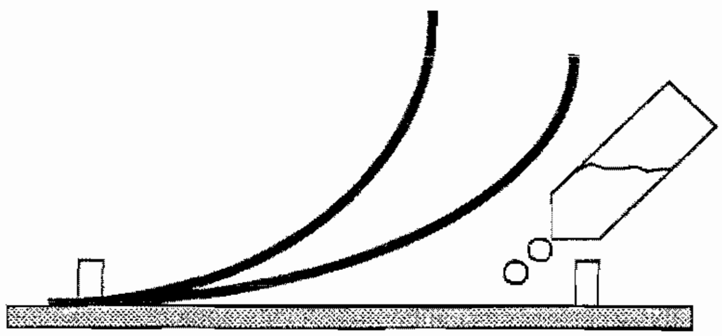
Some labs have been using the chemical used in the dye cleaning business called Perclorethylene. It is commonly called "Perc". This works fine, but since it evaporates quickly, one must work with speed. It is also toxic. Castor oil works, and so does mineral oil. They are harder to clean off the transparency. Regardless of which chemical you use, the final negatives will look much cleaner and sharper if some sort of an oil immersion system is used.

8. Enlarged Separation Negatives

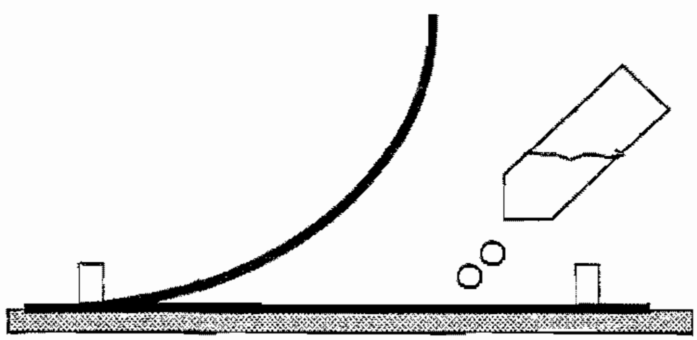
Using "Oil"

I use an oil carrier by placing enough "oil" in between all of the film elements and the glass, and then **squeezing out any bubbles that may be trapped in the solution.**
This idea is not entirely new. Motion picture studios have been using a liquid film gate when making optical copies, which works on the same principal.

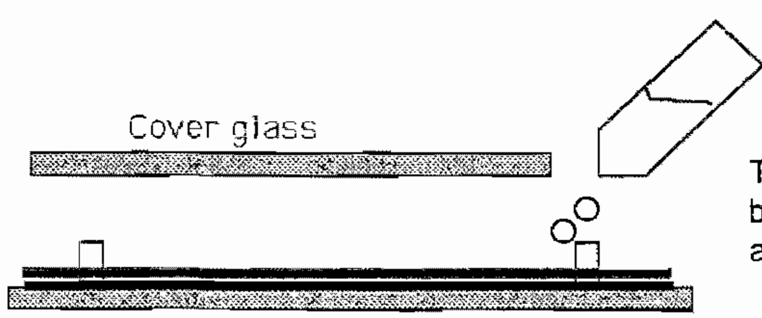
If more than one sheet of film is to be placed in the carrier, the following procedure is used.



The "oil" is first placed under the transparency



Then between the transparency and the mask



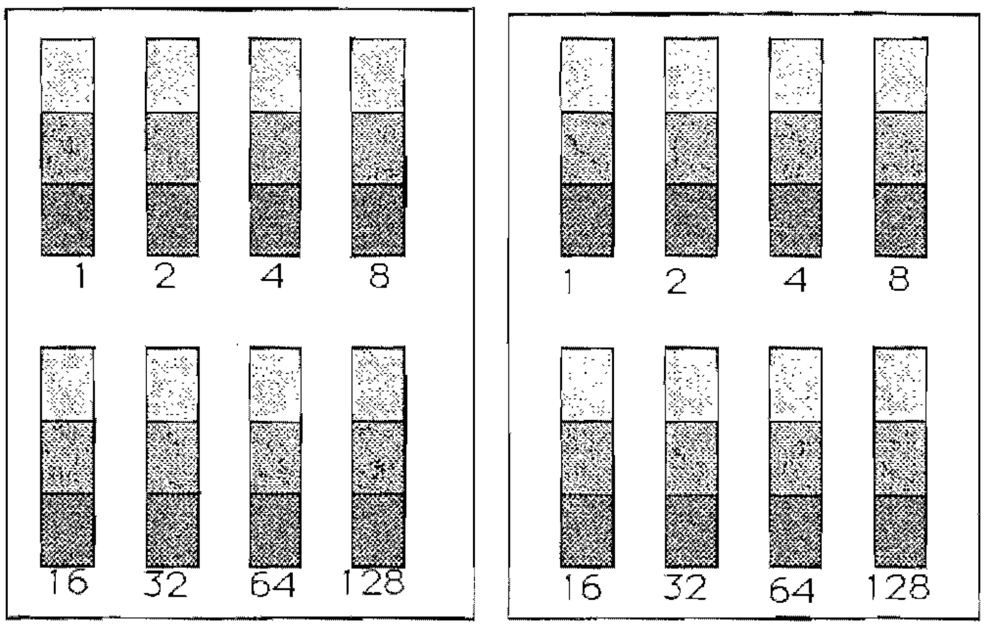
Then over the mask between the cover glass and the mask.

8. Enlarged Separation Negatives

Making enlarged separation negatives with system # 1.

In order to make negatives with this system, a few tests must be made.
Use the three step grey scale, Q-6C. Cut off the color patches and just use the grey scale portion.

If you are using a variable light source in your enlarger, set it at a specific voltage and with the lens wide open, make a series of enlarged exposures on Kodak Pan Masking Film through a Red 29 Filter. Make 2 identical sheets.

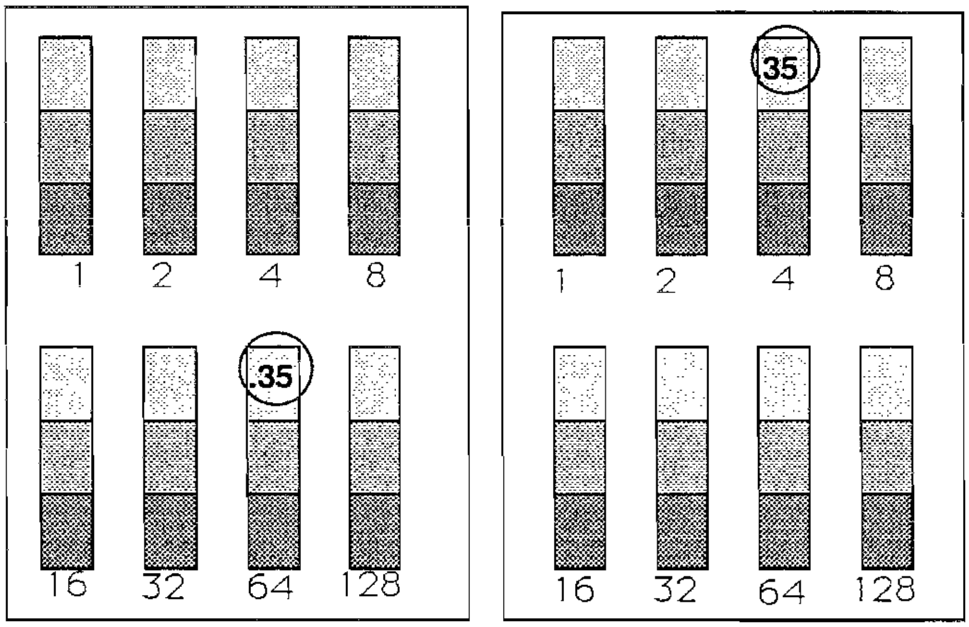


1:30 development   5 00 development

As we did in the earlier masking calibration procedure, process these two sheets for different times, 1:30 and 5:00 minutes in the same dilute masking developer of 25 cc of HC-110 concentrate per liter of water.

8. Enlarged Separation Negatives

Using the same technique as before, find the grey scale that reads as close as possible to .35 in the lightest step on the mask exposure test. Mark these steps for exposure.



1:30 development

5: 00 development

The reason for repeating all of these steps is due to the different variables, such as the color of the enlarger light source and the lens, and all of the other variables that may occur.

We will have very different exposures and developing times from those with the contact system. The different exposures for the green and blue filters can be done by testing in order to determine the filter factor.

Make another chart in the same fashion as we did for making contact masks. This will enable us to determine the development time for each image. Since the light source cannot be touched, we must rely on easel readings to establish the exposure times.

The big difference is that we cannot change the f stop; therefore, you must take a white light easel reading of the projected grey scale in order to determine the correct exposures.

Read the light step only. This will represent the highlight portion of any new transparency. Mark the reading down. This will be your reference point to compare to, when making other masks and negatives.

Any changes in exposure due to differences in density must be determined by the logarithm calculation steps on a scientific calculator.

Your new chart will give you the correct developing time for any gamma, and the correct exposure for any developing time. However, the exposure must be corrected each time a new transparency is placed into the film carrier.

No two transparencies will read alike. Read the difference on the easel with the Wallace Fisher Meter, or any other comparable easel meter, then use the log scale on a slide rule or a scientific calculator to calculate the difference in exposure.

The method for determining the contrast level of the masks and negatives is the same as they were earlier. In fact, the Wallace Fisher Meter makes it possible to read the density range on the easel, thereby allowing you to make the necessary masking mathematics with the flare factor included as part of the reading.

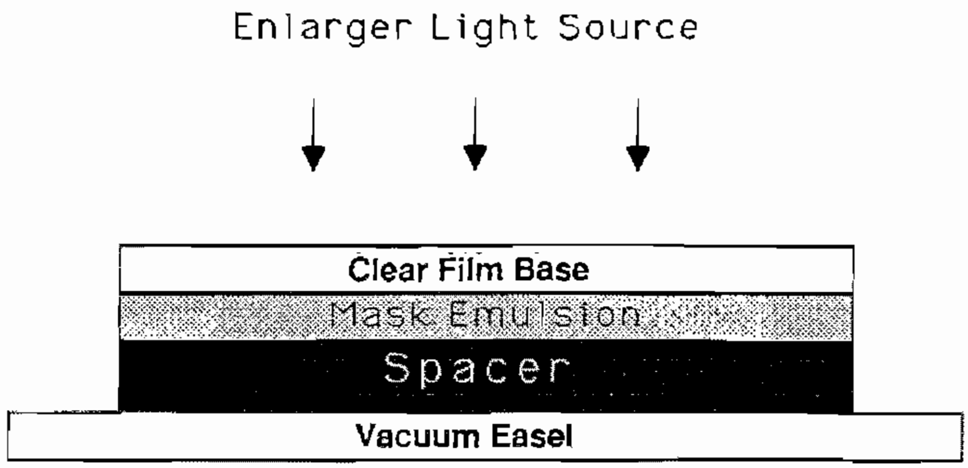
A black sheet of film used as a spacer (black reduces flare) with the same thickness as the separation negative film (which will retain the correct focal plane), is punched with the diagonal pin system, and placed on the pins on the vacuum easel. This sheet will eventually be replaced by the separation film and must be the same thickness.

The unexposed Pan Masking Film is also punched with the diagonal system so that the film will be facing emulsion down when also placed on the pins.

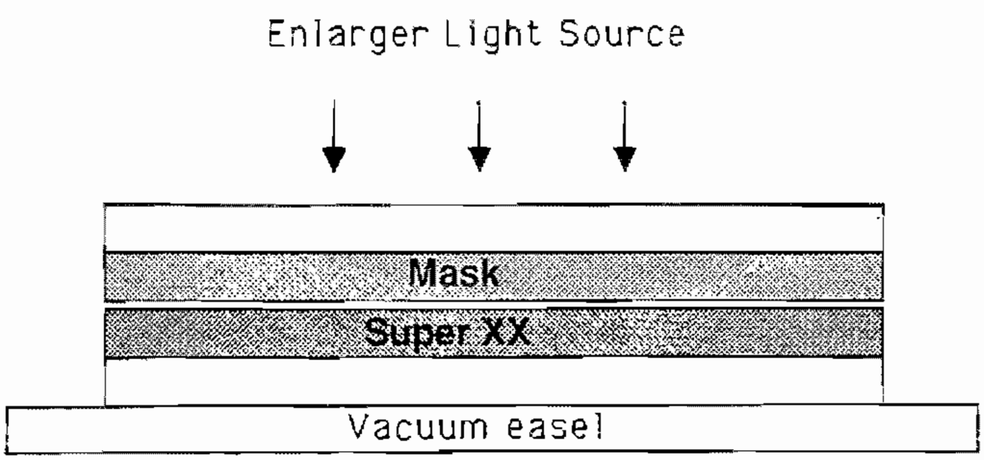
8. Enlarged Separation Negatives

Why is the masking material placed face down?

It is placed face down because the vacuum will pull the emulsions of the mask, and that of the Super XX Film together tightly, face to face, with no air space between them. If you made the mask emulsion up, the clear backing of the Pan Masking Film would act as a spacer and the emulsion of the mask would cause diffusion and eventually cause an out of focus negative.



This is the proper position for placing the mask over the unexposed Kodak Super XX Film. In this position, the diffusion problem is avoided.
Again, if the mask were emulsion up, the emulsion of the mask would act as a diffuser.



8. Enlarged Separation Negatives

Size the image on the easel to the working size. Use an easel meter to establish the exposure, since the lens must remain wide open and you cannot use the f stops to adjust the light level and you must rely on an easel meter and change the exposure times when necessary.

Once the exposure and development times have been determined, proceed to make the exposures of the masks through the proper separation filters.

Process the film in the same fashion as we did when processing contact masks.

After the film has been dried and verified, remove the black film spacer and replace it with the separation negative material emulsion up. Place the mask over the Super XX Film emulsion down.

You must also make a new chart for the **separation negatives.** In this case, with the mask on the easel, you can only make one exposure of the grey scale, because If you attempt to move the easel, the mask will be out of register.

You may have to produce two or three sheets for each color and contrast level before you produce an acceptable chart.

Make new charts with a masked grey scale on the easel., and then make 3 step grey scales on Super XX Film through the masks.

As we did when making the contact separation negative charts, make as many exposures as possible on two identically exposed sheets of film, through all three separation filters, and process them at extreme times, such as 4:00 and 8:00 minutes, in HC-110 developer, using 30cc of concentrate to one liter of water.

This will allow you to make another set of charts for each color separation negative and to make a time gamma chart that will work for your system.

You may have to make more than one attempt at making charts for the separation negatives.

Don't forget to read the highlight area of the image projected on the easel, as this will be your **comparison point.**

8. Enlarged Separation Negatives

Procedure

Here is a method of determining the correct negative exposures.

When you first placed the transparency in the enlarger, you were able to read the high and low densities of the projected image, in order to establish a density range from which you were able to choose the correct exposure and development times for making the masks.

Now read the darkest part of the mask and compare it to the **test mask density.** If they match, use the same exposure. **If not, then use your TI 30 calculator and find the difference needed to make a new negative exposure.**

Use this procedure to make the separation negatives:

1 The first thing to do is place a spacer on the vacuum easel.

2. I use a special carrier that was made for me by Condit Mfg. It is a sealed carrier with diagonal pins set into glass. I can place oil in this carrier and it will not leak out. The pins are diagonal and are set to accept 120 size film.

3. Mount a 35 mm. transparency into the center of the 2 1/4 film of the same thickness as the 35 mm. transparency. Use 3M silver tape #380 around the entire 35 mm. transparency and leave the sprocket holes open on one side.

4. Place a three step grey scale, outside, on the upper or lower glass, and cover the sprocket holes so that the grey scale will be part of the exposure through the sprocket holes.

5. Use black or silver tape to block any light from leaking out around the transparency to avoid flare.

6. Enlarge the transparency to 8x10 on the vacuum easel. Use a grain magnifier to make sure that you are focused properly.

7. Read the projected image of the transparency to establish a density range.

8. Enlarged Separation Negatives

8. Calculate the mask exposure. Don't forget to include any difference in light level reading compared to the original grey scale test.

9. Make an exposure through the Red 29 Filter and then through the Green 61 Filter. The green filter usually needs about three times more exposure than the Red 29 Filter.

10. Process the masks in dilute HC-110 developer, 25cc per liter accordng to the times chosen from the working chart..

11. Verify the masks. When they are dry, read the mask grey scale and calculate the gamma of the mask by dividing the mask grey scale density range by the original grey scale. If you are within .02 of your aim point, you will be close enough. If not, find the reason for the discrepancy and correct it. This is one argument for using an accurate processor like the Jobo.

12. At this point, remove the spacer from the vacuum easel.

13. Before any film is placed on the easel, read the same highlight density on the image in the mask, and if it matches the test density, you will know what the correct exposure is.
    If it is different, calculate the separation negative exposures. Use the red mask for the red filter and green filter negative exposures. Use the green mask for the blue filter separation negative exposure. (Unless you are making split masks).

