Art Enhancements for Prepess Departments

With your mechanical (pasted-up, waxed-up page, area composition, or illustration, etc.) ready, you now go to the camera.

Before you have completed your copy, it helps if you try to think like a camera.

Don't be afraid to look at your copy under a magnifying glass. You might as well use a lens, because the camera is going to inspect it very carefully with its very fine lens.

The process camera is a lot like any other camera. It has a place for the object to be photographed (called "copy" in the graphic arts), a lens, and some method to hold the film flat.

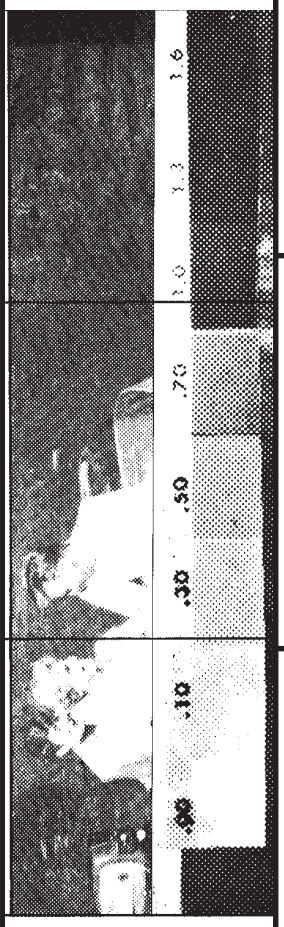
The usual process camera has limits as to how much it will enlarge or reduce from the original size. An average one works to 200% enlargement and down to a 50% reduction. Auxiliary lenses can increase these ranges to one-tenth size and enlarge up to ten times.

Let's see just how this camera works, and what it's all about.

Use the human eyes–your eyes–as a basis of comparison. During the daylight hours, a great majority of your mental impressions are formed by what you see. Light is reflected from all objects at various degrees of intensity. We see these objects as light, gray, and dark, depending on these primary conditions existing at the time: the intensity of the original light source bombarding the object and being reflected toward our eyes, the distance from which we view these objects, and the ability of our eyes to detect reflected light and transmit the correct intensity of light, through the optic nerves, to the optic centers of the brain. Similarly, at night the same conditions still exist, yet we receive different impressions of the same objects we viewed in the daylight. Why? Common sense tells you the only condition that has changed is the intensity of the light source.

We can now sense a correlation between the ways that two optical systems work; our own as related to that of a camera. Theoretically there is very little difference between the two. If you could somehow lift a section of your skull, remove the optic centers of your brain and replace them with a sheet of photographic film, or any light-sensitive substance, you would come up with a nearly perfect image of what your eyes saw. Naturally, the nearer to 20/20 vision you maintain, the nearer you approach the perfect image. The basic principle of all photography is the principle of human vision.

Contact Screen
Exposure Technique Chart

Name	Object Technique		Creates solid areas	
Bump or No Screen Highlight Exposure (Optional)	Creates drop out areas and/or highlights in negative	**Exposure** (Approximately) Close *f*/stop two numbers then 20% of your main exposure Rx. I /5 of 3 0 seconds = 6 seconds		or #3 (10%) windows in film. See 00-.10 boxes
Main or Middletone Detail Exposure	Light and gray tones screened INTO white and/or black printing dots in negative	Use your shop standard (approximately 30 seconds)		Creates all B&W dot sizes from # 1 shadows (80%,) to #2 (20%) See .30 to 1.00 boxes
Shadow Flash Exposure	Adds extra tones in dark shadow areas in negative. Improves ink, "balance" fountain on plate printing	Approximately 33% of standard main exposure Rx. 1/3 of 30 seconds = 10 seconds **Example Negative "Key" Size**		Creates "flashed" black dots in dark shadow areas in film See 1.00 to 1.60 boxes

A Few Hints

When using all the contact screens, it will be necessary to "test" each screen at same-size (S.S.):

1. With contact to emulsions.
2. ALSO shooting with the screen acetate in contact with the film emulsion, and the screen emulsion.
3. Careful vacuum flatness is a requirement for smooth results.
4. For more movement (thick and thin) in the film lines, a thin 5 mil. clear (clean) acetate may have to be added between the reversed screen and the film emulsion.
5. Different film emulsions produce a wide range of different contrast results. Try your line and also the halftone emulsion brands you use. Explore which one works best for you.
6. Do not overlook the shadow flashing exposure that should be made first or before the main exposure. It helps to supersensitize the film emulsion and produces more contrast.

Basic Differences Between Regular Camera and Copy Lenses

WORKING CHARACTERISTICS COMPARISON

Characteristic	Regular Camera Lens	Copy-Process Lens
1. Light source	Daylight or flash variable	Artificial, quartz, etc. Constant
2. Speed (stops)	*f/2* to *f/16* average	*f/8* to *f/45-64* average
3. Negative size range	Approximately one-quarter size to infinity	Same-size to one-quarter or one-fifth size
4. Working *f/*stops	Variable	Constant *(f/22 - f/32,* etc.)
5. Exposures	1/500 to 1 second	20 seconds to 2 minutes
6. Filters, used	Occasionally	Often
7. Films	Panchromatic & Color	Orthochromatic, usually.
8. Focal length, lens	1" to 5" average	10" to 18" average.
9. Can be used in darkroom? Enlarger unit?	Maybe, if bellows' length fits focal length of lens.	No, enlarger bellows usually too short.
10. Color corrected	Yes	Usually.

To explain the basic difference between news and copy camera lenses, we will try to compare them.

A rapid inspection of the chart above indicates there is a wide difference in the requirements for a regular camera lens and a flat-field copy lens.

Copy lens is designed for wide-angle coverage of flat drawings, sketches or photos. Copy style lenses should cover about a 60 degree angle or approximately the diagonal of the square or oblong of its copy. As an example, a 5 x 7 copy job, to be reproduced at same-size, would require a lens with at least a focal length of 8 inches to copy or resolve it sharply at the four corners of the copy film negative.