14. Proceed to process the separation negatives.

15. Verify the accuracy of your contrast level and the contrast balance. The overall densities should be as close as .05, plus or minus. If they look correct, then place the spacer back over the easel and prepare to make the highlight masks.

16. Expose and process the three highlight masks and you will be ready for the next step.

8. Enlarged Separation Negatives

Method 2

Here is a different approach to making enlarged separation negatives.

Make the principal masks by contact. Then place the mask and transparency in the enlarger to make enlarged separation negatives.

The reason for this approach is to eliminate flare.

The biggest enemy in the whole field of photography is **flare.** It flattens contrast and destroys print quality. Placing the principal mask in the enlarger carrier with the transparency will help to eliminate this problem.

Unfortunately, the soft diffused image created by Kodak Pan Masking Film, can cause a problem with some small originals when light sharp edges are photographed against a colored and smooth background.

When this occurs, I will use a film that has a sharper image, such as Kodak Separation Negative Film, Type 1, and make masks with this material instead of Pan Masking Film. You may have to modify your developing times to make the masks fit the gamma requirements.

I also use an oil immersion system. The "oil" is silicon made by Dow Corning, # 200 with a viscosity of 100.

The reasons are as follows:

1 The silicon eliminates all of the abrasions and light scratches.

2. Because it is placed between glass, it keeps the image very flat, eliminating out-of-focus edges.

3. The main reason for using silicon oil is that it has the **same refraction index as glass.** In effect, there is only one piece of glass in the enlarger. This eliminates the annoying raimbow effect along the outside areas of the projected image.

4. **As a by-product, it also eliminates Newton Rings.**

8. Enlarged Separation Negatives

By predicting the exact amount of contrast reduction masks in advance and combining them, one at a time, with the original transparency, you can make fully formed negatives with detail in the shadows and highlights.

Special equipment is not necessary to make these enlarged separation negatives. The enlarger that I use for making enlarged separations is an old **Omega D2 with variable condensers.** However, there are many fine enlargers on the market. The choice is yours. Make sure that the necessary registration equipment will fit your enlarger.

I use Rodenstock Rodagon Apo Lenses. However, there are many quality lenses on the market. Again, take your choice.

When making separations from a 35mm transparency, use lenses between 80 and 105 mm and use matching or larger condensers. The condenser lenses must never be smaller in focal length than the focal length of the lens you are planning to use.

Let us try to read the transparency.

If you have ever tried to use a densitometer to read a 35mm transparency, I am sure that you had trouble in locating the exact spot to read. The style of most densitometers make it virtually impossible to locate the tiny spot of density and place it exactly under the probe.

I have used the old **Kodak Visual Densitometer Model 1A.** Except for the fact that you can't get a decent visual reading through all the color filters, it is easier to find the exact spot.

Speedmaster has a great densitometer that will read transmission or reflective art, and also has a separate enlarging system that attaches to the unit. It will blow up a 35mm or any transparency 18 and 1/2 times. The transparency is projected on a viewing light box, and the probe is such that you can read the whites in the eye of a portrait. This unit is fairly expensive but worth every penny.

However, I do have the perfect instrument for just this chore. The Wallace Fisher Easel Meter.

8. Enlarged Separation Negatives

The Wallace Fisher Easel Meter reads color as well as black and white. It is a digital meter and has a 6.0 density range.

All you need to do is enlarge the 35 mm transparency to the proper size, shut off all safelights, and proceed to read the highlight and shadow densities. You can now find the density range of any small transparency.

It also takes into account the fact that the flare produced by projecting the image in the enlarger, is also included in the readings, and is used to calculate the necessary masking strength.

Why do I use this system of making contact masks before I expose the separation negatives?

The main reason for making negatives this way is the **flare factor.** In my opinion **flare is the biggest problem** in all of photography.

Many years ago, I was in the process of making a dye transfer from an 8x10 transparency of a very large mechanical press.
Off to one side of the press was a small black box which housed the electrical switches and little colored lights.

The dye transfer print looked great except for this one area. The detail in the image of the little black box was just about gone. The separation negatives showed all the detail but it was lost in the print due to flare.

What had happened was that the separation negatives exhibited a light detailed negative in the area of the black box. This isn't anything abnormal, but the fact that I was making an enlargement allowed the black box area to bleed light around the areas of the switches and colored lights. This is called **flare.**

If anything in photography is subject to criticism, it is flare. This is not an unfamiliar subject to those of us who make prints for a living every day. I was able to correct this problem by:

1. Make a silhouette mask of the box in order to make an exposure of this area only. The term "frisket" is used by the art field. This mask could therefore be called a "frisket".

2. Make an exposure of only the silhouetted black box area onto a sheet of Pan Masking Film and produce a thin negative.

3. Add this new thin negative to all of the separation negatives when exposing the matrices.

I didn't want a full scale negative, but just enough density to help eliminate the clear film effect. This improved the print detail in this area immediately.

However, at this same time, I was experimenting with the Cibachrome Print Process. I had made a contrast mask for this same transparency and made a test print. The details in the black box were all held in the print. Upon reflection, I was able to understand what was happening.

The fact that the shadows in the original negatives were almost clear film, made that area flare, but the black area of the transparency, which wasn't clear, didn't flare when making the Ciba print.

This opened up a Pandora's box for me. I finally understood why some jobs that I struggled with didn't work and why others were just fine. **FLARE was the problem.**

As a result, I began a new system of making separation negatives.
Whenever I encountered a transparency that had a "sudden black" image, such as a black hat or a black suit, I was able to isolate this black area, re-expose another image on Pan Masking Film, and add it to the separation negatives when making the Dye Transfer matrices. This works well with any negative-to-positive process.

Anytime a transparency or negative is enlarged, the flare factor becomes your enemy.

For instance, if you have a transparency of a white shirt on a white background, and were to make an enlarged Type R. or an enlarged dupe transparency, the whites (being almost clear film), would flare and destroy much of the top portion of the curve shape of this image.

8. Enlarged Separation Negatives

On the other hand, if you were to make a **contact dupe transparency, or a contact set of negatives**, the detail would hold far better and the negatives would be dense enough so that the flare factor, when making the enlargement, would almost be non-existent.

My system for making enlarged separation negatives is based on **eliminating as much flare as possible,** right from the beginning.

The main reason for the success of the new scanners that have invaded the photographic reproduction field, is the fact that the transparencies are scanned with a laser beam which has no optics or air space about which to be concerned.

Most Dye Transfer labs will enlarge their 35mm transparencies, and some will even enlarge the 2 1/4 sq. transparencies. I certainly do.

Making the separation negatives by contact on films such as T-Max, or Technical Pan, will still not be as grain free as if they were made by enlargement.

The "oil" system and the use of a point light source was first used by **Evans and Peterson Color Lab in 1947.**

The enlarging system that I explained earlier, has been followed by every major lab in the field of Dye Transfer. Without going into all of the fine points of negative making, let us just stop here for a moment, and examine the merits of both systems.

Making the masks on the easel, together with the oil immersion system, works great. It will allow one to make very sharp, clean negatives, without having to remove the transparency from the carrier during all of the steps involved in negative making. This includes making the highlight masks as well. This does make a lot of sense.

However, This is where I differ from my colleagues.

8. Enlarged Separation Negatives

The **flare factor** bothered me so much that I decided to try another approach. If I were able to reduce the flare factor by placing my masks in the carrier with the transparency, would that help eliminate most of the flare? You bet your life it would. However, it meant that I would have to take the masks out of the carrier each time I exposed a separation negative. This would be very inconvenient unless I devised a system that would allow me to do so without too much hassle.

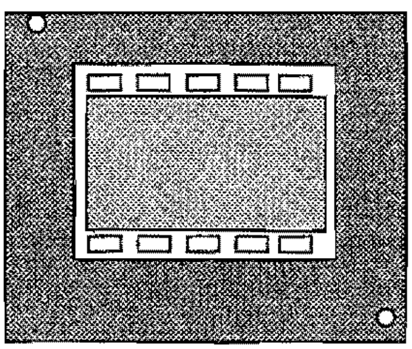
The key element is the special carrier that Condit Mfg. made for me.

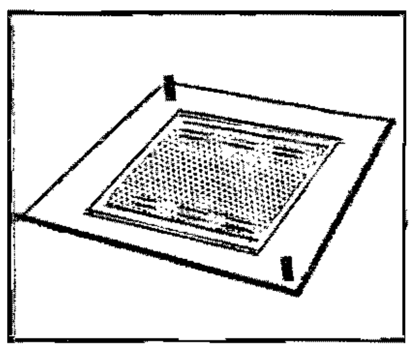
It is a true registration carrier.

It enables me to place transparencies and masks in the carrier, on pins, and also to remove the mask and replace it with a different mask and still be in register in the carrier as well as on the easel. This means that I can put the mask where it belongs, in the carrier, and eliminate 95% of the flare.

I don't need a point source with this system because the last thing the lens will see when making a set of negatives is the emulsion side of the transparency. The "oil" has converted the entire sandwich of glasses, mask, and transparency, into one piece.

As I said earlier, mount the smaller transparencies into a larger sheet of film. This keeps the transparency from being damaged every time it is removed from the carrier and re-inserted. The larger sheet of film takes all of the abuse. The transparency remains safe.





I punched this mounted 35mm using a diagonal system. This system fits the carrier. The masks are exposed by contact, on an identical pin system built into the glass on my contact vacuum platen.

8. Enlarged Separation Negatives

I normally use a tray for processing most masks, but if you wish, use the Jobo Processor, so as not to produce scratches or abrasion marks on the masks. Since the masks need to be processed to different percentages, you will need accuracy and repeatability when processing film.

The Jobo Processor works well. The Kodak Versamat Processor also works well. It all depends on the kind of volume you plan to do.

Let's work with an imaginary transparency.

1. The first thing to do is mount the 35mm transparency into a sheet of .004 mil film. Leave one side of the sprocket holes open and cover the other sprocket holes so that light doesn't escape and cause flare.

2. Using the enlarger, project the transparency on the easel, so that you can read the high and low densities with a good easel meter and calculate the density range.

3. Remove the transparency from the carrier and place it on the pin glass of the contact vacuum platen. Attach a three step grey scale on the bottom of the glass so that it will expose through the sprocket holes. Take a basic contrast reading of the transparency so that you can establish some kind of average density and proceed to expose the masks.

4. The masks are processed and dried and verified. Any scratches at this point will be magnified and will show up in the final print. Be extremely careful. This is another good reason for using a Jobo Processor.

5. Place the first mask and transparency in the enlarger and size the image to fit the 8x10 vacuum easel. Use the silicon "oil" at this time.

6. The same developing times as the first enlarging system will not be valid, because of the use of a different light source.The exposures must be re-established.

8. Enlarged Separation Negatives

7. Make a few exposures on Super XX Film using the red filter. When the proper level of density has been found, record the exposure. The factors for the other filters also may not be valid. In other words, a new chart must be devised.
   Record all of the exposures.
   It is most important to record the light reading of the lightest part of the image on the easel. Any future exposures of new transparen - cies will only need to have the light level adjusted by the f stop. The exposures and developing times will remain the same.

8. Change the masks to expose each separation negative. The carrier will have to have the "oil" added to it each time.

9. Remove all principal masks and expose the highlight masks using the same system to determine the new exposures.

Let me repeat the reasons for using an "oil" system.

By using an oil, such as castor oil, mineral oil, or silicon oil, the refraction problem is solved. All three oils have the same or very similar refraction indexes to glass.

This means that if the oils are used between the two pieces of glass, the "sand-wich" acts as if there were only one piece of glass being used. If you put anything in between the glass,it too, becomes like one piece of glass. So, in effect, what the oil does is :

1. Eliminates the refraction problem.
2. Removes all light scratches and abrasions by filling them in with "oil".
3. Keeps the image perfectly flat, eliminating out-of-focus edges.
4. Combines all the layers of film and glass into one homogeneous unit.
5. Eliminates Newton Rings.

The only problem here is to determine what kind of **"oil"** will do the job properly. Both castor oil and mineral oil are almost inert. But they have the tendency to soften the emulsion of the transparency and make it very easy to damage.
The silicon "oil" that I use does not have this disadvantage. I use a Dow Corning #200 with a viscosity of 100. The oil is easy to remove when you're through making the separation negatives. Remove the transparency from the carrier and separate it from the mask, and place it in a jar filled with film cleaner.

8. Enlarged Separation Negatives

With the cover on the jar, shake the jar for ten seconds. Then transfer the transparency to a new second jar, also filled with the film cleaner.

Again, shake the jar for ten seconds.

Then finally, transfer the transparency to a third clean jar, also filled with film cleaner, and shake the transparency for another ten seconds.

Hang it up to dry. It will be clean, and will not have been handled.

When using oil to make the separation negatives, we have to replace each contrast mask each time we finish using it. I use a palette knife to lift up the cover glass, and also to lift the film off the pins.

The cover glass must be spotless at all times.

The procedure here is to add the proper amount of oil to each part of the system:

1. Add "oil" to the inside part of the bottom glass.
2. Place the transparency into position on both pins.
3. Add oil to the top of the tranparency.
4. Add the mask to the sandwich, on pins.
5. Add oil to the top of the mask.
6. With your forefinger, press and move the top oil in a circular manner in order to press out any air bubbles that may have been trapped in between the films and glass.
7. Add more oil to the top of the sandwich and place the top cover glass into position. Again, press out any bubbles.

By keeping the very bottom of the sandwich clean, and by placing each element into it's proper position, the entire group of pieces must be as clean as possible. The outside of this "sandwich" will be easy to keep clean.

Once you try this system, you may hesitate to to go back to anything else.

8. Enlarged Separation Negatives

Mask off any stray light.

Make sure that you mask off any extraneous light from escaping the carrier with 3M silver tape, except for the image. Place a three step grey scale along the outside of the bottom glass of the carrier so that the three step grey scale will show through the spaces left by the sprocket holes. The same sprocket holes had been used for the grey scales when the principal masks were made.

I can now enlarge this 35mm image to any size I wish, on a vacuum easel.

I choose to make my separation negatives to 8x10 in size, because I have an 8x10 Durst Enlarger. You may have a 4x5 or even a 5 x 7 enlarger. Make the negatives as large as you possibly can. The larger the separation negatives are made, the less trouble you will have with the grain of the separation negative film appearing in the final print.

Once this image is sized, the next step is to make sure that everything is locked in position. Nothing should be allowed to move.

My easel happens to be a simple vacuum easel that has built-in magnets cemented to the bottom. It will stay put on the metal table top without fear of movement. However, Condit Mfg. makes a system of clamping bars that definitely will keep the entire enlarger, as well as the easel, from moving.

At this point, a series of exposures of a three step grey scale should be made that will surround the pre-determined time with an over and under exposed variation, in order to determine the exact time to produce the correct density in the final red filter separation negative.

After stopping the lens down to at least f- 8, make a series of exposures through the Red 29 Filter. Let us assume that the correct exposure was given and the average processing time for the red filter separation negative is 3:30 min. in HC-110 developer concentrate diluted 30cc per liter.

Process this sheet of film and dry it.

8. Enlarged Separation Negatives

Kodachrome K-12 and K-14

Read the shadow area of the negative with a densitometer and try to find which exposure produced a .40 reading. When this particular reading is found, make a note of the exposure and place the probe of the easel meter or a Speedmaster analyzer on the **lightest area of the image. Record the number.**

Anytime in the future, one can place the probe of the meter on any new masked transparency projected image, and **by adjusting the f stop**, produce the correct light level of exposure.

Remember that whether you are making contact separation negatives, or making enlarged negatives with a point source, the light source must be stabilized.

The **exposure must be changed**, depending on the density of the original transparency.

However, when making separation negatives by enlargement, with the system that I subscribe to, the times can remain constant, **but the f stop will have to be changed.**

Kodachrome and it's difference from Ektachrome.

The old K-12 Kodachrome process produced transparencies that required no change in separation filters, compared to other color films, when making separation negatives.

The filters that most of the labs in the world use are the Red 29, the Green 61 and the Blue 47B.

However, Kodak decided to improve the quality of the new Kodachrome K-14 process. The make-up of the K-14 Kodachrome process, with it's much longer cyan scale, requires a change in the use of the red filter in order to make the separation negatives work properly.

The Kodachrome K-14 process cyan layer now produces a much deeper curve. This makes a much richer black, but all of the labs began to exhibit dark blue areas in the shadow portions of the image when making prints or when being separated for the graphic arts field.

8. Enlarged Separation Negatives

Kodachrome K-12 and K-14

After months of experimenting, most labs came up with the same solution.

When a K-14 Kodachrome is being prepared for separations, use a **Red 25 Filter** instead of the Red 29 Filter when making the actual separations.

The Red 29 Filter can be used for making the masks. The fact that the Red 25 Filiter produces more color overlap then does the Red 29 Filter, made it easier to eliminate the dark blue effects in the shadow portions of the Kodachrome K-14 image. Color accuracy didn't suffer as much as it did with the Red 29 Filter.

One would expect the cyan layer to be improperly separated, but the overlapping feature of the Red 25 Filter made it work so that the colors did not become garish.

By making tests, I know that my basic ratio for exposing a 35mm pre-masked Kodachrome K-14 transparency is :

Enlarged Simplified Separation Negative Working Chart

Red 25	**8 Sec**
Green 61	**20 Sec.**
Blue 47B	**14 Sec**

If the transparency had been an Ektachrome instead of Kodachrome K-14, the red exposure would have been :

Red 29	**20 Sec.**

The rest of the exposures would remain the same.

The developing times for the set of enlarged separation negatives are usually different than for a contact set. The reason for this is all of the variables: such as the light source, lens, voltage, and type of light source: such as condensers versus diffusion. Just going through new optics would be enough to make a change.

8. Enlarged Separation Negatives

The tray developing times with my particular system, water, temperature, and agitation, are as follows:

Red filter separation negative	**5:00 Min.**
Green filter separation negative	**4:30 Min.**
Blue filter separation negative	**8:00 Min.**

The main object here is to make sure that the level of exposure is the proper amount so the shadows fall around .40, and that the grey scales match as closely as possible. Remember, you are not printing the grey scales, you are only using them as guides. However, they should read as alike as possible, though they will rarely read perfectly alike because of subject failure. This is a product of flare. The different amounts of light coming through the transparency will govern the amount of flare that will be introduced into the system for each exposure.

Making all of the separation negatives to read alike is almost an impossibility when they are enlarged, unless you are making the separation negatives by contact. Even this is a tough problem because the action of the developer will be different for each sheet of film.

At this point, let us reflect on what has been done. I have made a set of separation negatives by placing the masked transparency in the enlarger and changed the mask for each new separation negative exposure to reduce flare.

The filters were placed in the space where the variable condensers are housed. This keeps them out of the path of the image, and helps to keep the transparency from losing it's sharpness. It is always prudent to place the separation filters between the light source and the film carrier.

You have a few options to choose from at this point.

If you want to just place your "sandwich" of films in the carrier, using a glass carrier, you may encounter much more than Newton Rings. Every speck of dirt on each layer (8 layers) will be exposed onto the separation negative.

Even worse than that is the fact that the refraction of the image, caused by the two pieces of glass, will cause colored rainbows along the outside dimensions of the transparency.

8. Enlarged Separation Negatives

You might be able to eliminate the Newton Rings by using lithographer's "dust" (fine ground powder), but you will still produce dust specks in your final print because of the small size of a 35mm transparency.

The most important part of this whole system that must be corrected is the refraction, caused by the two pieces of glass in the carrier. This will cause the edges of your separation negatives to have an out-of-focus as well as an out-of-register appearance.

Recognizing edge flare and how to correct it.

Edge flare is noticeable when you see a picture of a light subject (like a white hat) against a darker background (like a blue sky). If you look closely you will notice a dark rim around the light object. This is edge flare.

An Example of Edge Flare

The size of the original transparency, and the kind of masking film used in making the separation negatives, are usually the reasons why this problem occurs.

Here is what causes the problem:

The film conventionally used for making the principal mask is Kodak Pan Masking Film. This material is manufactured to produce a soft and diffused image.

8. Enlarged Separation Negatives

The reason the film is made this way is interesting.

In the early days of color printing it was easier to register the mask by eye back to the transparency because it was diffused. This was before the days of precision punches and pin register systems.

One of the interesting by-products of this soft diffusion was the fact that it improved the illusion of sharpness of the final print, because the fine details in the shot were not masked as accurately as the large areas, and even though the overall contrast was reduced, the fine detail stayed almost intact, and the image appeared sharper.

The diffusion of the masking material is what causes edge flare.

It would be hard to detect in a set of separation negatives made from a large transparency. However, in a small transparency, the flare may only be 1 mm in size, but it would be noticeable when enlarged. The same 1 mm thickness in an 8 x 10 image would not be noticed at all. It's just more visible when enlargements are made.

The white hat will flare automatically when exposed. It is a very light area and the flare is to be expected. This dark silver flare is converted to lighter silver when a separation negative is made. And that again converts to a darker edge when printed.

There are two ways to get rid of this effect:

1. Make enlarged negatives by first making enlarged masks and printing through them to make the final negatives. The edge effect is still there, but the size of the image is much larger while the size of the flare is still about the same size as it would be if made by contact.

2. Use a different film for making the masks. There is no law which states that you must use Kodak Pan Masking Film, so why not try something else?

8. Enlarged Separation Negatives

Different films for masking

I used Kodak Super XX and Kodak Separation Films, Type 1 and 2, and even Kodak Technical Pan Film. They all work and reduce the flare to almost nothing.

The trick here is to find the proper dilution of the developer used to process the masks. Use a very dilute developer when making your new tests.

Make a time gamma chart of your own that you know will work and repeat accurately.

9. Enlarged Highlight Masks

Making enlarged highlight masks.

In order to fit the enlarged separation negatives, we must make highlight masks by enlargement, and the registration must be accurate.
The most important aspect of this system means that we must be abe to determine a way to make accurate exposures that will reflect the correct density and color balance.

Here is the procedure to follow:

1. With no image in the film carrier, stop the enlarger down to f 22.

2. Then make a series of exposures on the top 1/3rd of a sheet of Kodalith Pan Film on the easel, emulsion up. Use a Red 29 Filter and keep a record of your exposures.
   Use the same step exposure series that we used for making contact highlight masks, but this time you are using the enlarger as your light source.

3. Do the same for the Green 61 in the middle third of the same sheet of film.

4. Do the same for the Blue 47B on the remaining third bottom space of the film

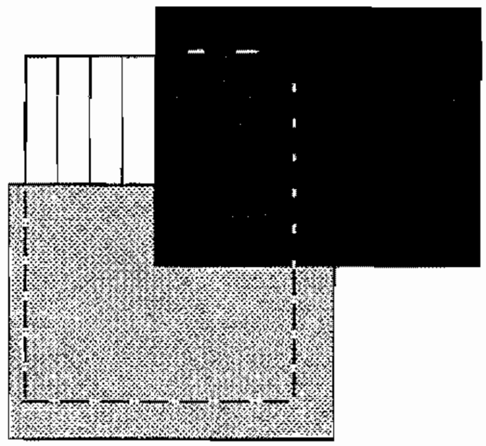
5. Process this one sheet of Kodalith Pan Film in a tray of D-11 for 2:30 minutes at 68° F.

6. When dry, try to find an area that reads .35 density. When you find it, count the steps in your test and determine the exposure that it required.

9. Enlarged Highlight Masks

Procedure

Here is an example of the exposing procedure



Using an easel meter, read the light level on the easel with white light only. **Record this light reading and the three exposure times** that were used to obtain a .density for the red, green, and blue exposure tests.

Place this recorded light level reading **key number** nearby, as this will be the key number when making future highlight exposures. This light level will be considered the highlight exposure level for any transparency.

Here is the procedure :

1. Place a transparency into the film carrier and project it on the easel.

2. Read the highlight area of the **transparency** on the easel.

3. Using the f stop as a control, adjust the f stop until you get the same **light level key number** as you did for the tests.

4. Your exposures will then be the same as they were for the test exposures.

In order to make the enlarged highlight masks you must remove the principal masks completely, and project only the transparency.

9. Enlarged Highlight Masks

However, there is a problem with film speed.

In order to expose the Red 29 Filter properly, when using Kodalith Pan Film, I had to add a neutral density filter to my light source. Try a 2.3 neutral density filter. That's how sensitive the film is to red light. Remove the neutral density filter when exposing the green and blue filters.

You may or may not require the need for such a neutral density filter, depending on the type of film you decide to use for making highlight masks.

These three sheets of Kodak Kodalith Pan Film can be tray processed in D-11 for 2:30 minutes, or using HC-110 concentrate, 30cc per liter of water, for the same time. Any negative strength developer will work. Crispier results can be obtained with a stronger developer.

If you feel that a specular highlight negative would improve the detail in the highlight of the print, pick out the best detailed highlight negative, and expose it by contact on Kodak LPD 4 Film, or Dupont CRR4 film. The object here is to have just a whisper of detail in the specular highlight mask.

You can process this sheet of film using a red safelight, in either Kodalith developer or D-11.

If you want to learn more about what happens when highlight masks are added to the separation negatives, make a set of black and white prints (bromides) and examine them carefully. (This is described in the next chapter).

Making and using three highlight masks when making Dye Transfer prints is the one area where brilliance and sparkle can be added or lost to the final print. Make sure that you meet the density requirements.

10. Making the Matrices

The use of "bromides "in producing accurate matrices.

In order to decide how to determine the correct exposures when making matrices, there are three methods that I use:

1. Making black and white prints (called bromides).

2. A combination of making "bromides" and the use of an easel meter.

3. The use of an easel meter only.

Making bromides (black and white prints), to establish the color balance and the exposures of the matrices is not a new idea. This is a method that was once used by myself and all of the Carbro printers.

The bromides were rolled into contact with the pigments in order to produce the pigment relief image. Bromides were the most important step in the Carbro process.

We made bromides from the customer's negatives and had to imagine what a flesh color would look like when all we had were black and white images to go by.

After making many incorrect decisions about color balance, one became adept at "guessing" the density and balance of a set of glass separation negatives.

Since most of the negatives were shot and developed at the photographer's studio, and were processed by lab technicians who were never really qualified as color technicians, there were many times when the glass negatives didn't meet the criteria for quality.

The Carbro technician had to be an excellent black and white printer. These prints were the only method we had to really control the contrast, density, and color balance of the Carbro print.

There were no easel meters as we know them today. Densitometers were hard to find and expensive. You learned the hard way, by trial and eror, and experience

10. Making the Matrices

It's possible today to make bromides using developers such as Kodak Dektol and papers such as Kodak Polycontrast Rapid.

However, with today's new Ektamatic processors, a method of using bromides to establish matrix exposures can be simplified.

The "trick" of making bromides with today's technology is as follows:

The ideal tool for this procedure is a stabilization processor.

The temperature of the chemistry has little bearing on the outcome of the bromide.

We can establish some kind of contrast similarity, although it is not 100% necessary.

Since we already know that we would like to process the matrices to a normal contrast, the only thing we can do is to change the contrast of the bromides so that their contrast matches the contrast of the matrix film. Here's how it is done:

Method #1. Making black and white prints called bromides.

Accurately expose a 21 step grey scale on a sheet of matrix film. Process normally and dry the matrix film. Dye it in cyan dye and transfer it.

Then make a series of exposures on a sheet of variable contrast Kodak Ektamatic SC Paper. Use a #2 polyconrtrast filter. Compare the results by viewing them through a Red 29 Filter.

If the contrast doesn't match, adjust the contrast filtration for the bromide and continue to search for the correct contrast.

Once you have found the proper contrast filtration for the bromide, you are ready to start.

10. Making the Matrices

You can use your eyes and determine the densities with accuracy.

You will be able to fold the bromide paper to compare densities when you lay it against another sheet to place the grey scales as close together as possible. Use your eyes and try to match the steps of the 21 step grey scale. It will be easy to see the scale either expand or contract in contrast.

When you have found the correct filtration for contrast control, and the bromide exposure that matches the matrix density, all that remains to be done is to use a "factor" to determine the correct exposures for the matrix film. Here is an example:

The grey scale on the matrix film required 30 seconds.
The grey scale on the bromide required 9 seconds

Divide the matrix exposure by the bromide exposure.
The factor is 3.3.

The procedure for determining the exposures from a set of separation negatives for the matrices is as follows:

First make a bromide exposure strip test using the red filter negative, so that you can find one of the strips that look similar to the transparency by looking at **both the bromide and the transparency through a Red 29 Filter.**

Once you have found the correct density match for the cyan image, make a full sized (8x10) print of the same negative.

Then make exposures of the magenta and yellow printers until a **neutral area in all of the bromide prints look alike.** When they do, multiply the bromide exposures by the factor that we established.

10. Making the Matrices

An example:
If your bromides established a balance of:

Cyan	10 sec
Magenta	12 sec
Yellow	15 sec

Your factor of 3.33 is multiplied by the above numbers to give you an accurate set of exposures for the matrix film.

An example:

If your **cyan bromide** required 10 seconds exposure, then multiply the **cyan matrix** exposure by a factor of 3.3. The answer is **33.3 sec.**

If your **magenta bromide** required an exposure of 12 seconds, then multiply the **magenta matrix** exposure by a factor of 3.3 and the answer is **39.9 sec.**

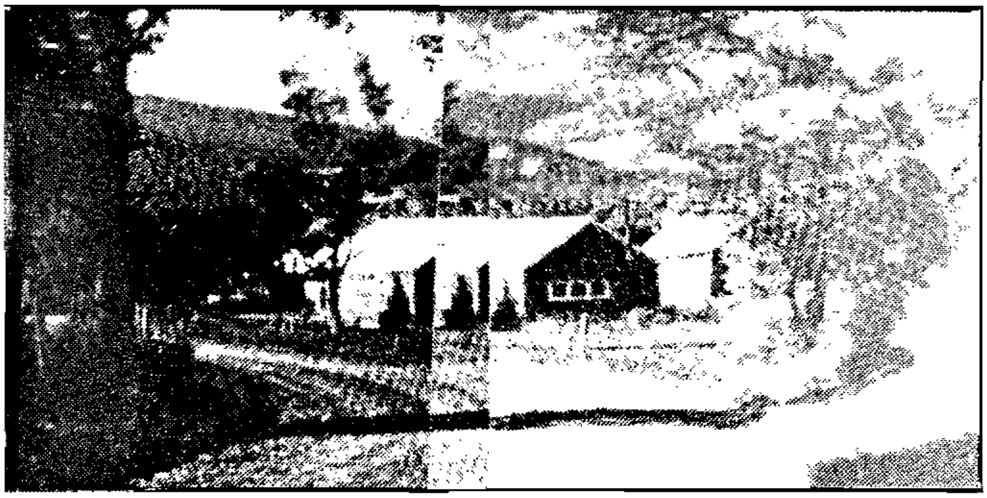
If your **yellow bromide** required an exposure of 15 seconds, then multiply the **yellow matrix** exposure by a factor of 3.3 and the answer is **49.9 sec.**

By folding the bromide paper and laying it against an area that is supposed to be neutral, you will soon find that making an accurate decision is not that difficult.

The best procedure at this point is to make a small Dye Transfer print of an important area of your transparency and use that information to make any changes in contrast, density, or color balance.

In the beginning of your adventure in making Dye Transfer prints, I recommend very strongly that you make many tests of your images before committing yourself to the cost of large matrices.

10. Making the Matrices



The roof of the building in this particular transparency was grey. By matching the roof densities of the magenta and yellow bromides to the roof density of the cyan bromide, we were able to establish the exposures for a correct balance between the three matrices.

Practice and experience will allow you to become quite adept at using bromides to produce the necessary exposure times for accurate matrices.

Remember, the method for using bromides is as follows:

1. Make a cyan bromide until it matches the transparency for density when viewed through a Red 29 Filter.

2. Make the magenta and yellow bromides until all the neutral areas in the image match in density.

3. Use the **factor** and your calculator to establish the correct exposures for the matrix film.

4. Make a small test Dye Transfer print of the most important area of the image.

5. At this point, make any necessary corrections before making a final full sized set of matrices.

10. Making the Matrices

Method 2. Bromides and easel meter.

We have already seen how making a set of black and white prints called **"bromides"** can help in determining the matrix exposures.

However, if we use an easel meter such as a Wallace Fisher, or any other comparable meter, and read the grey roof in the image of the cyan printer and record the density number, then read the other two negatives in the same spot and record their density numbers, we can use our scientific calculator to determine the other two exposures. Here is how:

Make a cyan bromide that matches the transparency in overall density. Use a Red 29 Filter to view both the bromide and the transparency.

Use the log scale portion of your scientific calculator (TI-30) and determine the magenta and yellow exposures by the differences between the readings.

Again, once the exposures are determined for bromides, **multilpy those numbers by the factor to obtain their correct exposures for the matrices.**

Method #3.

What do you do if you have **no neutral areas** in the transparency? In order to find the exposure balance using just a grey scale, here is how it is done:

Using the step and repeat exposure jig, size the red separation negative and make a series of strip exposures of the **same area** on a sheet of matrix film (8x10) using different exposure times. Use exposure times like 5, 10, 15, 20, 25 seconds, and so on.

Process the matrix film normally in the tanning A (1 part) and B (2 parts) developer, in a tray.

Make sure that your chemistry is at 68° F.

Use 200 cc of A and 400 cc of B

10. Making the Matrices

In the dark, with a red #1A safelight, mix the two developing components, the A and B, for no more than 10 seconds. If the developer is allowed to remain mixed longer than 10 seconds it rapidly begins to deteriorate. You must have a fixed time for the mixing stage.

Process this single sheet of 8x10 matrix film for 2:30 minutes. Keep flipping the film, first emulsion up, then emulsion down. Keep the agitaition as smooth as possible.