A modern wide angle 8 1/2" focal length lens should copy or resolve sharply at the four corners of a 10 x 14 copy at same-size. This is double the length of the diagonal of the 60 degree lenses.

The flat-field copy lens is also employed to process contact or glass screen negatives for tints or halftone reproduction requirements. To use a press lens for copy work would not produce maximum resolution at the corners of normal copy work.

Each type of lens is designed to produce a particular result. The press lens is made for capturing instant action under all kinds of lighting while the copy lens must be operated under a rather constant light source. Copy lenses have little depth of focus but fantastic covering power for flat-field copies, with extended sharpness at the four corners.

Never use the regular camera type be employed to do photomechanical copy work.

Mysterious Magic We Call Light

For discussion, subscribe to the "bombardment" theory of light. It can be demonstrated that light physically hits a photographic emulsion. No one knows precisely how it is transformed or reacts to produce the final developed result. Many formulas have been propounded because there seems to be a wide divergence of individual opinion by the experts themselves. There is no final theory that all of experts can agree on but a common one is that light travels in "waves."

Now, a wave must have a substance through which it travels. When scientists found out how water waves behaved and how sound waves traveled, they found that light acted as if it were a wave, too. Yet, curiously enough, they still don't know whether light waves need a medium through which to travel!

The most important things about any wave are its length, frequency, and amplitude. In addition, light has "color temperature," which is important for determining different reactions to different film emulsions. This color temperature is important in color photography, color separation work with filters and when using orthochromatic or panchromatic film.

Types of Contact Screens

Contact screens are used for making halftone negatives and positives for photomechanical reproduction of pictures. The screens are composed of vignetted dots on a flexible film support and are used in vacuum contact with the litho film or paper on which the halftone dots are created.

There are three basic types of contact screens:

1. Magenta contact screen (negative) for making halftone negatives for photomechanical reproduction.

2. Magenta contact screen (positive) for making halftone positives from continuous-tone negatives.

3. Gray contact screens for making black-and white halftone negatives and for making color separation negatives on pan film from color copy.

When any positive or negative type screen is used for its basic purpose, it will give superb results without complicated exposure techniques.

Note: If a positive screen is used in a normal manner for making negatives, or a negative screen for making positives, the resulting reproduction will usually lack sufficient highlight contrast. Excellent halftone negatives can be made with a POSITIVE screen if a no-screen, or highlighting, exposure is added. But there is no way to overcome the basic loss in highlight contrast if positives are made with a negative contact screen.

The lens opening does not affect contrast or dot formation. Therefore, use an aperture of *f/11* or *f/*16 because most process lenses give sharp results at these settings.

For making enlargements or reductions, either the aperture or the exposure time must be changed. If the lens aperture is not changed, enlargement of the image size will necessitate longer exposure; a reduction requires shorter exposure than same size.

Magenta Contact Screen (Negative)

Magenta contact screens (negative) can be used with white-flame arc, tungsten, or pulsed xenon lamps on the camera with only small differences in tone reproduction. The magenta dye in the screen permits tone-reproduction changes to be made with recommended filters.

The controlled-flash method is the simplest method of controlling halftone contrast. It requires two exposures:

The main exposure is made through the screen and with white or contrast-control filtered light. It depends primarily on the highlight density of the original copy, on magnification, and on lens aperture.

The second exposure is a shadow-flash exposure through the screen. The actual shadow-flash exposure, to produce a satisfactory shadow printing dot, depends on the density range of the original.

General Rule.

The larger the black areas, the LONGER the flash exposure is required.

The Highlight Extra Exposure. Because the copy is too gray, increased highlight contrast may be

needed in the light tones for making snappy halftone negatives. A highlighting image exposure can be made without the screen. The highlighting exposure is from 2% to 10%, of the main exposure, depending on the amount of extra highlighting required. With the film in place on the vacuum back of the camera, (1) make the no-screen, or highlighting, exposure first. Then (2) place the screen over the film, and give the screened main exposure, followed by the shadow flash exposure through the screen. Remove screen and film and develop your standard time and temperature. Inspect, evaluate the results.

Gray Contact Screen. It is the simplest screen to use and is recommended for use in processes that do not require the magenta dye for controlling tone reproduction. The shadow-flash method is recommended for controlling halftone contrast. The main exposure is made with white light or through "separation" filters. The flash exposure is made through the screen by using the same flash lamp and flashing procedure as is standard practice for the magenta contact screen.

Gray contact screen will usually give adequate highlight contrast. For any situation that requires additional highlight contrast, a no-screen, or highlighting, exposure can also be given. To do this, make an exposure without the screen before the screen is put in place for the main exposure. The highlighting exposure time is from 2% to 10% of the main exposure. If the highlighting exposure times become too short for control, use a neutral density filter or stop the lens down one or two f: stops.

Elliptical Dot Screen. These contact screens incorporate an elliptical-dot structure which, in turn, produces an elliptical dot in the middletones.

This feature of the screen eliminates the sudden jump in density that is usually encountered in vignetted areas of the reproduction because all four corners of the dots join at the same place in the tonal scale. With the elliptical dot, only two diagonal corners join at any one place in the tonal scale at 49/50%. Consequently a smoother printing reproduction is usually obtained. This screen is used for black-and-white reproduction in the same way as a regular square-dot contact screen.

A Few Don'ts for Contact Screens

1. No smoking in the darkroom. Contact screens and films often become electrostatically charged. They are capable of attracting dust, smoke and tar particles, especially on dry days.

2. Screen abrasion is often traceable to ashes. Hang your contact screens on a string from the ceiling, with a clip, when not in active use. Do not lay them down on dusty shelves. Wax your floor every week.

3. Adhesive, inadvertently stuck to screens, may be removed with a standard solvent FILM cleaner. Use only recommended screen cleaners.

4. Gray contact screens with fingerprints may be cleaned by washing in a weak solution such as Joy or Lux. Dry slowly, hang from two corners.

5. Don't rub your bare hand against the screen. A clean paper top **mask** should be used to eliminate or roll out air pockets to insure contact between the screen and the film.

6. Sensitized film should be cut clean and sharp, so as to avoid torn or rough edges of any film being pressed into contact with the emulsion on the screen.