Stop the action of the developer by inserting the sheet into a tray containing 500 cc of 1% acetic acid solution. Agitate this sheet in this solution for 45 seconds. This is a critical step. The time it takes for the 1% acid rinse to completely penetrate the thick swollen emulsion is at least 30 seconds.

Fix the film for 1 minute in a non hardening fixer such as C41 fixer.

Then wash the film's soft unhardened emulsion off, by placing the sheet of matrix film emulsion up in a tray of hot water (120° F), and keep rinsing it until you think that it is perfectly clean, then give it one more rinse. What is left, is the gelatin relief image that will carry the dye to the Dye Transfer paper.

Make sure that you clean the edges of the matrix film with your fingernails as gelatin will adhere to the edges of the film where it was cut at the factory. These pieces of gelatin can get loose and float around in the dye tray and eventually stick to the emulsion and cause dye specks on every succeeding print.

Then give it one more final rinse.

At this point, hang the film to dry.

Place some Dye Transfer paper in a tray containing Kodak Paper Conditioner. Let the paper soak for 20 minutes, in order to expand and to be properly con-didtioned to accept the dye.

10. Making the Matrices

After drying the sheet of matrix film, place it in the cyan dye and let it soak for 5 minutes. Place the matrix film in the first of two 1% acetic acid rinse trays for 1 minute. Then place it into the second tray for 30 seconds. This second rinse is simply a holding rinse, while you place the conditioned Dye Transfer paper on the transfer table.

Proceed to transfer the cyan dye image to a sheet of paper on the transfer table. Let it transfer for 5 minutes.

After peeling the matrix film from the Dye Transfer paper, compare the dyed cyan image with the original transparency, viewing both through a Red 29 Filter.

When you have found what you think is a close match for density, record the exposure.

Since you have already read the middle step of the grey scale and have determined the differences in density, use these calculations to establish the correct exposures for the magenta and yellow matrices.

	Density	Exposure	
Cyan	1.20	10.0	seconds
Magenta	1.16	9.1	seconds
Yellow	1.25	11.0	seconds

Try this mathematical procedure with your own scientific calculator and see if you can get the same results.

Suppose, instead, that you had a predetermined bromide exposure balance of :

Cyan	3 sec.
Magenta	6 sec.
Yellow	9 sec.

If you had to make a change of exposures so that the new cyan matrix would need 13 seconds, you could divide the cyan 3 seconds into the matrix 13 seconds and obtain a factor of 4.33, or you could use another simple method of comparison as follows:

10. Making the Matrices

Do the following to obtain the new matrix exposures for the cyan, magenta and yellow.

Multiply (magenta) 6 sec. by original (cyan)13 sec = 78 then divide by (new cyan) 3 sec. to obtain the answer, 26 sec. for the new magenta.

The same procedure is used for finding the new yellow exposure.

Multiply (old yellow) 9 sec. by the new magenta 26 sec. = 234, then divide by the old magenta 6 sec. and the asnwer is 39 sec. for the new yellow matrix exposures.

A slide rule would make this chore quite simple, but slide rules have become as scarce as hen's teeth. Instead, get an inexpensive scientific calculator made by Texas Instruments, TI-30. The log program in this instrument is excellent.

Try another example:

This time the matrix exposures are,

Cyan 38 sec. Magenta 45 sec. Yellow 62 sec.

The new cyan is changed to 12 seconds. Using the same approach as in the previous set of exposures, try to work out the correct exposures.
The answers should be:

Cyan 12 sec. Magenta 14.2 sec. Yellow 19.6 sec.

This is one of the reasons why I insist on placing a grey scale along the edge of a transparency, or having it appear through the sprocket holes, so that we can use the information from their densities, in order to make a satisfactory set of matrices.

To sum up all that I have been saying throughout this book, my approach to making a print is not complicated and can be done by anyone.

How to properly process matrix film.

There are many ways to process all kinds of film. I have used trays, a Kodak Versamat, a Jobo processor, A Pako Processor, tanks, rotary drums and a few more. **The simplest and one of the best ways is in a tray.**

Once you shut the lights out and start to develop, the time goes by quickly and the accuracy of development and agitiation can be maintained quite well. In order to maintain a specific rhythm when agitating the film in a tray, try using a metronome set at 60 beats per minute. I trained many darkroom workers in how to establish their own agitation speed and repeatability using a metronome

However, processing the matrix films is different.

The first thing any of my amateur students asks me is, "**Do you process all three sheets of matrix film at the same time?**" The answer of course is **yes.**

In order to keep all of the elements of "surprise" out of your Dye Transfer system, always process the three sheets together.

Here is how this developer works:

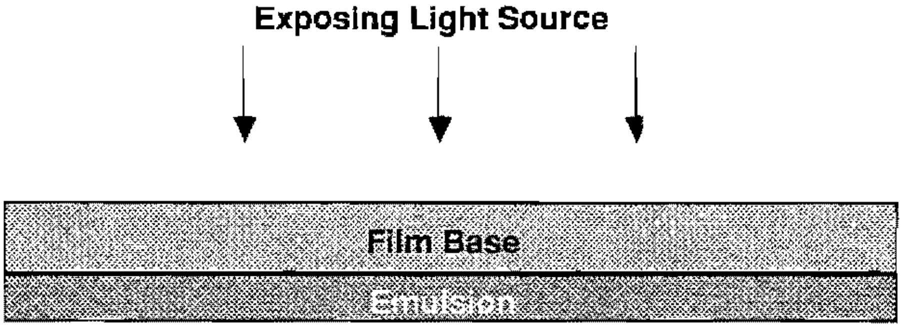
The Kodak Tanning Developer is made up of two main separate components. They are called **Tanning A and Tanning B.**

The main developing agents in the A portion are elon, citric acid, and pyro. The single ingredient in the B portion is pottasium carbonate. This is simply an accelerator.

These agents will not only reduce the silver salts to pure silver, but the pyro, in conjunction with citric acid, will harden the gelatin wherever there is silver present. This means,if the matrices are processed properly, you will achieve a gelatin relief image.

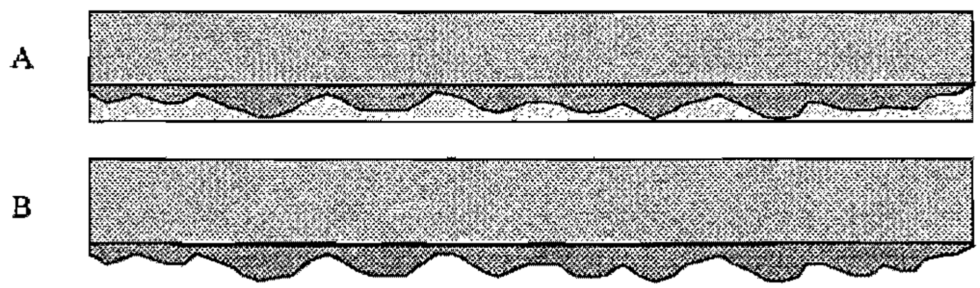
10. Making the Matrices

The construction of matrix film is what makes this process work. To begin with, the matrix film must be exposed through the base side.



The yellow color prevents the film from being over exposed as the film is highly sensitive to blue light. The emulsion is then formed next to the base so that it will adhere to the base and not wash away.

The following diagram (A) indicates what the matrix film would look like after development. The exposed image is tanned in the developer and is attached to the film base as a gelatin relief image.



This above diagram (B) shows the final gelatin relief image after the hot water wash which removes all of the unexposed and undeveloped emulsion.

Incidently, the hot water segment of the processing stages must be done emulsion up to keep from damaging the very soft fragile image.

This part of the process is done in normal room light.

10. Making the Matrices

This is not magic. The formula has been around for a long time. Before this formula was discovered, there was a system that used pottasium bichromate (and also pottasium dichromate) as a bleach, which also hardened the emulsion in the presence of silver. The year was 1870.

However, this new developer has the ability of being able to produce variations in the contrast of the matrix emulsion just by changing the proportions of the A solution and the B solution.

The chemistry is prepared in two separate parts, marked A and B.
Again, here is the makeup of the two separate components.The A portion has all of the developing ingredients and the B is the accelerator.

The contrast of the chemistry is controlled by the proportion of A to B.

1 part A to 1 part B would produce a very flat image, while 1 part A to 5 parts B would produce a high contrast image. **1 part A to 2 parts B is considered normal.**

The various packaged chemicals for processing the matrices and running the prints are available from Kodak and the instructions for their use are enclosed. However, if you wish to make your own, here are some formulas:
The formula for the tanning A and B developer is as follows:

Tanning Developer Part A

Elon	16 grams
Sodium Sulfite	8 grams
Pottasium Bromide	16 grams
Pyro	18 grams
Citric Acid	4 grams

Mix in 1 gallon of water (110 ° F) in the order listed. Make sure that each chemical is dissolved before adding the next.

Tanning Developer Part B

To five gallons of hot water (120 ° F), add 9 1/2 pounds of pottasium carbonate, anhydrous. For a small quantity mix 3.8 lbs. to 2 gallons of hot water.

This mixture must be completely cooled and totally dissolved before use. If the mixture has not totally dissolved, the print will have a granular appearance in the clear areas.

Another important point to consider is the temperature of the darkroom in the winter. **If the temperature in the darkroom drops below 55° F, then the B solution will precipitate and harden. It cannot be used again. Dump it.**
Even the hottest water used to re-dissolve it won't help. It will harden again. In other words, dump it and start again. Then make sure to keep the B solution above 55° F.

Another word of caution. If your B chemistry is too hot and you wish to cool it down, **don't add ice** to the mixture. It will harden the solution surrounding the ice and will look as though you were about to make jello. Intstead, use a waterproof sandwich bag filled with ice cold water and ice and float it in the tray of B solution in order to cool it off.

This is the procedure to be used when processing one 8x10 sheet of matrix film.

At this point, prepare three 8x10 processing trays with the following chemistry:

Tray 1	**Volume of part A 250 cc** **Volume of part B 500 cc**

This chemistry is kept separate until you are ready to use it:

Tray 2	**500 cc of 1% acetic acid rinse**
Tray 3	**500 cc of non hardening fixer (C41)**

10. Making the Matrices

If you wish to make an inexpensive fixer, use regular hypo crystals, with pottasium metabisulfite. Use a 1000 cc graduate full of crystals and a teaspoon of pottasium metabisulfite to a gallon of water. The metabisulfite acts as a preservative. Without it, the fixer would be "shot" in one use.

I work from right to left. The reason for working in this direction is that I am a

"righty", and as I place film from one tray to the next, I can keep one hand free from contamination at all times. If you are a "lefty", try the other direction.

The first 8x10 tray will consist of our developer. Do not mix the A and B together until you are ready to process, since tanning developer has a very short life.

The proportion of A to B is "1 to 2". This is considered a mixture for normal contrast. The chemistry temperature should be set at 68 °F. If possible, use a water jacket to keep the temperature as accurate as possible for processing repeatability.

Before you process the matrix test sheet, mix up a quart of paper conditioner, and place it in a moving tray. It can be obtained from Kodak, ready to use. The formula for the paper conditioner is as follows:

Paper Conditioner

To 4000 cc of water add:	
Triethanolamine	**60 cc.**
Glacial Acetic Acid	**20 cc**

The pH of this mixture should be **6.5.** If it is higher, add more 28% acetic acid. If it is lower, add more of the 10% solution of triethanolamine.
An inexpensive pH meter is obtainable from Edmund Scientific, in Barrington, N.J.

In preparation for making a print, place a sheet of dye transfer paper in a tray of paper conditioner, emulsion up, and let it soak for 20 minutes. While the paper is soaking, process the one sheet of matrix film.

10. Making the Matrices

Use a **Red 1A safelight** during the dark part of the processing steps.

Check the temperature of each container of solution A and B.

Pour the B solution into the tray containing the A solution.
Mix for 10 seconds by rocking the tray, and proceed to process.

If you have followed my suggestions and have used a water jacket or some sort of temperature control system, you will have little difficulty with the temperature changing during development.

Remember, mix the chemistry thoroughly for no more than **ten seconds.**

At this time, place the sheet matrix film into the tray, emulsion down, then emulsion up, and continuously rock gently for 2:30 minutes. (include all drain times when determining the developing times). Preview the video tape to better understand my procedure.

Then place the sheet into the stop bath for 45 seconds.

The stop bath is an important part of the process. If you just use water for the stop bath, there will be some activity in the developer and this may cause density unevenness in smooth backgrounds. The use of 1% acetic acid stops the action of the tanning developer. However, it takes awhile for the chemistry to be completely absorbed by the film. **45 seconds** will assure you that no further developer action will continue.

Then into the fixer until clear.

The fixer is just a simple non-hardening fixer. Two minutes in this solution should suffice.

This sounds very simple, and it is. There is no special skill in processing matrix film. You must be neat and repeatable. I do explain my methods for processing more than one sheet at a time in the video. It is easier to show you then to try to explain it.

Dry this sheet of film in a warm gentle air flow, hanging it on a line. Be careful not to damage the very soft gelatin relief image.

In the meantime, mix some dyes according to the instructions that accompany the dye kit.

When this processed matrix film is dry, place it emulsion up in a moving or rocking tray, containing the cyan dye, for 5 minutes.

Using two clean 8x10 trays with 500 cc of 1% acetic acid rinse in each tray, lift the matrix out of the cyan dye and drain the matrix until the little cyan dye drops can be counted, for a repeatable and accurate drain time.

Place the matrix into the first tray of acid rinse and rock gently for one minute.

Again, lift the matrix out of the first tray, drain it, then place it in the second tray of acid rinse which is the holding bath before making the transfer.

While the matrix is in the second tray, remove the paper from the paper conditioner and place it, emulsion up, on the transfer surface about 1/4 inch away from the pins.

Using a roller, roll the paper as flat as possible, emulsion up. Then squeegee the paper to remove as much of the paper conditioner as possible. Sponge the surface with clean 1% acid rinse.

With clean hands, remove the dyed matrix film from the second tray, and while holding onto one end up in the air, place the end with the punched out holes in it over the registration pins, emulsion down.

Push the film down on the pins so that it will not lift and fall off the pins.

Now, place the roller right up in front of and against the pins, and roll the film into contact with the paper with a smooth motion, letting go of the matrix as the roller approaches the edge of the film.

10. Making the Matrices

Squeegee the film and paper sandwich from the center on out towards all four sides.

Let this cyan matrix transfer for 5 minutes. The dye will transfer to the paper without any problem.

Remove the cyan matrix from the paper and dry the print in a flat bed dryer or rotary drum. Hang the matrix film to dry.

The chemistry that I suggest that everyone use is conveniently supplied by Kodak, or you can use the formulas in the book and mix your own. They are basically the same.

The proportion of the tanning developer part A to part B is the key to contrast control.

The normal contrast proportion mixture is one part A to two parts B.

To lower the contrast of the matrix use less B, and to increase the contrast of the matrix add more B.

However,if your negatives are so far out of contrast balance, you may have to process the three matrices separately and at different proportions of A and B in order to bring the out of balanced separation negatives closer together.
You will then have to process one matrix at a time.

This may be the only way to save a job if the transparency is lost and all you have are the separation negatives. **Otherwise, if you have the transparency, make the negatives over until they balance.** But in most cases, you should be able to process all three matrices together.

Is there a special way to process the three matrices without getting unevenness, or scratches?
Yes.

10. Making the Matrices

Some of the rules that you must lay down for yourself.

Make sure that you have plenty of developer in the tray. If you have too much developer in the tray, nothing harmful will occur except for the waste of chemistry. If you don't have enough developer in the tray, you will experience the matrix film sticking together and not developing evenly.

My suggestions are as follows:

The minimum amount of developer for processing a set of 16x20 matrices should be 1000 cc of A and 2000 cc of B. This amount will insure you of easy handling in a 16x20 tray.

The amount of chemistry needed for making tests on smaller sheets of matrix film should be calculated by the square inch.

An example:

A 16x20 sheet of film has 320 square inches. The solution for this size is 1000 cc of A and 2000 cc of B.

An 8x10 sheet of film has 80 square inches. The correct amount of A solution should be 250 cc of A and 500 cc of B. By following this simple formula you will always have the proper amount of developer in your tray.

The first tray contains the developer.

The temperature of the chemistry must be the same as the test chemistry. If it isn't exactly 68° F, it's not critical, as long as the test and the final processing temperatures are exactly the same.

You will have difficulty in finding any thermometer that is exactly right.
The closest I have ever found is the digital lab thermometer sold by Edmund Scientific, In Barrington, N.J.

The second tray contains the stop bath.

Most Dye Transfer publications suggest that water is sufficient to stop the development of the matrix. I disagree. The developer keeps working up to the time that you are in the fixer. Maybe slower, but still working.

It is most important to stop the development in order to eliminate any streaks or unevenness. I use 1% acetic acid rinse. It is the same chemistry that you will be using to run the print.

The amount of time in the stop bath is important.

I have found that because of the thickness of the gelatin of the matrix film, it takes time for the stop bath to be absorbed. I found that activity keeps taking place up until 35 seconds. I therefore keep my matrix film in this tray for 45 seconds in order to make sure that there is no further development.