7. Most operators find that 8 to 10 (inches) on their vacuum dial gives a better, smoother result than 20 or 22 (inches). Less vacuum helps overcome minute dust (out of contact) spots. A small hand valve, to bleed the extra air, should be used in the vacuum hose line to obtain a smooth contact result with lower vacuum pressures.

8. An air conditioner is a profit-making machine for all darkrooms. It reduces dust, keeps the operator wide awake, and solutions at normal temperatures, at all working times.

Gray Line Art

In the event the old art copy is so faded, delicate or gray or dirty that a successful same-size negative cannot be made, a new piece of art must be created.

We know that a process lens works better at any size away from same-size so we enlarge it. We automatically obtain superior resolving power at 150% size and usually twice the lens resolving power at a double-size enlargement. That is the basic reason why enlarged line or "copy art" enlargements look sharp. They really are more clean cut. Care must be used not to use a too-big *f/*stop. A limit of *f/*16 is a good number to remember. The extra exposure time must be made to compensate for the larger film enlarged area.

Develop, fix, wash, inspect critically.

Next, a clean vacuum contact print can be made. The art department may do a cleanup or restoration job. Now the new (2X) copy is ready for a new half-size reduction shot. Here again the lens resolution is 2X that of the weaker same-size position. Now you have finally produced two superior resolution film negatives for your "fine line" art copy. The final result should be outstanding quality.

Lens Power

Resolving power or sharpness of a process lens increases rapidly as the size is changed up or down from its same-size position. In other words, a process lens works at its most inefficient resolving position for sharpness at its critical same-size position.

If your process lens is ever moved closer to the copy board than its critical same-size measurement, it will never focus at maximum sharpness.

It may "look sharp" but it is not at its best resolving position.

The actual focal length of any lens is never quite the dimension stamped on the front lens ring of the lens barrel.

Some lens manufacturers supply the critical focal length in millimeters for each individual lens. This usually helps in setting up the lens critical same size position.

The copy-to-the-lens distance is always double the actual focal length of the lens. The lens is halfway between the copy and the film plane positions at SAME-SIZE.

Changing Weight of Type Lines

Many times a customer will have a big (10" x 12") line copy with lots of fine lines in it. He wants it to fit into a 4" x 5" space in his advertisement.

An ordinary reduction camera negative and print will have all the very fine lines "missing" or washed out.

This is true for small-type reductions; 6 or 51/2 point reduced from 12 point will be ragged. The body design of 12 point type is more delicate than a 6 or 51/2 point type face of the same font. The designer has made the smaller face type slightly more bold because it must have more black to be more easily read, etc., when printed.

A suggested solution is the use of ultra violet (UV) light. Use a 250 watt (UV) black lamp. Hang it four feet over your printing vacuum frame. You will need some four or five point fine ground or "M" type acetate to be used as a spacer or diffuser. The "M" type surface will permit an easy pullout for the vacuum to eliminate air pockets and produce perfect contact.

Make a 75% reduction negative, with no fill-in for the fine lines. Then use a recommended contact paper (blue sensitive) with the "M" spacer and the 75 % negative on the top.

Expose six steps, of 20 seconds, develop, inspect. You will be surprised and delighted at the new extra bold lines and type face you will have in the new paper copy print at some of the test steps.

Keep this test print for future reference. Select the time of "UV" black light exposure that you consider best for the reduction you must make.

Make the new 75% print. Then make the 4" x 5" reduction negative and print for pasteup.

By using a film positive (blue sensitive, contact grade) you can also make a "test" film that can be made "lighter face" (undercut) using the same general procedure, depending on the length of exposure to the black "UV" lamp.

Panels with light tints can be made darker, using a first step "negative." Using a film positive, the tint dots can be undercut and eliminated or dropped out in a secondary negative contact.

Spreads for "two-color fits" or "fatties" are easy to process, using the "UV" light spread system.

Make Textured Backgrounds

Many texture designs can be adapted for printing. Ordinary artists' texture sheets have been used as contact tint screens. Combining different designs to obtain unique backgrounds is done by making "sandwiches" of the selected texture sheets. The sheets that have a wax side should be cleaned off before being used on the vacuum back.

If two (or more) texture sheets are to be used together, the inside one should be cut one inch smaller to help obtain a good, smooth vacuum pull-down.

Several texture sheets can be sandwiched and rephotographed (preferably on a transmission light box) as line negatives to a smaller working-size film.

These new films will have a smaller texture design and they, in turn, can be used for contact screen texture camera negative work.

Contact (texture) negatives can also be made from suitable line or halftone negatives. Usually a positive must be made to confine the new background to the original texture design.

The possibilities of making up your own set of texture films is unlimited.

Note: These films work like a "tint" screen. They will NOT produce a contact screen graduated-dot effect.

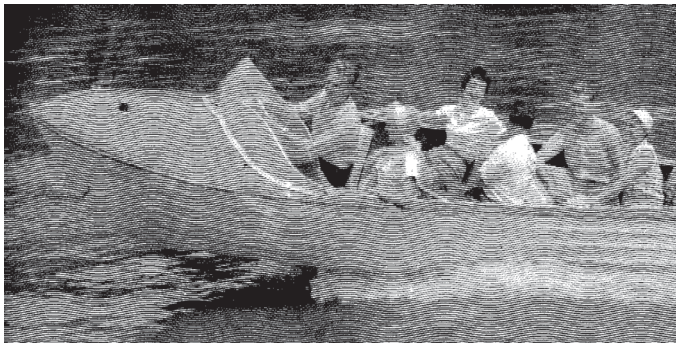
Special Texture Screens

The standard halftone contact screen is a mathematical series of alternate open and dense areas running at ninety degrees to each other and spaced at a fixed interval, as 120 lines per linear inch or 14,400 alternate open and dense areas per square inch.

It is often desirable to switch from the smooth screen or photographic effect and jump into a bold pattern design or a series of lines to create an artistic reproduction.