The third tray contains the fixer.

This fixer must be just a simple non-hardening fixer.
The time in this tray is not critical. Usually one minute is all that is required to clear the matrix film. This chemistry can be used again and again until the clearing time takes more than one minute. All of the other chemistry must be dumped after one use.

Most films can be exposed today and processed tomorrow, or next week. In fact I have seen Ektachrome film that was exposed and processed one year later, and it still looked good. **But this is not the case with matrix film.**

Matrix film has a very short retention period for the latent image.
Matrix film should be processed as soon as possible after exposure.
The image will get lighter as time goes by.

Matrix films exposed at the end of the day should not wait until the next morning to be processed. If you expose on a Friday and wait until Monday morning to process the matrix film, you will lose almost a full stop of exposure.

10. Making the Matrices

The developer tray and the containers of chemistry should sit in some sort of chilling system (a water jacket), so that the temperature of the developer won't change during processing.

The A and B chemistry, once mixed, has a short life. Some publications say that you have a minute or more to adjust the temperature. I disagree.

Since the chemistry rapidly becomes exhausted, it makes sense to time the mixing so that you will get consistent results. I mix the A and B chemistry only ten seconds before starting to process.

The technique for handling the film is as follows:

In the dark, using the proper safelight (Kodak 1A), place the exposed matrix film on a table or shelf next to the processing area, emulsion down, with the cyan matrix on top of the pile and the yellow on the bottom.

The A and B chemistry should not be mixed until you are ready. The temperature of the A chemistry and the B chemistry in the tray must be exact.

Add the chemistry to the developer tray and rock the tray for ten seconds in order to mix the two components. The timing is important.

Place the film into the developer at 15 second intervals. We will be processing the film for 2:30 minutes. A metronome would be helpful for agitation consistancy.

If you are using a timer that starts at zero and continues to the end, place the cyan matrix face down in the developer at zero.

While rocking the tray gently, **turn the film over (emulsion up), and continue to gently rock the tray until 5 seconds before the magenta matrix is to be placed into the developer. This is very important if you want even processing.**

Turn the film face down again with a steady and continuous agitation pace.

10. Making the Matrices

Developing Procedure
Identification

The magenta matrix enters the developer at exactly **15 seconds**. Go through the same agitation procedure with the second sheet as you did with the first. Gently rock the tray at all times (an automatic rocker would be a great help).

Then at the **30 second** mark, the yellow matrix is placed into the developer. The same agitation procedure is again followed.

During the rest of the processing time, just remove the bottom sheet of matrix from the tray and place it on the top. Rock the tray in such a way as to keep the developer covering all of the sheets, especially the last top sheet. This will keep the film from sticking to one another.

The matrix film when exposed is supposed to be marked in some manner for identification. I use a single hole paper punch in such a manner to make little half moons along the edge of the matrix film. This will enable you to find the correct sheet of film in the dark, in order to process the films at their correct dvel-oping times.

Cyan Matrix **Magenta Matrix** **Yellow Matrix**

When the time approaches for the first sheet (the cyan) to be removed from the developer, feel for the identifying notch with your finger, then with your middle finger and thumb, grasp the bottom sheet and remove it from the developer 5 seconds for a short drain period, before it must be placed into the stop bath.

At exactly the **2:30** mark, place the cyan sheet of film into the stop bath with the same agitation procedure as with the developer. This will keep the film from sticking and will insure even processing.

At the correct time 2:40, remove the next sheet, drain it for five seconds and also place it in the stop bath at exactly **2:45.**

Then at the correct time remove the yellow, drain it also for 5 seconds and place it in the stop bath at exactly **3:00.**

10. Making the Matrices

Rotate all the sheets from the bottom to the top.

At exactly 3:15 (allow time for the draining), place the cyan matrix into the fixer. Use the same agitation procedure as we did for the developer.

At 3:30 place the magenta matrix into the fixer, and at **3:45** place the yellow in the fixer tray. Rotate these three sheets until they are all clear.

At this time, dump the exhausted developer and rinse the tray with hot water. Set your temperature between 115 ° and 120 ° F.

Fill the clean tray with fresh water and place the first matrix (the cyan), into the tray, emulsion up.

Rock the tray to help dissolve the soft unexposed and unhardened emulsion. Wherever the emulsion recieved exposure, development will take place and form silver and the image and gelatin will remain.

This gelatin relief image will absorb the proper amount of dye according to it's thickness, and transfer it to the paper to reconstruct the full color image of the original transparency. This is what the whole process is about.

Keep changing the water until the matrix looks perfectly clean, then give it an additional one or more changes.

At this time, using your fingernails, scrape the edges of the matrix film to dislodge any emulsion that may be sticking to the cut edge.

Then one more rinse. Use a separate tray of cold water as a final rinse for one matrix at a time. The cold water helps to set the gelatin emulsion.

Drying, or not drying, the matrix film.

Most of the literature that pertains to the Dye Transfer process, states that drying the film is imperative. However, most of the professional labs do not dry their matrices, but instead, place them right into the dyes.

Placing the matrices directly into the dyes presents a few problems.

The emulsion is still in an extremely soft state. Little particles of gelatin or dust will adhere to the emulsion and show up as dye specks on the print. This makes the job of filtering the dyes very important. The only reason for working in this fashion is speed.

Most of the commercial Dye Transfer labs in America work with the advertising community, whose motto is "I need the print yesterday". After doing the same thing for 45 years, as they do in New York City, I don't see any real harm in the practice. However, I now prefer to work a little differently.

If you first dry the matrices, and then place them into the dyes, you will obtain a much more accurate print on the first transfer than with the previous method. The reason should be obvious. You will have to replace all that water in the matrices before the dyes are in their proper strength. Whenever you place swollen and wet mats into the dye tray you will also be adding water to the dyes.

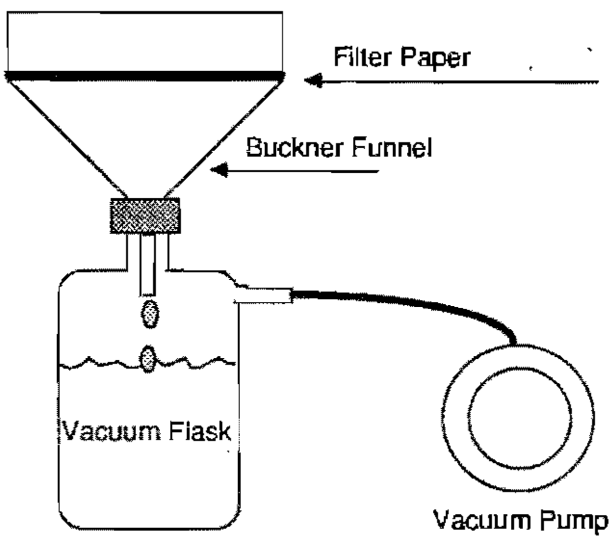
Hardening the matrices.

Hardening the matrices will make it very easy to keep the matrices clean by wiping away any little specks or gelatin by just wiping a wet cloth (Handy Wipes) across the emulsion of the matrix. This will dislodge any dust specks or gelatin that has adhered to it's emulsion. Hardening the gelatin emulsion also makes it more difficult to scratch.
This is a procedure that has it,s origins in the old "Wash Off Relief" process.

When the matrices are just out of the hot water part of the process, place them, **one at a time**, in a tray containing 10cc of formaldehyde to one gallon of clean water. Add about 2 cc of Kodak #200 Photo Flo to the mixture. Let them soak for three minutes each, then hang on a line and dry them with a gentle flow of warm air. This procedure is definitely worth the trouble.

Filtering the dyes.

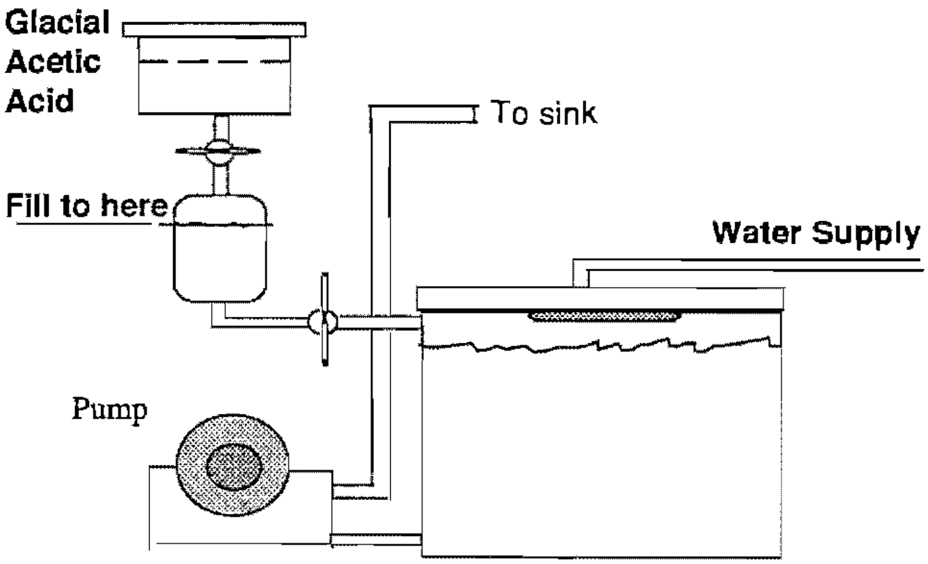
This is a simple chore. Purchase a one gallon vacuum flask from any laboratory supply company. It looks like this:



You will need a rubber stopper and Buckner funnel. Using Whatman's Filter Paper, you can filter a single color in less than 15 seconds. It takes a little more time to clean the set up for the next color.
The vacuum pump creates a vacuum in the flask, drawing the dye right through the filter paper. The whole set of dyes can be filtered in 10 minutes or less.

How to run the print.

Mixing a large enough quantity of 1% acid, and a method of delivering it to a convenient place is important. Eliminating the strong odor of acetic acid will help keep the lab odor free. The glacial acetic acid is placed in a closed container and the mixing is done in another closed container.



The next thing to consider is what kind of moving table or shelf you will need to hold the trays of dyes and paper conditioner. The video shows one example of the kind of transfer area one needs to set up.

You must have a solid transfer area. I prefer a sheet of granite placed over a 3/4 inch sheet of exterior plywood. If you build the transfer table into a sink, then the mess (yes, there will be a mess), will be confined to the sink. Again, the video shows where, and how, the transfer board is situated.

Make sure that you have a fresh mixture of paper conditioner in a tray and that you have soaked a few sheets of paper for at least 20 minutes.

I usually pre-soak my paper in hot water (120 degrees F), to remove any loose gelatin from along the edges of the paper and to help expand the paper to it's proper size. This treatment also helps to remove any acid that may be present in the paper.

11. Making the Print

The dyes should be mixed according to the instructions that Kodak has supplied with the dye kit.

The amount of dye to put into the tray depends on what size matrices you plan to produce at this time. If you plan to make 8x10 matrices, then 500 cc of dye will suffice in an 8x10 tray. If you plan to produce 16x20 matrices, then add two liters of dye to each tray.

When the dried matrices are placed into the trays containing their respective dyes, let the matrices soak in a moving tray for 5 to 10 minutes.

The next thing to do is to make one straight transfer print. Let us run a print.

Remove the cyan matrix from it's tray. Hold it up high enough so that the surplus dye will run off one corner of the matrix. When you can actually count the drops of dye dripping off the edge, place the matrix into the first of two 1% acetic acid rinse trays for 1 minute.

Rock the tray by hand or by motor and gear box. Try to have a haphazard rock rather than a repeatable rock for the entire 1 minute time.

Drain the matrix and place it into the second clean rinse tray.

Orient the film so that it is in the second tray, **emulsion up, with the register pins away from you.**

Rock it, and then let it sit there, while you remove a sheet of paper from the paper conditioner and place it on the transfer table, emulsion up.

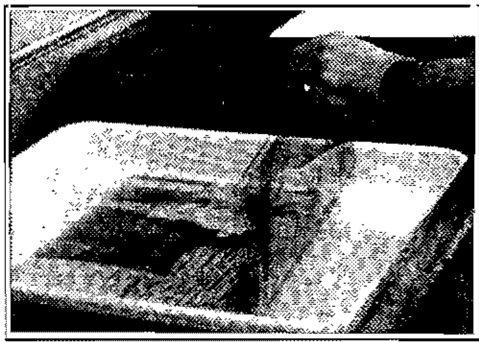
Position the paper so that it is about 1/4 inch away from the register pins.

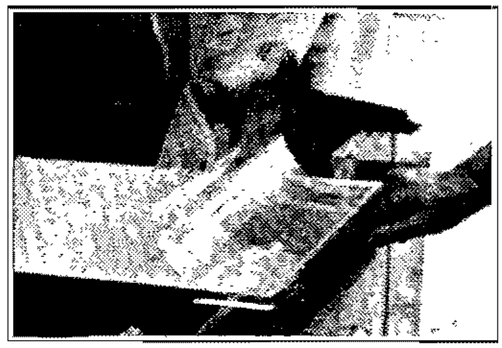
Roll the paper down tight. Squeegee it dry. Using a sponge, moisten the paper with some 1% acetic acid .

At this point, grasp the matrix film at the closest end with your left hand, forefinger and thumb only.

11. Making the Print

Lift the film by pulling it to you with the emulsion away from you, then grab the bottom of the film (the end with the pin holes), and hold the film so that you can retain some of the acid rinse.





Let some of the acid rinse drip across the leading edge of the paper next to the pins so that you will have a moistened area to work with and you can help to eliminate "skipping" of the dye onto the paper.

Air bubbles (commonly called "skipping"), can, and will, appear on your first transferring attempts. These bubbles will not allow dyes to transfer and the result will look like a pattern of colored pepper and salt.

Place the film over the pins and press the film down over the pins. Use your finger nails to push the film to the bottom of the pins.

The next step is critical.

Place the roller in front of the pins.

Pull the roller back toward the pins so that you can square the roller properly with the pins and matrix film.

When you have the roller positioned properly, start the transfer by rolling the matrix down into position, in front of the roller.

Do not put any pressure on the film as it will cause you to go out of register. Let the matrix down gently, just in front of the roller. One strong roll should put the matrix film in place.

11. Making the Print

Check the film where the pins are. If there is a buckle of some sort, the chances are that you will be out of register.

Let the cyan image transfer for at least 5 minutes.

Start to prepare for the magenta image when you have one minute left for the cyan transfer.

Using a fresh and clean first rinse tray, do the exact same thing to the magenta matrix as you did with the cyan.

When you are in the second rinse tray and are ready to transfer the magenta, you must now remove the cyan image.

With the roller at the top of the print, peel the cyan matrix from the paper and let the matrix push the roller back toward the pins.

Place this cyan matrix, emulsion up, in a tray of fresh warm water. While the cyan matrix is in the water bath, repeat the exact steps for transferring the magenta image. In the meantime, the cyan matrix is still in the water bath.

Let it rock there for 30 seconds, then drain and hang it on a line until the water drops stop dripping. Draining the water off the matrix before placing it back into the dye will avoid diluting dye which would change the balance of future prints. Place it back into the cyan dye for a possible second print.

Let the magenta image transfer for 5 minutes.

Repeat the exact steps for the yellow.

Let the yellow dye image transfer for three minutes since the yellow dye transfers faster.

Remember to place the preceding transferred matrix in the fresh water bath. If you place the transferred matrix into the dye tray without first washing the matrix, **you will be contaminating the dyes by changing the pH and carrying unwanted dyes back into the fresh dye.**

When the time is up, remove the yellow matrix, squeegee, and dry the print. You can use a flat dryer, or a rotary dryer, or just a warm air flow. It is best to dry it quickly with a little heat to minimize dye bleeding.

Chemical corrections, when running the print.

The first thing that you should be concerned with is the kind of water that you will be using.

If you are in the New York City area, you are in luck. Most of the water for this city comes from the Croton Dam, or the Hudson River. This is primarily rain water, and is very soft. It is really excellent water, but it can still be improved.

If you work on the west coast, you will have a few problems, because the water in the Los Angeles area comes from the Colorado River or mountain areas and is very hard. This water will cause the matrix to pick up mineral deposits on the clear edges of the film and these deposits will capture the dyes and eventually transfer them and stain the "white" borders of the film.

I would suggest that you contact a soft water company and have them install a De-ionizing water system. This is more than just soft water.

This system will remove the minerals from the water and produce very clean prints.

I would use the de-ionized water to mix my acid rinses, and all of the dyes, paper conditioner, and subsequent liquid chemicals that are needed to control the print. However, I wouldn't worry about this problem until, and unless, you have to.

There are quite a few things that you can do to fine-tune your print.

It is almost impossible to get a perfect print with just one run of the matrices. The reason is easy to explain.

Most of us really do not see the finished print in our "minds eye". Our everyday moods will not allow us to accept the print as it is. We will find some reason for making a change.

Another reason is that the film and the dyes are not perfect. The entire Dye Transfer process is one that requires constant compromise.