The mezzo screen effect or a combination of straight line screens can usually be purchased on special order. Their use must be supervised and visualized by the art director as they will have only a limited field where they will produce acceptable results.(See examples of circular and wavy line screens, below)

Circular Screen



Wavy Line Screen

Techniques For Middle Tones

The best printing halftones are usually made with three separate "additive" exposures: (1) middletone, (2) flash, and (3) bump or highlight.

The present contact screens, now on the market in either magenta or gray, are designed to perform at their best efficiency only when used with films with special emulsions that are made for halftone screen processing.

Make the test middletone exposures first, as this will give you basic information about the density characteristics of this particular screen. All screens are slightly different, and it is the slight difference that must be discovered and used to your advantage.

1. Set up a twin test copy with developing gray scales at the sides. To save film, reduce the size area to one-half, and adjust the exposure accordingly.

Assuming that your (line) standard time at *f/22* is 20 seconds for same size, half-size the line exposure time should be approximately 60%, or 12 seconds, on your camera and lights.

2. Open the lens two stops to *f/*11, put on film, add the halftone screen on top of film. Do not rush the exposure as all the air must be vacuum pumped out between the film and screen. This usually takes 10 seconds waiting time.

3. COVER ONE-HALF OF THE TWIN COPY WITH BLACK FELT OR PAPER. Expose for approximately 12 seconds at your half-size. This is the same time as your one-half-size line standard exposure.

4. SWITCH BLACK COPY MASK TO OTHER HALF. Repeat another exposure cycle but have the *f/*stop at *f/*16 on the lens (which will pass only half the intensity of light bombardment for this exposure).

5. Next, develop both sides together for the same developing time you have selected for your line exposures. Fix, rinse, blot off, and inspect under a magnifying glass. Concentrate on the .50 square or middletone on the developing scale. Study the relative sizes of the windows and/or the black dots in this block.

You may have large round black dots, almost connected, in this square in either the *f/*11 or the *f/*16 exposed film. There should be a visible difference in the size of the black dots as the *f/*11 exposed side had double the exposure bombardment of light rays through the contact screen than did the *f/*16 side.

Let us assume that this screen is a "normal" type; then the black dots in the *f/*16 film should be much smaller than the *f/*11 black dots in the squares below the .50 square.

If you were using a fast screen (gray screens are usually the faster contact screens) there are no unconnected black balls in the *f/11* film at .50. They grew so big they connected together, and all you see through the magnifying glass is very large white (open) areas surrounding by black film areas. (Inspect picture at 50% on negative strip.)

The normal or correct key exposure for the middletones of the printed halftones is determined by creating large black dots on the offset plate in the tones of the copy or picture that correspond to the approximate 49/50 gray or middletones. Inspect the .50 square in your developing scale. Different pressmen may require different-size black or white dots on their offset plates at the .50% gray tone areas of their copy.

How skillfully the pressmen lay their ink, cylinder pressures, types of paper (coated, offset, pebble) may necessitate a slight movement up or down the gray scale for your middletone windows or black dots. This tone movement is accomplished by exposing with less or more exposure. An easy way to accomplish this change is to open or close the lens f./stop. Larger stops will make the offset negative highlight areas SMALLER, causing the middletones to print lighter tones, because less ink will be deposited to cover up the white paper if the black PLATE dots are smaller.

Reducing the size of the lens *f/*stop opening will cause LESS bombardment of light rays through the contact screen, and this, in turn, will produce smaller black balls in the shadow areas of film negative, and these black balls, in turn, when printed on the offset plate, produce smaller clear metal areas. These clean shadow plate dots assist in keeping the fountain solution and ink in proper offset balance for clean printing in the very dark middletone and shadow areas.

This may seem a rather lengthy explanation of middletone techniques but the middletones or grays are the most important tones of any offset picture.

Let us assume that you are using one of the faster screens (gray or magenta), and the (ap-

proximately) 13-second test exposure which gave a large, clear window in the .50 square, much smaller windows in the .30 square, and smaller windows in the .10 developing scale square.

If you have pinpoint dots in your .00 or white picture areas, you have an exceptionally fine, fast screen.

For Razor Sharp Focus!

You will have to run careful tests on your own camera lens and lights. Reproduced is a visual test target that is easy to see and evaluate. It is keyed on a basis of "lines per millimeter."

There are two targets. Clip them out and paste one up four inches from the center of your copyboard on a brown or gray sheet (not white). Paste the other on a diagonal line near one corner of your largest (average) copy. Put an 18-inch strip for measuring same size on the copyboard. Focus your magnifier (down on the glitter side) on the ground glass, focus on the center set of crosses as sharp as possible on the 2.5 cross; then inspect the test set on the long diagonal near the corner with your magnifier. Perhaps only the 2.5 will be clear and sharp. Close the lens to *f*/22 and reinspect. Now perhaps the 3.5 is clear and sharp, but the others may be fuzzy. Close the lens to *f*/32 and reinspect.

If there is no visual improvement, slowly move the lens only, back and forward. Maybe the 5.0 and the 4.0 images will brighten up. If this happens, then check your same-size strip. It may be larger or smaller.

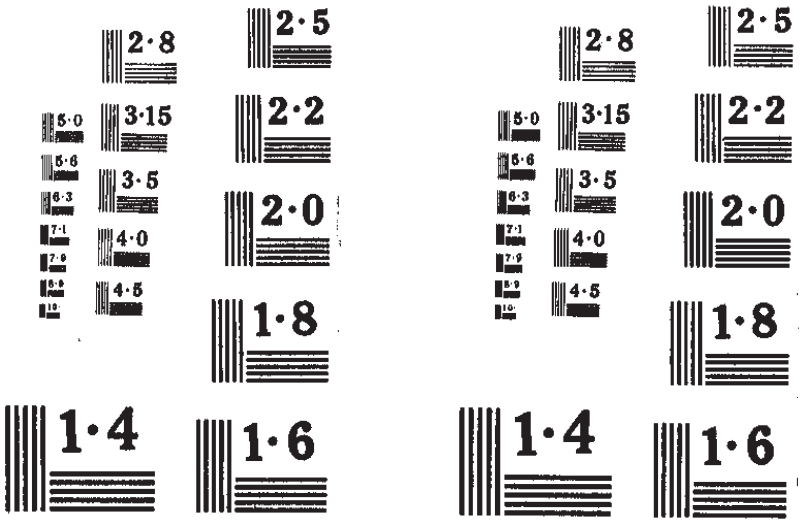
If the new size is larger than same size, move the copyboard one-half inch NEARER and refocus the lens sharply on the crosses.

If the size is smaller, move the copyboard NEARER again (about one-half inch) and refocus the lens on the crosses.

If you cannot improve the sharpness of your test image by moving the lens forward or backward, you are too near for the "critical same-size" copyboard position.

Then move the copyboard (approximately one-half inch) away from the camera. Keep moving the lens and copyboard to different settings until you can move the lens backward (reducing 10%) and forward (enlarging 15%) from your sharpest same-size copyboard spot.

The test images should not lose their sharp, clear test lines. Then you have the critical same-size position for your copyboard. Mark it carefully, as it will never change, with the same lens you are using, for same-size work.



Halftones Superior To Line Art?

This is a question that is often asked of an art director.

The definite answer is "maybe." It is really no answer at all. The choice of tones or lines depends in a large measure on the type and quality reproduction (printing) value of the art work being used.

Here in the very free style sketch of the hat and the girl either the fine (120) screen halftone or the sketchy line sketch would both be eye-catchers. Do convert, photomechanically, line to tone or tone to line without serious thought and a valid reason.

Each situation should be weighed in the light of previous experience as to what the customer likes and dislikes and how it will look to the consumer.

A General Rule for Shadow Flash

A too-small and too weak shadow flash dot can give the pressman extra problems. Small dots in the shadow (dark photo areas) are very important.

If you "guessed" you had a solid black (for printing on the offset plate) shadow black dots.

BUT . . . when you make an enlarged positive film, all the weak black dots in the shadow areas dropped out or disappeared, the same dropouts would occur when you attempt to print the original film negative on an offset plate.

AND . . . if the small plate was put on a press, the pressman would have a difficult time trying to balance his ink and fountain solution so that the picture would print clean during the run.

Hint: When in doubt about the size and blackness of shadow dot: (1) Ask the pressman what size he needs and (2) be extra sure they will print on the offset plate and NOT drop out.

Bump Or Extra Highlight Exposure

The usual procedure is to always close the lens down to *f/45-64,* load the film only and expose without the screen on top, for one-half of your key exposure time. For our example, one-half of 13 seconds, YOUR key exposure time, or about 7 seconds. This 50% is usually sufficient to close up the windows in the .00 and .10 squares in the gray step developing scale with the average contact screen.

Run tests to find out your exact requirements.

If the copy is very flat and lacks highlight areas or tones, it may be necessary to extend this highlight or bump exposure to equal the key standard exposure (in our approximate example, this would be 13 seconds), but remember to stop down to *f/45-64*

Now, if this negative, with the correct middletone, plus the extra bump exposure, were developed and fixed and inspected, it may look like a high contrast halftone negative. But ...

All the dark or shadow areas of the copy would be clear film - no dots, - and would print up a solid (muddy) black. This is caused by the fact that no light rays bounce off the black areas of the copy or photo to bombard through the screen, to create black dots on the film after development.

Shadow Flash Exposure

(To Print Clean Blacks)

An extra auxiliary exposure, called a SHADOW FLASH exposure in the trade, will produce black dots in these dark areas of the film negative. These print up as very small, bare metal areas on the offset plate, permitting easy control of the mixing or balancing of ink and fountain solution on the offset plate and press. Without these thousands of small clear metal areas on the plate, the greasy offset ink would pile up and print muddy blacks.

Shadow Flash Techniques!

The very small black dots can be created in the film by using a number of different flash techniques.

The yellow flashing lamp technique, on the vacuum camera back, can be explained by your film supplier. It is a good method to use for all-over flashing, as the exposure time is always the same for average films.

Another system employs a clean sheet of white or yellow paper which covers up the entire copy and the developing scale (see example pix in another section of this manual). The lens is kept at the f/45-64 stop-the contact screen is now placed over the film (which may have been “bumped” or has had the extra highlighting screen exposure, without the screen).

The timer is set at the same time used for the main exposure. The lights make the white paper “flash” by bouncing off the paper through the lens and through the screen so that small black balls are created all over the film area.

After the flash exposure the paper is removed.

Note: After development, the black dots can be studied and if too large, perhaps 50% of key time is enough for your screen.

Middletone Detail Exposure

The lens *f/*stop is now opened to the selected one *(f/*11 or *f/*16 or *f/*13) as next determined after the first series of middletone key tests.

The key time (we use 13-14 seconds in this discussion) for half-size exposure is made, which is usually the #3 or final exposure, for the middletone detail areas.

Let us review the steps we take to create a clean printing halftone negative.

1. First, we bump it (no screen) to get pin point or blank dots in the negative for bright highlights (white areas) in the printed picture.

2. Next, flash through the screen the entire picture to create black dots all over the picture and also in the gray developing scale.

3. Finally, expose the picture or copy to a large volume of light rays (at *f/*11 or *f/*16) to create both areas and black dots in the gray middletones of the copy.

While this is a long description of how to make key standards for your halftones, once you have the, *f/*stop sizes and the key time you need, you should be able to produce fine or bold screen halftones from all kinds of copy by changing either your *f/*stop or exposure time percent selections.

Note: You may have to modify some of the imaginary exposure times to suit individual conditions because all lights and contact screens are different. For instance, the developer - a very delicate and variable solution-after lunch **will not** be exactly the same as before lunch. You must continually watch its strength and temperature.

Be sure that developer is mixed or "diluted" correctly for halftone use, according to the manufacturer's instructions.

Shadow dots should be made to please your pressman. Different presses may require different-size black dots in the negatives in order to provide the appropriate open pattern required for best presswork, setup, etc.. You may have to make minor changes in these instructions to meet the pressman's needs, but once you recognize what the different exposures produce on the film, you can easily make modifications to suit the requirements of your production equipment.