You may aim for a mask strength of 30% and only reach 28%. Some adjustment will be necessary to change the contrast at some later stage, such as, development of the negatives, or the development of the matrices, or the changing of the pH of the dyes, and so on.

However, here we are, with a first proof print.

The first thing that you must say to yourself is, "What can I do to improve this print?"

No matter how great the print may look, you must imagine that it can look even better. The process is such, that controls are almost unending.

The amount of acid rinse should be repeated exactly, each time it is poured into the first rinse tray when chemical controls are used, to fine-tune the print color and density balance.

Use 1000 cc for a 16x20 tray. The second tray is not critical as far as the amount of chemistry is concerned. I would place 2000 cc into the second tray (the holding bath).

Let us start with the chemicals that can be added to the first rinse tray.

Sodium Acetate, in powder form (Anhydrous), is mixed with water.
When this liquid chemical is added to the first rinse, the matrix will shed some of it's dye and cause it to print lighter.

A 5% solution requires that some sort of fine scale must be used. 5 grams of Sodium Acetate mixed in 100 cc of water will work fine. However, I have a short cut for you.

A 2 oz.. whiskey shot glass, filled with Sodium Acetate, and mixed with 1000 cc of warm water, will also work fine. As long as you repeat the exact amount each time you mix a new batch, you will get repeatable results.

Sodium Acetate has a tendency to create mold. Add 30 cc of Listerine to this mixture and the mold will be reduced drastically. (Listerine contains Thymol).

Adding a small amount of liquid Sodium Acetate (10 cc), to one liter of acid rinse, will lighten the print so that you can see the difference in density.

The longer you time the rinse, the more this lightening action will take place. The more you add of the Sodium Acetate liquid to the first rinse, the more the print will lighten.

Sodium Acetate can be used to remove dyes in equal parts for all three matrices in order to lighten a print, or remove one or two colors in order to change the color balance of the print.

Highlight Reducer.

The highlights can be kept clean, all by themselves. Sodium Hexametaphosphate will do the job. This is pure Calgon. Dissolve 1/4 teaspoon of Sodium Hexametaphospate in a liter of water.

This amount will last quite some time.
Add 30 cc of Listerine to this chemical also.

A small amount of this mixed chemical (4 cc) per liter, will show a significant increase in producing brighter highlights.

The more you add, the brighter the highlights will become. This chemical can be used in conjunction with the Sodium Acetate.

Here is an example of how Sodium Acetate and Highlight Reducer are used:

A proof print is pulled. This is a print that is transferred straight, without any chemical inducements.

The print is examined and you decide that the cyan is too heavy.

To remove some of the cyan when making the next print, add 10 cc (or more), of the Sodium Acetate to the first rinse (1000 cc of 1 % acetic acid). You can also add about 3 cc of highlight reducer.

Lift and drain the matrix from the cyan dye. When you can count the drops, place the matrix into the first rinse tray. Rock the tray gently in all directions for **two minutes,** then transfer the matrix to the second tray to stop any further action.

Continue to run the entire print with the magenta and yellow matrices using the normal first acid 1 minute rinses.

When completed, dry the print. **This is important.**

Compare the new print with the first print. If you feel that too much cyan was removed from the print, add less Sodium Acetate solution to the first acid rinse than you did before, and run another print.

If you feel that not enough dye was removed, then add more to the running of the next print. If the highlight areas need to be brighter, add more highlight reducer.

This part of the Dye Transfer process is where your individual taste and judgement takes over. With enough experience you will be able to judge just how much chemistry you will need to add to the first rinse.

This will require you to run plenty of prints, and to experiment with different amounts of corrective chemistry. **There is no short cut!**

Making the transfer print heavier or darker.

If you add concentrate dye (5 cc to 20 cc), and also add small amounts (5 cc to 15 cc) of 28% acetic acid, to the first rinse, this will cause the matrix to absorb more dye and produce a slightly heavier image. This is one way to save a print that is just a hair too light.

The amount of time in the first rinse will also affect the amount of dye increase in the print. You can also alter the color balance of the print by **adding 28% acetic acid** to the dyes containing the matrices. **This will increase the density as well as the contrast.**

If you dilute the first rinse with an equal amount of water, you will reduce the strength of the rinse by 50% and the result will be a much lighter and less contrasty print, especially if the lightening chemicals are added (Sodium Acetate or highlight reducer). **This is usually an emergency procedure.**

Changing the contrast of the dyes.

The addition of Triethanolamine, (a 10% solution), to the dyes will cause the pH to rise and make the dyes more alkaline. This will reduce the contrast.

Kodak supplies a chart with the dye sets that shows the amount needed by the different colors in order to achieve the same contrast change.

Take these amounts, which indicate one full step of change, and break them down to 1/4 steps for much more accuracy and control.

Reducing the Dyes Contrast.

To reduce contrast, by quarter steps, add these amounts of a 10% solution of Triethanolamine **per liter:**

Amt. of Change	Cyan	Magenta	Yellow
1/4	3.2 cc	2.5 cc	4.2 cc
1/2	6.5 cc	5.0 cc	8.5 cc
3/4	9.7 cc	7.5 cc	12.7 cc
1 step	13.0 cc	10.0 cc	17.0 cc

Increasing the contrast
The dyes can be increased in contrast by the addition of 28% acetic acid. Again, Kodak supplies the necessary information needed for changing each color. Take these numbers, which represent a full step of correction and break then down to 1/4 steps for much more accuracy.

To increase the contrast of the dyes by quarter steps, add these amounts of 28% acetic acid to the dyes, per liter.

Amt. of Change	Cyan	Magenta	Yellow
1/4	5.0 cc	3.0 cc	12. cc
1/2	10.5 cc	6.0 cc	23. cc
3/4	16.0 cc	9.0 cc	35. cc
1 step	21.0 cc	12. cc	47. cc

With these controls, and lots of experience, you can increase one color's density, or contrast, while you are decreasing another color's density, or contrast.

The amount of changes that go up in contrast, and down in contrast, when combined with the changes in densities and highlight brilliance, can be overwhelming.

I have made as many as 30 prints, constantly changing densities and contrast levels until I was satisfied. (This occurred when I was new to the business).

For ease of handling, use 1 liter squeeze bottles that can be purchased from any lab supply company.

You will need cylindrical graduates for accurately measuring the amounts of these chemicals for print control.
Keep records of each print so that you can repeat a set of controls or change them.

The addition of concentrated dyes to the mixed dyes in the tray will increase the saturation of the dyes. This is needed when the image looks colorless, or needs a boost in overall strength.

You can write the control data on the back of the print, or you can use a simple sheet system to record all of your moves.

11. Making the Print

The use of bleaches on the print to improve or correct the color.

The three colors, cyan, magenta, and yellow, can be bleached out so that a more pure or lighter color will result.

The chemicals that I will describe are easily available and easy to use. However, don't confuse this method with the real professional systems that are used and performed by professional retouchers.

Cyan Bleach

In order to lighten the cyan image, a few grains of potasium permanganate can be used.

To remove some of the cyan dye from a print, mix up a very small amount of potasium permanganate in a 100cc vial of 1% acetic acid rinse. **The color will tell you how strong it is.** If it looks like a **light rose wine, then the action will be light.** If it looks like a **dark burgundy wine, watch out. It will remove most of the cyan in the print.**

This chemical is strong and will cause brown stains if not used properly.
A very small amount of the potasium permanganate crystals are dissolved in a small graduate of 1% acid rinse (plain water will cause the dyes to bleed).

The resultant color should look like a rich rose wine.

Moisten a fist sized piece of cotton with your acid rinse and keep it handy. Moisten a cotton swab or a spotting brush that you don't care for any longer, and add the Permanganate liquid to the area where you want to reduce the cyan. The effect will be almost immediate.

Using the moistened cotton, wipe the area until no further effect takes place. This process works very quickly. Work carefully. Check the effect on a separate, discarded print first.
I have even placed an entire print in a tray with a weak solution of this potasium permanganate to remove an overall cyan cast. It works.

The Magenta Bleach #1.

I take credit for discovering this particular use of the next chemical, in 1950. Kodak Photo Flo. Quite by accident, over an entire weekend, some photo flow solution was spilled and dripped over a pile of discarded Dye Transfer prints. When I arrived on a Monday morning and saw this pile of prints with almost kelly green areas in patches on the prints, I realized what happened.

I applied the chemical on other prints using a small wad of cotton, or a brush, and found that the magenta was able to be removed by the use of Photc Flo. Cotton soaked with 1% acetic acid rinse will neutralize the area. Unfortunately, this method of removal of magenta can cause the area to appear soft.

Magenta Bleach # 2

Kodak has a new formula for removing the magenta with less softening of the image. Apply this chemical with a wad of cotton, and neutralize with 1% acetic acid.

Kodak anti fog 5	7.5 grams
50% Sulphuric acid	1.0 ml
Ethylene Glycol	100.0 ml

The Yellow Bleach

To remove the yellow dye, a 25 % solution of liquid Sodium Thiocyanate or:

Sodium Thiocyanate..(powder)	6.2 grams
Acetic acid (28%)	38.0 ml
Water	62.0 ml

Applying this solution to the printwith a wad of cotton, or a brush. Itmay suddenly look quite purple and you may think that you overdid it. Don't be alarmed. Wipe the print with cotton soaked with 1% acetic acid rinse to restore the image to it's proper color with some of the yellow removed.

This will be a **stop, look, and repeat** system, until you are satisfied with the result.

Use a cotton swab for large areas or a nylon tipped brush for small areas. The harsh chemicals will destroy most spotting brushes with natural hair.

Remember, this is not a course on retouching. If this is your interest, I suggest that you get a copy of Kodak publication, E -92 "Retouching Dye Transfer Prints", or the new Kodak book, E-97, "Photographic Retouching".

"Tricks" on the transfer table.

It is possible to change the entire character of a print by using some of these techniques.

Double transfer for overall or local color control.

Try double transferring a single matrix, or a complete set of matrices, and the complete "look" of the print will be different.

If you are printing a landscape photograph, and one rock doesn't look important enough, you can use a fine sable brush and add dye to the clean, and dry matrix film, in just the right areas, using a light table to see what areas you are working on.

Then rinse and double transfer the color over an existing print, still on the transfer table.

This is not the same as if you were adding dye right on a print (This would be the worst thing to do).

By adding dyes to the matrix that has a detailed image, you will be adding color, form, and detail in the proportion of the image density, and it is a much better approach than just adding dyes to a print.

Using the same technique, you can add flesh tones to a print that has weak flesh tones. You can add green dye to weak green grass or leaves. Or you can add any color you wish and change the area to suit your taste.

You can use a small tube or squeeze bottle filled with water to eliminate dyes from a matrix in tiny areas.

You can also add, with a brush, a straight or diluted highlight solution to a matrix and clean an area, partially or totally.

In other words, print control is all up to you.

AtrueDye Transfer technician has all of these "tricks of the trade" at his disposal and uses them quite frequently.

Spotting the print.

This is the easiest part of the process, and yet one of the the most important.

If your final print is fantastic and beautiful but has little spots of missing color, you will be forever embarrassed. I speak from experience.

There is no reason not to spot a print.

Light spots are an indication that color is missing in this area. Try to find out why this happened, but for the time being, just concentrate on how to correct the print.

If your spot is green, you should realize that the missing color is magenta. Here is a simple way to find the remedies:

Color of Spot	Add this color
cyan	red
magenta	green
yellow	blue
red	cyan
green	magenta
blue	yellow

Use a small 00 or even a 000 spotting brush.
Buy the best quality that you can afford.

Never leave the brush in a jar with the bristles touching the bottom.

Use the same Kodak dyes that were used to make the print. Make sure that you use dyes that are a shade or two lighter than the spot, and build up to the density of the color.

Always use 1% acid rinse to mix the spotting dyes.

A small piece of cotton moistened with 1% rinse and squeezed dry will suffice as a blotter.

Potasium Permanganate

If you have to remove dark spots, mix some potasium permanganate with 1% acid rinse in a 4 oz. jar so that it looks like a dark Burgundy wine. Add one or two drops of Sulphuric acid. This will prevent the emulsion from being damaged. This mixture will totally bleach out a dark spot to the white paper.

There will be a brown stain left.

Potasium Metabisulfite

Mix 1 teaspoon of potassium metabisulfite to a liter of 1% acid rinse and use a cotton swab. This will remove the stain and leave a white hole. Spot this with the adjacent color.

Always use 1% acid rinse to stop the action and to clean the print.

However, leave the real retouching to the professionals.

12. Average Density

All Transparencies Vary in Intensity

There is one more topic to discuss: The "average density".

What do I mean by average density ?

Well, it really is quite simple to explain. All transparencies have different levels of density. Some are dark and some are light. Even when they look good to the eye, they still will have different levels of overall density. The overall level of density in any transparency is called the transparency's "average density".

As an example:

If you were to make a negative by trial and error from a masked transparency, and found that a ten second exposure through a Red 29 Filter produces a good negative (by good, I mean that the major portion of the transparency fits on the straight line portion of the negative material), then any other transparency with the same "average density" should receive the same exposure.

Here is the way the average density is determined:

Transparency shadow	2.75
Transparency highlight	0.75
Adding these two readings together =	**3.50**
Divide this answer by 2 and get	**1.75**
This transparency's avarage density is	**1.75**

Anytime you make a mask or a negative or any other kind of exposure from another transparency with the same average density, it's exposure would be the same.

If the average density is different from 1.75, use the logarithm portion of your your scientific calculator and find the difference in exposure.

By entering the difference in density and then going through a simple exercise in which buttons to push, you can solve any exposure problem no matter how complicated it may seem.

12. Average Density

A Visual Method

The main reason for all of this calculation is to make main portion of the transparency fit on the **straight line portion of the negative material.**

If your negative neglects to have at least a .35 to .40 reading in the shadow portion, then your shadow detail will not be captured on the negative film.

On the other hand, if your negative highlight area goes beyond the 1.65 or 1.70 reading, then you may be plugging up all the highlight details. If you plotted a full scale curve you would find the top end flattening out.

Occasionally we receive a transparency that has no blacks or clean whites. The only thing you can do here is to use your eye to make a judgement of the contrast of a transparency.

A Visual Working Chart

Gamma	Description
.10	Very flat
.15	Flat
.20	Slighlty flat
.25	normal
.30	Slightly contrasty
.35	Contrasty
.40	Very contrasty

The chart is used when readings are impossible to make. Your eye and judgement must be used.

12. Average Density

Exceptions to the Rule

A lopsided transparency is where the picture is almost all white or all black.We can take this one step further and try to find the proper exposure for a lopsided transparency.

When we originally made the principal mask graphs, we used a three step grey scale to produce the necessary information needed to find the gamma, developing times, and the correct exposure times. This three step grey scale had an average density of it's own.

If the light area of the grey scale had a density of .75 and the dark area had a density of 2.75, the avaerage density is 1.5.

If our exposure for an average density of 1.5 is 10 seconds, and we have a "lopsided" transparency to work with, then just use the same figures that were used to produce the working chart.

Shadow	2.75	= ten seconds
Highlight	.75	= ten seconds

If your transparency is of a white shirt against a white background, then just use the highlight reading. If the density is different, then use the logarithm portion of your scientific calculator to determine the new exposure.

If your transparency is of a black cat in a cave, then use the shadow reading. Again, if the density is not the same, use your calculator.

Remember, all of the exposure times that have been used to make all of the charts in this book, were derived from a single source, a 3 step grey scale.

This grey scale has it's own average density. All of the exposures were based on it's average density. The transparencies that you will be working on will be totally different. You must allow for these differences in order to keep the important parts of the transparency on the straight line portion of the masking film and separation negative film.

The simplicity of this system would actually allow you to visit a foreign country and if the need should ever arise, you would be able to use a strange film and developer and be able to make masks that would fit the occasion. You would be a hero in China.

13. Subject Failure

Optics and "Air" Can Cause Problems

Subject failure

This problem has been with us since the beginning of photography. It's real name is **flare.**

Making a determination of the projected matrix exposures based only on the use of a densitometer can be disastrous.

Whenever a set of matrices is to be exposed and the grey scale densities are used to determine the densities and balance, problems will occur which may baffle you.

The first thing to do is to size the image on the easel and make some exposures.

Make a strip test. Use the cyan printer negative with the highlight mask included, and make a series of different exposures of the same area on a small sheet of matrix film.

After processing and drying, place the matrix in a tray containing the cyan dye.

After 5 minutes, transfer the image to a sheet of previously prepared dye transfer paper.

After transferring, compare the cyan image to the transparency through a Red 29 Filter. When you have established the exposure that suits you, write it down.
So far, so good.

Now you should have a good idea of what the cyan exposure should be.

Now for the problem.