Note: Always enlist the cooperation, skill and brains of an alert film supplier or technical representative. They should be able to keep you advised on all the new and better films and methods. When you find a willing, capable salesman, stick by him as they are few and far between. They will help you earn more, learn more, and build up your own pride of technical accomplishments.

Enlargement Calculations

Much more light bombardment is required for all enlargements to overcome (a) the increase in area being bombarded plus (b) the reciprocity failure of the film emulsion itself.

Example: Enlarge a 2" x 2" (4 square inch) copy to double (or 2X), equals 4" x 4" (16 square inch). Here we have four times the film-to-copy area. Make your test on two pieces of film. Expose one with the formula explained below, and expose the other with 20% less time. Develop together. Watch your lines and gray scale critically. Fix, wash, inspect.

Note: Different film manufacturers will have different brand reciprocity failure factors. Make your own tests; keep accurate written records and samples. Your exposures must be sufficient to have chemical (wet) development completed WITHIN the time the film manufacturer recommends in his instruction sheets.

There are about a dozen different formulas to determine what exposure time is required for offset enlargements. We will deal withonly a few.

A reasonably simple one is:

Example: If your correct exposure for same-size is 30 seconds at *f/*22, then for a 3X enlargement exposure will be:

$$\frac{\text{New Exposure Time}}{\text{Known Old Exposure Time}} = \frac{\text{New Magnification + 1 (squared)}}{\text{Old Known Magnification +1 (squared)}}$$

Example: If your correct exposure time for same size is 20 seconds (at *f/*22) then for a 3X (three times up) enlargement will be:

Cross multiply:

4X = 320

X = 80 or 1 minute 20 sec.

Note: Open *f/*stop to *f/*16. It will cut exposure in half or 40 seconds. (This formula is accurate.)

This formula is reasonably accurate for "moving" copy light cameras and is accurate for most standard enlarger techniques.

$$\frac{\text{Time}}{\text{New Exposure Time}} = \frac{\text{Size}}{\text{New Enlargement Size}}$$

$$\frac{\text{Known Old Exposure Time}}{\text{Old Known Size Enlargement + 1 (squared)}}$$

$$\frac{\text{New Time (x)}}{\text{20 seconds}} = \frac{(\text{3 up} + 1)^2\ (16)}{(1+1)^2\ (4)}$$

Some film manufacturers give tables that indicate less time is required for enlargements than that given in the above formula. That is why actual tests should be made to make doubly sure that your own shop standards are correct.

Adding a small clip section of a printed halftone will insure a good, sharp enlarged focus. It will also help in inspecting for good black and white density in the finished test negatives.

A too LONG developing time indicates a too SHORT light exposure or a too SMALL *f*/stop.

A Few Hints on Lighting

Here are a few checkups to produce superior negatives. When shooting a series of copies, leave the copy board glass OPEN between group exposures-as it will help cool it faster.

Critical register copies will often dry out with excess heat from a hot cover glass and may be out of register. No one will know the real answer until the “make ‘em over” (lost time) announcement is made to the operator.

Your lighting on the copy board should be uneven. The four corners need about 30% MORE light than the center areas. This will insure that your developing film negative will get black all over about the same time and finish all even. This is impossible with only two lamps. Four lamps are a basic requirement.

Checking with a light meter is the best method to get the balanced over lighting of the corners mentioned above. Keep in mind that the light from the center of the copyboard is transmitted to the film plane most efficiently and thus requires the least light. A very important factor is to avoid “spectral” reflection of the copy lights from the copyboard cover glass (or from the gloss of the copy itself) into the lens. Whenever an experienced cameraman moves the relative position of the lights, lens and copy, he will make a quick visual check for spectral reflections. This is accomplished simply by putting your head in front of the lens and visually scanning the reflections in the copyboard cover glass (with copy lights turned off). There must not be any reflected image of the copy lights visible in the copy glass when viewed from this position. If there is, reposition the lamps.

To effectively reproduce type

composition in a camera, the light must come from a pair of relatively large area diffuse illuminating lamps or a set of four lamps with a wide beam spread to provide good overlap of light. The ultimate is four large area diffuse lamps. In the following discussion our attention will be directed toward the vast majority of work which falls within film size ranges of 16 x 20 inches, 18 x 22 inches and 20 x 24 inches.

The most economical, satisfactory lighting system is a set of four halogen cycle tungsten lamps of 650 watts (each) operating at a filament temperature of 3200 K. These are commonly referred to as "Quartz Iodine" lamps.

The final determination of your best exposure will be unique to your particular installation. However, you can count on your exposures falling within 15 or 20% of certain widely accepted values as being indicative of normal and correct operation. In the recommendation given below, a typical exposure is as the same size reproduced at *f/22.* For the minimum set of four 650-watt Quartz Iodine lamps the basic exposure for a line shot will be 40 seconds and for a halftone, four minutes. Going to a set of higher powered Quartz Iodine such as 850-watts or 1000 watt lamps, the time of the line shot will come down to approximately 30 seconds and the halftone will run between 2 1/2 and. 3 minutes. When maximum production is desired, a set of four 1500-watt Quartz Iodine may be used or, for the ultimate, a set of four 1500-watt Xenon lamps may be used. These will give a line shot in 10 to 14 seconds and a halftone in 25 to 45 seconds under the aforementioned conditions of same size at *f/*22.

As an operator gains more experience, other factors become of concern, such as those contributing toward a higher density range which lead to a negative which makes a better printing plate. Lighting conditions which contribute toward improved loss of density range of the film are flare, due to room illumination light bouncing off light-colored objects surrounding the copy. For improving contrast, going to a brighter and higher color temperature light will help. Thus, a 1500-watt of Quartz Iodine lamps will permit a higher contrast range, other factors being equal, than a 1000-watt set. A 1500-watt Xenon set, due to higher color temperature, will permit a greater contrast color range than a Quartz Iodine set.

Following the above guide lines and the exposure information furnished by the camera and film manufacturer, it will usually be only one or two short steps from your first test exposure to an exposure of a successful film that may then be used as typical and a basis for scaling other exposures. In some work, the use of a filter will be found necessary and in some other instances helpful. The thing to remember regarding filters is that the filter can only select from the light available in the source. Thus, where high blue content is desired, a high color temperature source such as provided by Xenon lighting is required.

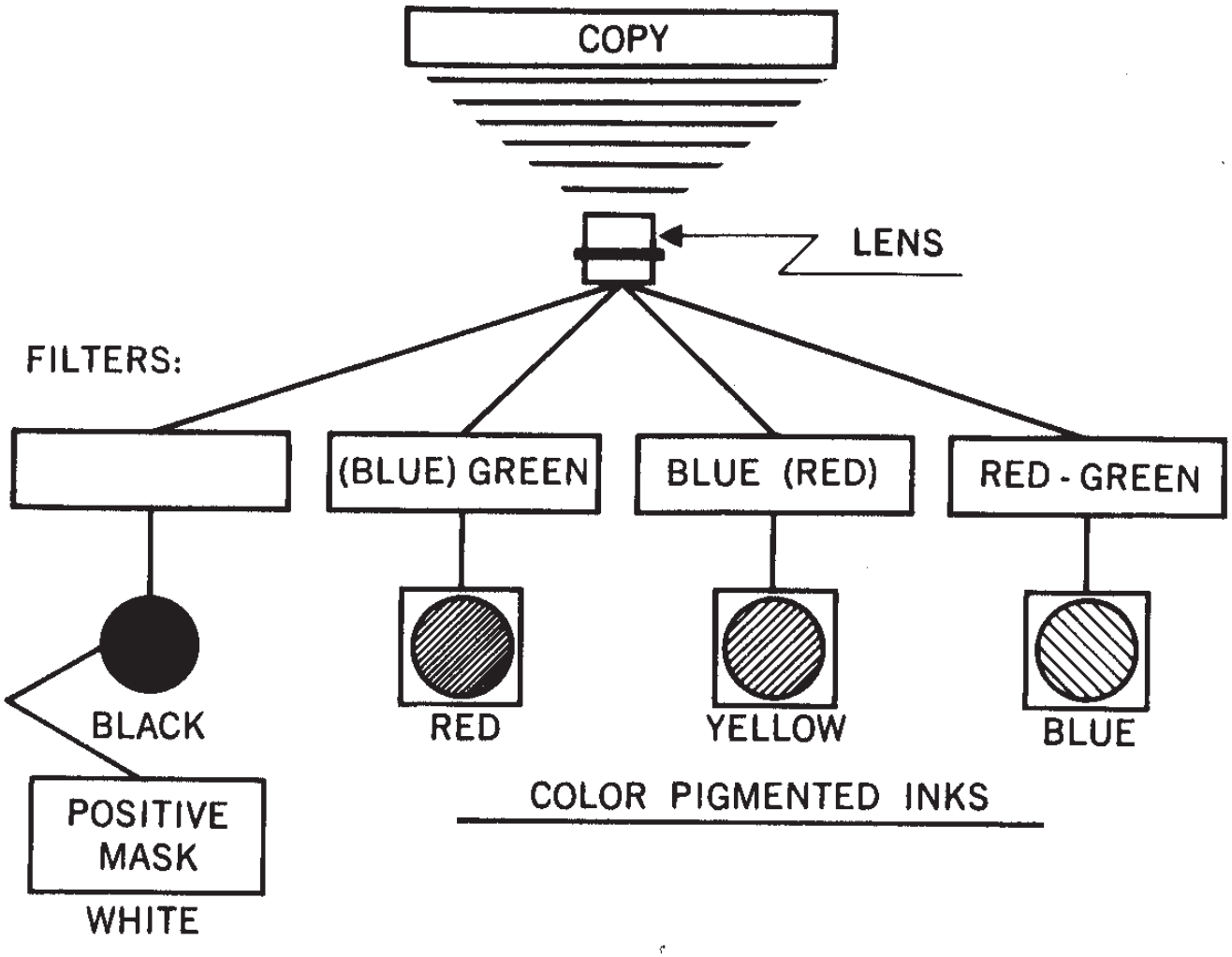
Filter Selection and Chart

Below is a graph showing the basic reactions of photomechanical filters.

The basic factor in the use of filters revolves around the fact that common filters pass two of the primary colors of light and do not permit the third color to react on the negative emulsion. This is not as complicated as it appears if you try to fix the chart we have sketched in your "color memory."

At the bottom of the pate is a film and color combination chart that shows the very wide selection of different filters that can be employed in color control or separation.

Let us go back to the sketch and review the filter reactions.



Black cannot be filtered out. Use the positive masking technique to drop out black.

Green is a primary color of light but not of pigment or inks.

Blue Violet. Approximately 80% blue and 20% red light is transmitted or passed through the average "blue" photomechanical filter. This filter helps to produce a yellow printing plate negative.

Filters

Study the sketch (below) of the eye looking at a piece of white paper that has all the colors of the rainbow projected through a glass prism.

Up to the present, nothing has been said about using filters because today many shots are made with a filter when they should be made straight (no filter). The lights, lens, and film emulsions are often better judges of the reflection curves or characteristics of colored copy and often give a superior, clean-cut result without filter **subtractions.** The key word in describing filters is that they "subtract" unwanted light rays and permit other rays to pass through to bombard the film emulsion.

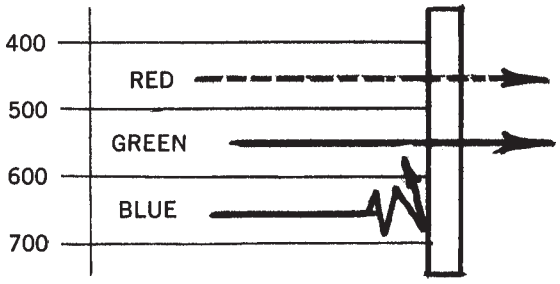
Most of the filters permit two kinds of light rays to pass through them and magically hold back the third primary light color. For example, if you look through a "blue" filter at a lamp filament, your eye will see both blue and red lines at the filament. This means both the blue and red rays will pass through, but the green-yellow rays will be held back and die. You can see for yourself just what rays will or will not pass through a single filter or a pair of two filters by using, this filament lamp inspection technique.