One system that has been promoted by those who do not really understand the problem of subject failure is as follows:

Using a densitometer, read and plot the grey scales that are part of the separation negatives. Use the information to establish the rest of the exposuresfor the green and blue separation negatives. We should get a pretty accurate balance. Right? **Not necessarily.**

13. Subject Failure

Red on Red

There is the matter of **Subject Failure.**

Subject failure is the one thing in photography that is almost impossible to determine accurately. Here is an example:

We have a 4x5 transparency of a little red headed girl wearing a red dress and red shoes and is placed in front of a red wall.
She is also wearing a little white flower in her lapel. Can you picture what the contact separation negatives would look like?

The red filter negative (cyan printer), would be quite dense as it is exposed through the red filter. The reds in the transparency would pass through the red filter with ease.

However, the green filter negative (the magenta printer), would be very thin as the green filter would stop most of the red image from getting through.

The blue filter negative (yellow printer), would be even worse, as the blue filter would stop most of the red and yellow image from coming through the filter.

Read the grey scales that were included with the negatives. They were just about perfect. In fact, the little white flower on the girls lapel read 1.15 on all three sheets of film. However, if we would make a set of matrices based on this information, the results would be disastrous.

The print would be extremely red and yellow.
What happened here was simple **subject failure.**

The fact is that most of the image in the green and blue separation negatives were almost clear film.
The room would light up to such a degree that you could read a book in the so called darkroom.

If we decided to make a set of bromides (black and white prints), of the entire set, with the same ratios that we gave the matrices, they would also exhibit the same distortion.

13. Subject Failure

If we then made more bromides and proceeded to correct the exposures on the prints until the little white flower visually looked the same on all three bromides, we would get a print that looked much more normal.

This is what all the carbro printers did in making their bromides before combining the bromides to the colored pigments.

Subject failure occurs in any photographic process except contact printing or scanning. Anytime you place your transparency or negative images "in the air", this will happen.

The same thing can occur when projecting a transparency in order to make a dupe transparency. This is the main reason why there are color differences, and balance differences, when making a print by projection.

There are two correct ways to establish a set of matrix exposures.
The first is to read the center step of the grey scale or any neutral area of the image **while it is being projected** on the easel. The second way is to **make a set of "bromides".**

If you can include the grey scale so that it will appear on the easel, then just read the center grey scale and compute the differences between the negatives. If you read the high step on the grey scale, you may be misled by an "out of balance" set of highlight masks.

The grey scales are primarily needed to verify the accuracy of the exposure and development times of the separation negatives. This you will do by using a densitometer, away from the enlarger.

When you are under the enlarger, the center step of the grey scale can be used to establish the ratio of exposures. This will include any differences caused by subject failure. You must be aware of the cosine error caused by any easel meter that is not pefectly aligned with the image.

You must still determine the correct density by making a test as earlier described.

13. Subject Failure

I use a Wallace Fisher easel meter. It is digital and has a 6.0 range. However, any good easel will work.

You must be able to see the differences in densities or in actual exposure numbers.

The advantage of using an easel meter is that the next set of matrices can be made with less trouble, as long as you have obtained an easel reading reference number.

Since you are able to read a light area or skin tone, record these numbers and when a new set of negatives is being projected, simply place the probe on a similar tone, and adjust the f stop until the numbers are the same.

Then read the center grey scale on all three separation negatives to establish the balance.

The purpose of this chapter is to acquaint you with a problem that is usually ignored by most of the photographic community. The main reason for using a dichroic color head on an enlarger is so that corrections can be made when making projected prints. The chances are that less correction is necessary when making contact prints.

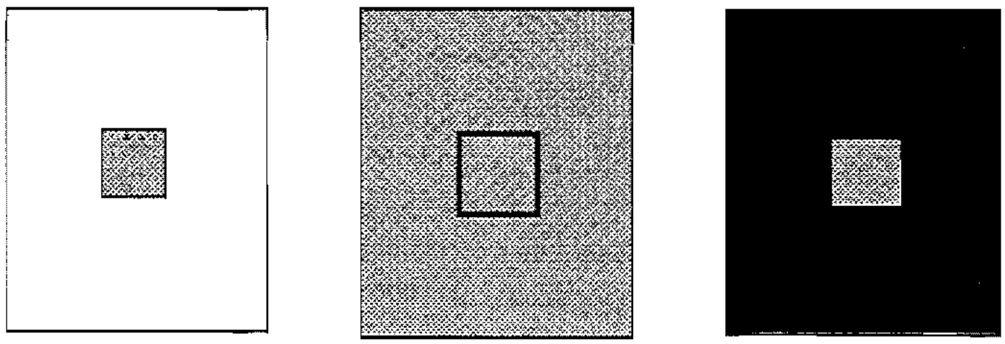
This has been and always will be the most critical part of exposing an image through an enlarger.

The next page will illustrate this problem with a bit of exaggeration so that you will more readily understand what I am trying to say.

13. Subject Failure

An Example

If you are in doubt about what has just been described, try this test the next time you are in the darkroom:



Clear **Same as Test** **Black**

Take a sheet of film that has been exposed and developed to a density of around 1.2. Then cut it into three small pieces.

Mount each small piece into 3 larger sheets of film of varying degrees of density. (clear, same as test, black).

Sheet # 1 should be clear film.
Sheet # 2 should be the same density as the smaller test pieces.
Sheet # 3 should be black.

Make some exposures onto any black and white continuous tone paper, via the contact method. The object here is to make all of the center sheets look alike.

By contact, they should all have the same exact exposure.

Now, place the stripped negatives into an enlarger and try to match the densities. I can assure you that they will not all be alike. The first sheet will have considerably less exposure in order to match # 2, and the 3rd sheet will have considerably more exposure to match the #2 sheet.

In other words, the different densities will contribute to the overall exposures.

This is the result of subject failure and flare.

14. Isolation Color Correction

Color Correction.

Most colors in a transparency will never reproduce accurately when making any kind of color print. You will improve your chances of getting close to an accurate color rendition if you make a print using the dye transfer process.

All of the millions of colors in the spectrum can be reproduced by using only the three primary colors, cyan, magenta, and yellow.

The only **pure** colors are the **cyan, magenta, yellow**, and the compound primary colors, **red, green, and blue.**

We really can't correct a specific color in a print, but we can make it more pleasing to the eye. The trick is to isolate the area of the color that we want to improve and eliminate one of the three colors to such a degree that it looks more pure to the eye.

The real problem with any color print system is the inability of the filters and therefore, the separation negatives , to accurately separate the primary colors. Unwanted colors manage to get through the filters and "dirty up " the final rendition.

I haven't mentioned the dyes. They too are in need of more accuracy than they presently possess. As a result, the warm areas in the print will contain too much cyan, and that will make for impure color in these areas. The greens will be contaminated by the amount of magenta that has crept into these green areas. And likewise, the blues will definitely have too much yellow in these blue areas.

As a result, even though the print may look pretty pleasing to the untrained eye, the final client, if he is an art director or an art photographer, I can assure you, will detect subtle color inadequacies in certain areas of the image.

The problem is "How to get rid of the unwanted colors ? "

Getting rid of unwanted color in a print, using photographic means, is sometimes very difficult.

14. Isolation Color Correction Eliminating the "Third" Color

Masks must be made that will hold back some of the densities in specific negatives in order to produce some color correction. The idea here is to eliminate **some** of the **unwanted third color** present in every transparency or print.

The use of a red dye, known as **"Cocine" (New Crosien Scarlet),** can be applied to specific areas of the separation negative in order to lighten or brighten a color by removing some of the unwanted color.

However, imagine what would go through a person's mind if he had to "clean up" a print of a plaid jacket. **One solution is as follows:**

Make a positive from each of the negatives on Kodak Separation Negative Film, Type # 1. The positives should look like well exposed black and white transparencies, with the same contrast level as the original separation negatives. This will insure the fact that the final mask will be a "negative" rather than a "positive".

The final mask being a negative form and added to a negative form will increase the modeling instead of flattening it.

When adding the cyan positive to the green filter negative, use a light box and look at it. You will plainly see the areas trhat will print the warm colors. You can now capture this area on Pan Masking Film and add this mask to the red filter negative when making the cyan matrix. This mask will lighten the cyan from printing in the warm areas.

Think about this for a minute.

I have been able to isolate the red areas from the cyan layer by using the **magenta positive** combined with the **cyan printer negative. (** red filter negative).

If you replaced the **cyan negative** with the **yellow printer negative** (blue filter negative) you could also remove cyan from any area that contained yellow.

14. Isolation Color Correction

One step further.

If it is possible to isolate any of the red, green, or blue families of color by adding the opposite color film positive to the separation negatives,we can correct the entire spectrum to our heart's desire.

In order to really understand how this process works, we must temporarily rename the separation negatives as printers.

For instance:

Red filter negative is now called the cyan printer.
Green filter negative is now called the magenta printer.
Blue filter negative is now called the yellow printer.

The procedure here is to use the two opposite negative colors as opposed to the positive color.

Use a contact printer to make these color coprrection masks.

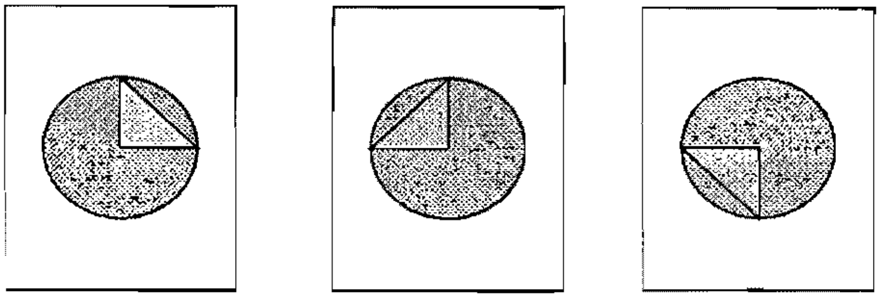
The following illustrations will show you how the system works.

Read the instruction carefully and try to understand what is being said.

This system will allow you to control the cleanliness of any color in the spectrum without causng damage to any other color.

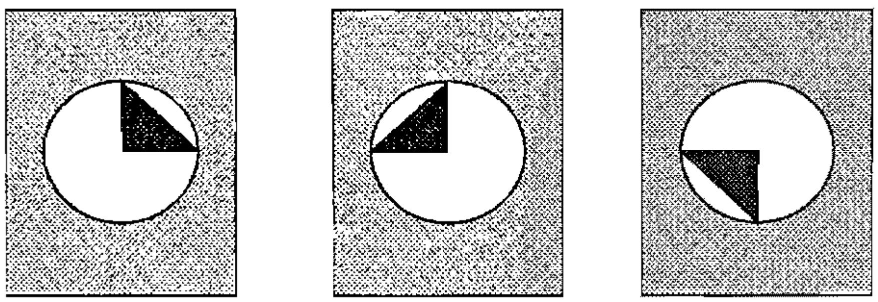
If you want brighter reds, greens, or blues, without distorting the overall quality of the transparency, this method works.

14. Isolation Color Correction

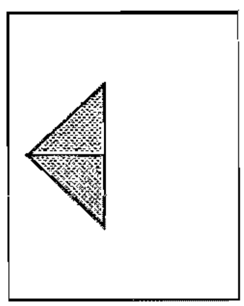


Red Filter Neg Green Filter Neg Blue Filter Neg

Cyan Positive Magenta Positive Yellow Positive



Combine the cyan positive with the green filter negative and make an exposure by contact on Pan Masking Film. Then remove the green filter negative and replace it with the blue filter negative and expose again on the same sheet of film.



Note: The densities show up in the warm colors only. Place this mask on the red filter negative when making the cyan matrix. This will hold out density in these warm areas only, making the warm colors cleaner and brighter.

14. Isolation Color Correction

Follow this procedure:

In order not to confuse your mind, do not think about "negatives" at this point. Think only as positive printers. In this way you can then easily begin to identify which printer goes with which printer. In other words, the red separation negative is now called the cyan printer, and the green negative is now called the magenta printer, and the blue negative is now called the yellow printer.

This is the way I analyize this system of thinking.

The cyan positive combines first with the magenta printer, then the yellow printer, exposed one at a time on the same sheet of pan masking film. Identify this sheet to be used with the cyan printing negative (red filter negative) when making matrices.

The magenta positive combines first with the cyan printer, then the yellow printer, exposed one at a time on a second sheet of pan masking film. Identify this sheet to be used with the magenta printing negative (green filter negative), when making matrices.

The yellow positive is combined with the cyan printer, then the magenta printer, also exposed on one sheet of Pan Masking film, then used when making the yellow printer matrix. Identify this sheet as the correction for the yellow printer (blue filter negative)..

In order to eliminate edge effects, the sheets should be exposed emulsion to emulsion.

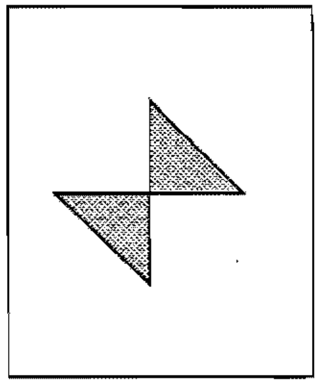
The exposure should be short enough so that the mask density does not exceed .30. If, when combined, there is no significant amount of "color" seeping through the sandwich, then do not make any exposure for that particular separation negative.

Use white light for the exposure and remember to keep the exposures short. My exposures were as short as .3 of a second.

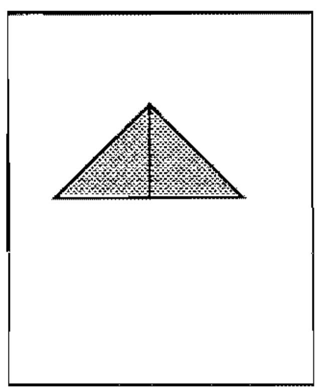
The following page illustrates the exposure pattern needed for accurately making these isolated masks.

14. Isolation Color Correction

If you combine the magenta positive with it's two opposites, the red filter negative and the blue filter negative, you will have succeeded in isolating the green and the blue areas and can then remove the amount of magenta from those two areas, or any combination of the same colors.

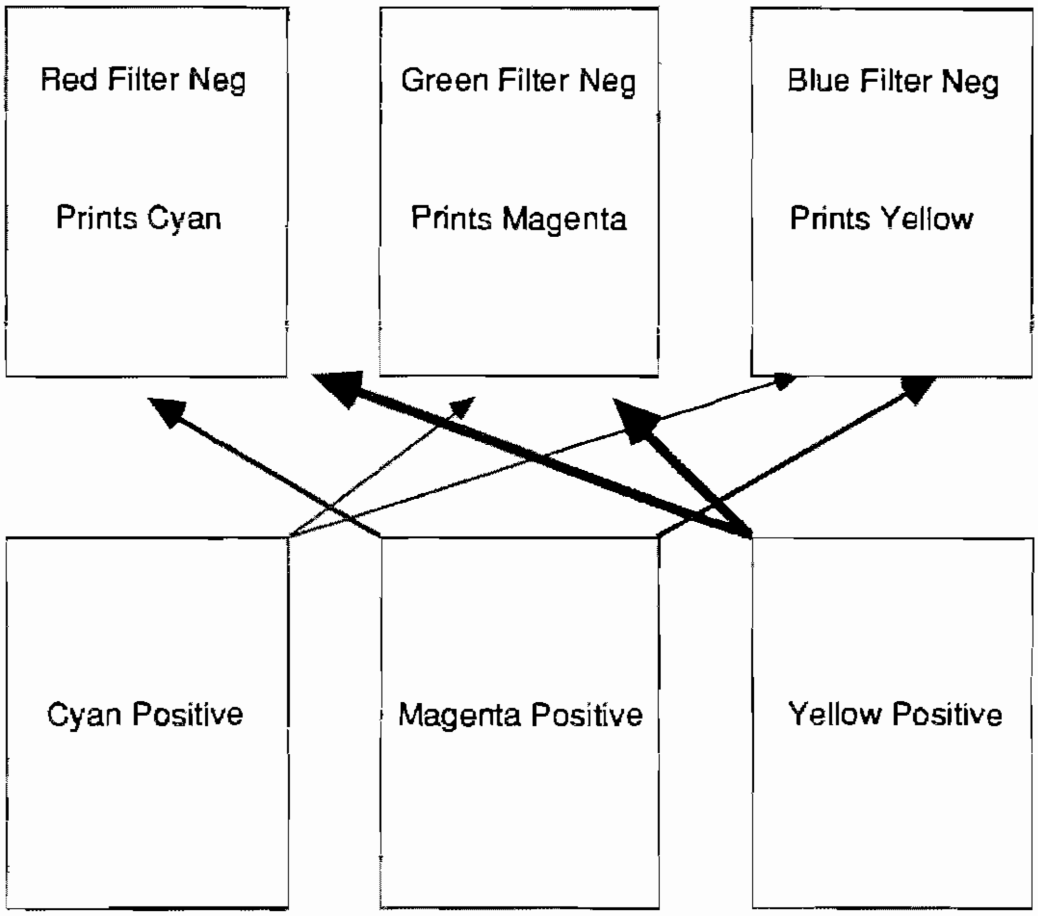


Note:
The areas covered by the mask only affect the green or blue colors, or any combination of the two. Finally, if you combine the yellow positive with it's two opposites, the red filter and the green filter negatives, again one at a time, the following will result:



Note
The colors affected by the mask will hold out yellow from printing in the cyan or magenta areas, or any combination of these two colors.