The chart included here presents a fast choice of selection of the "color" of the filter recommended. Next, you will have to determine the extra exposure time, above your normal white light, that the different filters require. Practice and patience is required to become a filter expert. Every time you change your film brand, you need to run filter factor tests.

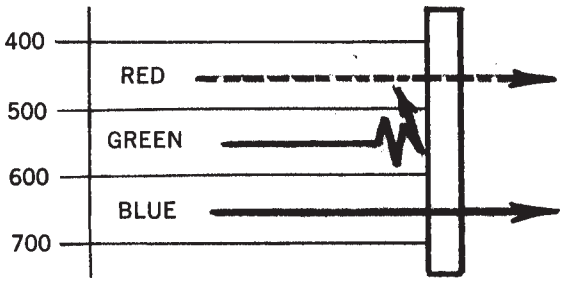
FILM AND FILTER COMBINATIONS
For Photographing Colors in Black-and-White

TO PHOTOGRAPH AS BLACK ON		COLOR OF ORIGINAL	TO PHOTOGRAPH AS WHITE ON	
ORTHO MATERIAL	PANCHROMATIC MATERIAL		ORTHO MATERIAL	PANCHROMATIC MATERIAL
(Kodak Wratten Filters to Use)			(Kodak Wratten Filters to Use)	
Yellow (No. 9) Green (No. 58)	Green (No. 58)	**Magenta**	Blue (No. 47) Magenta (No. 30)	Red (No. 25) Magenta (No. 30) Blue (No. 47)
None or Green (No. 58)	Green (No. 58) Blue (No. 47)	**Red**	Not Recommended	Red (No. 25)
Blue (No. 47) Magenta (No. 30)	Blue (No. 47)	**Yellow**	Yellow (No. 9) Green (No. 58)	Yellow (No. 9) Green (No. 58) Red (No. 25)
Blue (No. 47) Magenta (No. 30)	Red (No. 25) Blue (No. 47) Magenta (No. 30)	**Green**	Yellow (No. 9) Green (No. 58)	Green (No. 58)
Not Recommended	Red (No. 25)	**Cyan**	None Green (No. 58) Blue (No. 47) Magenta (No. 30)	Green (No. 58) Blue (No. 47)
Yellow (No. 9) Orange (No. 16) Green (No. 58)	Green (No. 58) Red (No. 25)	**Blue-Violet**	Blue (No. 47) Magenta (No. 30)	Blue (No. 47)

NOTE: These are not the only filters which can be used to produce the desired effects. Practical experience will show which variations of the suggested filters can be used with certain hues of the original colors.



Wratten Filter, K-3—G15; Color Yellow
Subtracts ("Minus") Blue; Film: Ortho



Wratten #47B; Color (Dark) Blue
Subtracts "Yellows"; Film: Ortho

Pasted-up, Patched Yellow, and White Copy

Using orthochromatic film and monochromatic light, or exposing with one of the primary colors of light, is quite popular now. Using a K2 or G15 filter (yellow) will eliminate the blue light rays, so you must increase your exposure (two or three times). These filters must be used with pasted-up copy where white and yellow backgrounds are mixed up or waxed up on the same sheet.

Weak blues can be darkened with the deep yellow (G15) filters. Then the orthochromatic film will "see" them as deep greens, which usually register as dark grays on the film. It is suggested that most filter shots on orthochromatic film can be manipulated with a deep yellow (minus blue) G15 filter. Orthochromatic films always see red as black.

Panchromatic films are required when dropping out or intensifying various "red" colors. See the chart on the previous page for the color of the filter required. You will have to find your own filter factors for the film brand you are using.

This information does not settle all the questions and answers that art directors or gallery camera experts can argue about. It does, however, answer a lot of questions and settle many of the basic arguments.

Fluorescent Print Techniques

If your cameras are using incandescent lamps, there should be no appreciable difference between the copy prints that fluoresce (glow because they contain a brightener pigment) and the "normal old style" prints. The prints with the "brightener" usually look "snappier" under average daylight viewing. Your camera lens is not affected by the new "brightener" pigments because incandescent light sources emit no ultra violet rays to bombard the copy prints and reflect into the lens.

This incandescent type of lamp permits all kinds of group prints to be shot at the same time, provided they all have the same general tone contrast for halftone processing.

If your cameras are using arc or pulsed neon lamps, these lamps emit a considerable amount of ultra violet rays. These invisible rays will bombard the fluorescent print and cause it to "glow." The lens will "see" both the glow rays and the normal white light rays. Since the ultra violet rays-focus at a different plane, there will be a measurable interference or confusion when the two kinds of light rays bombard the emulsion on the film during its exposure.

Easy **Solution:** Many operators use a Wratten (clear) 2B filter in front of their lens for all their B/W and color exposures. A lens hood can also be employed to reduce lens glare and the collection of dust on the filter.

Many color prints are treated in the processing with a blue fluorescent brightener. This treatment acts somewhat like the bluing used often in the rinse water of an average home clothes wash. It makes the wash LOOK brighter and whiter to the observer's eyes.

When these prints are "copied" with arcs or a light source that emits UV, the blue-white areas will be overexposed in relation to the yellow-red areas.

Artists who use the Kemart or Fluorographic techniques, especially with water or tempera colors, should put the color photographer on notice that his copy contains fluorescent pigments.

A low-cost blacklight lamp can be used for gallery bench inspection before the copy is put on the camera to estimate the intensity of the extra ultra violet radiation from the copy print.

Clever photographers keep reference file copies, technical data, and proof of both GO and NO-GO jobs. It's easier to look it up than to try to remember what you did for a difficult job last month.

Too-Dark Prints as Original Copy

Polaroid prints are often helped with double shadow: flash exposure, plus (2X) double "bump" highlight time exposure.

Use a normal middletone exposure was given both of these negatives. The extra bump highlight, plus double the normal flash exposure, produced the gray shadow tones in the printed picture. It avoids muddy shadow areas.