14. Isolation Color Correction



The combinations are simple to follow:

The Cyan positive combines with the magenta and yellow printers.

The magenta positive combines with the Cyan and Yellow printers.

The Yellow positive combines with the Magenta and Cyan printers.

15. Corrective Measures

Have you ever experienced the fact that the production of your separation negatives suddenly went out of control?

A number of things could cause such a catastrophe.

If your exposing lamp burned out and had to be replaced, or if your voltage regulator stopped working suddenly, or if your chemistry was on the shelf too long and needed replacement, or if your processing temperature suddenly was inaccurate because of a faulty thermometer, or if the separation filters needed to be replaced, or a new batch of film was a different speed, any one, or all of the above, could be the culprit.

How could you find out just what caused the problem? You would have to become a detective.

If you found that the voltage regulator was at fault, then a new regulator would solve the problem.

If the thermometer was inaccurate, a new one (digital) would answer that problem.

But if the chemistry had to be changed, or the bulb blew out and had to be replaced, or if the film batch was significantly different, then you had better prepare to make a new correction chart for your exposing and processing times.

However, there are steps that you can take which would make it easier to establish new exposure and developing times for the separation negatives.

If you are in doubt about the accuracy of the gamma to which you are developing your separation negatives, follow these steps:

Combine the transparency, the three step grey scale, and the mask that contains the image of the three step grey scale, and read the two end steps of the grey scale only. Record the density range. Call this **density range A**

Read the two end steps of the resultant grey scale on the set of negatives.
Record the density range.
Call these readings **density range B**

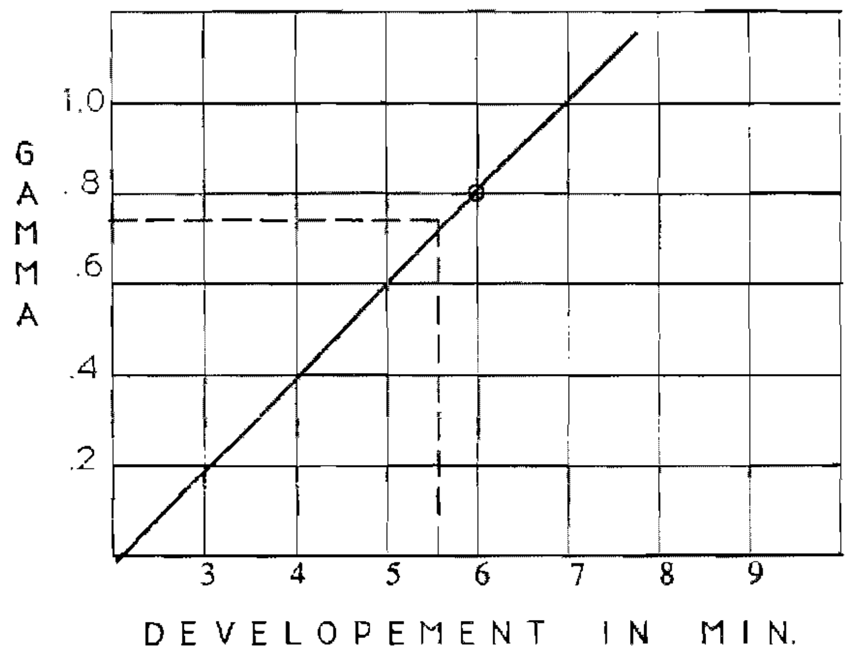
15. Corrective Measures

The Solution

Divide the **density range A** into the **density range B,** and the resuling answer will be the gamma of development that you have acheived.

If they are not what you had expected, here is a method of finding the proper exposure and development.

On a sheet of graph paper marked as shown in the sample below, place the developing times along the bottom of the page, and the gammas along the left side of the page.



If your resultant gamma was not correct, place a dot where the development line intersects the gamma that was produced.
example: gamma .8 at 6 minutes

Then draw a straight line to the lower left apex of the chart.

Then draw a line across the gamma .75 line. Where the diagonal line crosses the gamma .75, draw a line down to the new developing time. This will be the new developing time of 5:30 for gamma .75. Do this for all of the negatives that are out of balance.

15. Corrective Measures

Correcting the exposure

Whenever you process any film to a gamma of 1.0, the changes in exposures due to higher or lower densities can be calculated by using the log scale of your TI-30 calculator.

But, if you are processing any film to a gamma that is not 1.0, then you must modify the exposures. If you are processing to a gamma of .50 (which is half the normal strength of a 1.0 gamma), then you must double the difference in any change you make in exposures.

Example; Gamma .75 divided into 1.0 indicates a 1.33 factor. Any difference in the exposure must be multiplied by 1.33.
If a .20 increase in time from a 10 second exposure is needed, then follow the steps with a scientific calculator.

To find the exposure for an <u>increase</u> of .20 in density:

1. press the difference .20
2. press the button marked INV
3. press the button marked LOG
4. press the button marked X
5. press the old exposure of 10 seconds
6. press the button marked = and the new exposure will be obtained.

The new number is 15.8

The **difference** between the old exposure of 10 seconds and the new exposure of 15.8 seconds is **5.8 seconds.**

Multiply this 5.8 seconds by 1.33 (the factor) and the **answer is 7.7 seconds.** Add this 7.7 seconds to the original 10 seconds and the new exposure is **17.7 seconds.**
If we were too heavy, the method of correction would be reversed

15. Corrective Measures

To find the exposure for a decrease of .20 in density

1. press the difference .20
2. press the button marked INV
3. press the button marked LOG
4. press the button marked 1x (this is the step to remember)
5. press the button marked X
6. press the old exposure of 10 seconds
7. press the button marked = for the answer of 6.3 seconds.

The difference between the old exposure and the new exposure is 3.7 seconds.

Divide this by the factor of 1.33 and the answer is 2.8.
Subtract 2.8 from 10 seconds for a new exposure of 7.2.

This is how you can correct errant results.

In Conclusion

Dear friends,

After all has been said, it still remains up to you, the reader of this book, and the viewer of the accompanying video.

This is my version of the Dye Transfer process.

The fact that I have spent over 45 years in the rat race and pressure cooker of the advertising community, has helped me to produce quality prints. Most of the methods used by me, and others, have been the result of experimenting with the films, the various chemical formulas, and ideas.

Many of the color correction ideas and masking methods were "invented" because of the pressure put upon us to make better and better prints.

I hope my explanations are helpful.

I have always been available to the general public for explanations of my ideas and techniques. If, for any reason, you wish to contact me about anything in this video or book, please feel free to do so.

Thank you,

Bob Pace

Bob Pace

List of Suppliers

Registration Equipment
Complete Systems

Condit Mfg.
29 Philo Curtis Rd
Sandy Hook, CT. 06482
203-426-4119

Film, Chemistry & Equipment

Royce Photo Inc.
1300 Flower St.
Glendale, CA. 91201
213-240-1630

Used Quality Equipment

Lens & Repro
33 W 17th St New York City, N.Y.
212-675-1900

Magnifiers, pH Meters

Edmund Scientific
Barrington, N.J.
609-547-3488

Silicone
(Dow Corning #200 ,100 Viscosity)

K.R. Anderson
2800 Bowers Ave
Santa Clara, CA. 90501
408-727-2800

Used Motors, Gear Boxes, Pumps

C & H Surplus Sales
2176 E. Colorado Blve.
Pasadena, CA.
818-796-2628

Chemistry & Lab Equipment

Tri Ess Lab Supply
622 W. Colorado St.
Glendale, CA. 91204
818-247-6910

Professional Retouching Chemistry

Charles Carasqualle
5478 Wilshire Blvd.
Los Angeles, CA. 90036
213-935-9452

Your Local Eastman Kodak Stock-house Dealer

Glossary

A 21 Step Grey Scale	A grey scale with 21 separate density divisions used to plot curves or to measure specific results.
A 3 Step Grey Scale	A Kodak "Q-6C" tablet, contains 3 different dye image densities that represent the straight line portion of a curve shape.
A 5000 K Light Source	The Kelvin temperature that closely matches daylight.
Abrasions	Tiny scratches on either side of a sheet of film, visible when using a condenser enlarger.
Acetic Acid	An important ingredient used in making Dye Transfer prints.
Analine Dyes	Fast dyes made from vegetable products, used in the Dye Transfer process.
Apo Lenses	The apochromatic lenses used in color reproduction. All three colors will focus to the same focal plane, assuring accurate color registration.
Average Density	The middle point in density of any photographic image.
Besseler Enlarger	A quality enlarger used by many professional labs.
Bromides	The term used to identify the black and white prints used in the Carbro process.
Carbro	An older professional color print system that used colored pigments to produce a print.
Chemical Fog	A term used to identify the maximum end of the developing time where the highlight area ceases to gain density.

Glossary

CMT	A term "invented" by Bob Pace that simply means the "Combined Mask and Transparency" density.
Concentrate Dyes	The Kodak dyes before they are mixed into the normal set of working dyes. They are also used to replenish the strength of the working dyes as well as for spotting the prints.
Condenser Enlarger	An enlarger that utilizes collomnated light through a set of condensers to accent edge effects. It produces a "sharper" look.
Condit Punches	A series of professional punches for all sizes and kinds of film made by the Condit Mfg. Co.
Contact Frame	A system that uses pressure to place two or more sheets of film in contact.
Contact Separations	Separation negatives made by contact means of exposure.
Continuous Spectrum	The full band of light caused by a burning filament, as compared to a flourescent or gaseous tube that is missing one or more of the components in a full spectrum.
Curve Plots	The system for producing the shape of the film's grey scale in order to measure contrast and density.
D-11 Developer	Kodak film developer that produces a stronger than average contrast level. Used in developing highlight masks.
Densitometer	An electronic device to measure the different densities on a sheet of film.

Glossary

Density Range	The difference between the high and low densities in a sheet of film.
Diagonal Pins	The pin alignment in a register system.
Diffusion Enlarger	An enlarger that utilizes diffused light to project an image. It also reduces the need for spotting because of the soft light source.
Digital Thermometer	A more accurate kind of thermometer used by the author.
Direct Separations	Separation negatives of an original scene made in the camera using color separation filters in front of the lens.
Durst Enlarger	One of the finest enlargers made today.
Dye Transfer	A color print system that uses aniline dyes to transfer the image to a sheet of paper.
Dye Transfer Paper	Any photographic paper that has been de-silvered and mordanted in order to accept dyes.
Easel Meters	A device that measures the color and densities of a projected image on an easel.
Edge Effect	The light or dark flare that surrounds the edge of an image.
Edmund Scientific Co.	A company that sells various lab items which are of value to professional labs.
Elwood Enlarger	An old and great enlarger still used by many professional labs.

Glossary

Enlarged Separations	Separation negatives made by using an enlarger to project the image on an easel.
Factor	A mathematical term used to identify differences in numbers by multiplication.
Flare	The worst element in photography. The projected light that escapes around the image and causes fog and distortion of the original image.
Gamma	The term used to identify the relative amount of development contrast for a sheet of film.
Gasket Easel	A vacuum easel capable of holding more than one sheet of film in tight register and contact during an exposure.
Granite	The material used in producing a flat surface on which to transfer dyes.
HC-110 Developer	Kodak all around developer for virtually any kind of continuous tone film. Exhibits long life and repeatability.
Highlight Masks	Thin masks that represent the extreme highlight areas of the original transparency.
Isolation Color Correction	A system of color correction that isolates the different areas that need color correction.
Jobo	The name of a company that specializes in producing accurate rotary tube processing equipment.
Jobo Star Meter	An extremely accurate meter for producing repeatable density readings on the easel when making prints of any kind.

Glossary

K & M Light Sources	A specialized system of light units that are used for making separation negatives and principal masks
Key Number	A term used to identify the main reference number to be considered when calculating exposures.
Kodak Matrix Punch	A film punch made by Kodak that is used primarily for matrix film, and also other films.
Kodak Photo Flo	A chemical used to eliminate the surface tension of water. Can also be used to remove the magenta dye in a Dye Transfer print.
Kodalith A and B Dev.	A two part litho developer used in making high contrast "friskets" and specular highlight masks.
Kodalith Pan Film	The main film used for making highlight masks and "friskets" through different color filters.
Macbeth	A Newburgh, N.Y. firm that manufactures light boxes, densitometers, etc.
Magic Box	A device produced and used by the author for establishing the amount of color balance correction of the original transparency prior to making a print.
Magnifiers	The devices used on a light table or easel to check the sharpness of an enlarged image.
Masking	The term used to identify a contrast mask, a color correction mask or a frisket.
Matrix Film	A special film that has the ability to be processed into a gelatin relief image.

Glossary

Metronome	A timing device used in music. It helps to establish an agitation rhythm in order to repeat developing contrast.
Mordanting	The chemical action of hardening a paper emulsion and it's substratum base so that dyes can be transferred to it without bleeding.
Newton Rings	Irregular circles of color caused by two smooth surfaces coming in contact, or too much pressure between two sheets of film.
Normal Pin Glass	The pin glass where the pins are set in a specific order, mainly used to make separation negatives.
Oil Carrier	The name for an enlarger film carrier that can be loaded with "oil" and not leak.
Omega D2	An older 4x5 enlarger.
Pako	A company that produces roller transport processors and other related lab equipment.
Palette Knife	The art tool that is used to pry the film from the pins on the contact glass or the carrier glass.
Pan Masking Film	One film used for producing principal masks. It has a low contrast level and is diffused.
pH	A term used to express acidity or alkalinity
Point Source	The term used for a tiny but very bright light used in an enlarger or with a contact system, which produces a very sharp image.
Post-Masking	The making of principal masks after the negatives have been made. They are then added to the separation negatives when making the final matrices.

Glossary

Potassium Metabisulfite The chemical used to clear any stains caused by the use of potassium permanganate on the print.

Potassium Permanganate A chemical used to reduce the cyan color in a print. It can also be used to lighten a dense matrix by bleaching

Pre-Masking Making the principal masks prior to and incorporating them into the separation negatives when they are made.

Principal Masks The main masks used to control contrast and color saturation in the Dye Transfer process

Refraction The bending of light as it passes through two or more sheets of glass causing a rainbow effect on the outside edges of the image.

Register The placing of more than one image over the other in perfect alignment.

Register Pins The small steel pins used for registration purposes. They are usually imbedded in glass or granite.

Reverse Pin Glass A pin glass that has the pins set in reverse order, mainly used to make principal masks.

Scanners The electronic method of gathering information from a sheet of film or paper and transforming it into separation negatives.

Separation Filters The color filters used in photographically separating the three primary colors of a transparency, or original image, in order to reproduce them as a print or transparency.

Glossary

Silicone "Oil"	A liquid that is used by electrical devices that can also be used as in liquid film carriers. The refraction index is almost the same as glass.
Sodium Acetate	The main chemical used to lighten the dyes during the transfer stage of making a Dye Transfer print.
Sodium Hexametaphosphate	Pure calgon. Which is used to make a "highlight reducer" solution to improve highlight brilliance in a dye transfer print.
Sodium Metabisulfite	A chemical added to a hypo mixture to act as a preservative and can also be used as a stain remover.
Sodium Thyocyanate	A chemical that can be used to lighten the yellow color in a Dye Transfer print.
Specular Highlight Masks	Very thin representation of a highlight area. This thin film image is added to the main highlight masks to augment the highlight separation.
Speedmaster	A company that manufacturers easel meters and densitometers, etc.
Split-Masking	The exposing of the original image, through different filters on the same sheet of masking film, in order to change the color rendition of the final print.
Sudden Black	The term used to identify a "sudden" black area in a photo. Such as a black shirt in an otherwise light picture.
The Light Source	Any kind of light used to make exposures.
TI-30 Calculator	The Texas Instrument calculator, used by the author, when using the log scale method of determining new exposures based on differences in density.

Glossary

Time Gamma Chart	A chart made in order to establish the correct exposure and developing times for any given film.
Timers	The little devices that we place our trust in when making exposures.
Transfer Board	The transfer area used in producing Dye Transfer prints. It is usually made from granite or glass.
Transfer Roller	The roller used to roll down the dyed matrix film onto a sheet of prepared paper.
Transparency	A positive image on a sheet of film.
TTLM	The short term for the chemical Thiethlyanomine, used in contrast control of the dyes and in mixing paper conditioner.
Type C Print	A negative to positive print system that uses a color negative and a prepared Kodak Ektacolor Paper.
Type R Print	A reversal print system that produces a color print on Kodak Ektachrome Paper directly from a transparency.
Vacuum Frame	A contact frame that is pressurized by the use of vacuum.
Versamat	The Kodak processor that many professional labs use to process separation negatives and masks.
Wallace Fisher Meter	An easel meter with an extremely long scale. Used for establishing light levels and measuring densities.
Zone V1 Timer	A revolutionary timer that compensates the processing time for the differences in developer temperature.

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