In itself a complete guide to taking still pictures in color, the Kodak Color Handbook is also the foundation of a publication program covering all aspects of color photography with Kodak materials. Registered owners are kept informed of (1) revisions of the four basic Data Book sections; (2) new Kodak Color Data Books and other booklets as they become available; and (3) supplementary articles on color photography which can be obtained free on request.

Eastman Kodak Company, Rochester 4, N. Y.

Kodak Color Films
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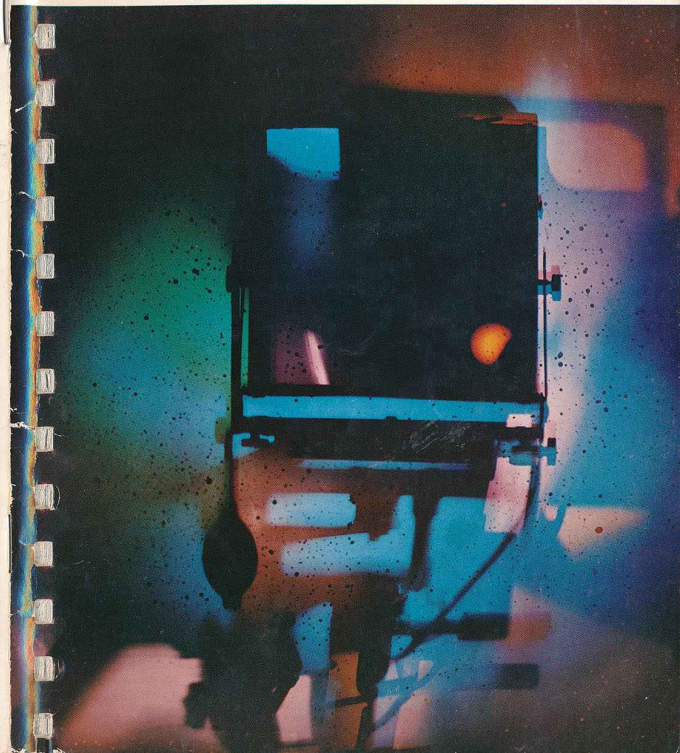
KODAK color films



KODAK COLOR FILMS

FOURTH EDITION

Modern color films can produce excellent results, and the making of good color pictures does not require extensive experience, great technical skill, or expensive equipment and materials. However, to get the best possible pictures consistently, the photographer must know the specific characteristics of the color films he uses. This Kodak Color Data Book provides detailed practical information on the Kodak materials designed for still color photography. The important handling aspects are discussed in the text, while exposure and filter recommendations are given in the Data Sheets.

CONTENTS

THE COVER PHOTOGRAPH, *by Richard Boden, Eastman Kodak Company, was made by photographing the shadow image of a studio camera projected onto a ground acetate screen by colored lights. The picture is from a print on Kodak Ektacolor Professional Paper made from a negative on Kodak Ektacolor Film, Type L.*

This punching fits the *Kodak Color Handbook*. See your Kodak dealer.

THUMB INDEX

FOURTH EDITION—
First Printing, 1961

KODAK color films

THE various film types and sizes available—as well as exposure, filter, and processing recommendations—are presented in the Data Sheets which occupy the central section of this book. The types of color films are described briefly below.

REVERSAL FILMS

THESE films yield positive color transparencies which can be viewed by transmitted light or projection. Color prints of the transparencies can be made by photomechanical methods, by the Kodak Dye Transfer Process, on Kodak Ektachrome Paper, or on Kodak Ektacolor Paper or Kodak Ektacolor Professional Paper from color internegatives of the transparencies.

Kodak Ektachrome Films incorporate couplers which form dyes and which are put into the emulsion layers during manufacture. As a result, only one color developer is needed to produce dye images in all three emulsion layers, and the processing does not require elaborate chemical controls. The films can be processed by any of a large number of laboratories or by the user himself. Prepared chemicals are supplied in Kodak Ektachrome Processing Kits, available in several sizes. The Eastman Kodak Company maintains processing services for Ektachrome Film in roll and 35mm sizes. Film can be sent to a Kodak processing laboratory through a dealer or directly in a Kodak Prepaid Processing Mailer.

Kodachrome and Kodachrome II Films require more complex processing and therefore more elaborate equipment. Since both the developer and the coupler components of the dyes are introduced in the film from solution, three separate color-development steps are necessary, and sensitometric, chemical, and mechanical controls must

be accurate. Processing can be obtained through a dealer, who will send the film to a Kodak or other laboratory equipped to process it. Kodachrome Films may also be sent directly to a Kodak laboratory if the Kodak Prepaid Processing Mailer is used.

NEGATIVE-POSITIVE FILMS

These films yield color negatives from which pictures can be made in a variety of ways. Not only can prints be made by photomechanical methods, by the Kodak Dye Transfer Process, or on Kodak Ektacolor Paper and Kodak Ektacolor Professional Paper, but the color negatives can also be used to produce color transparencies in any desired size and quantity. In this latter case, either Kodak Ektacolor Print Film or Kodak Ektacolor Slide Film is used. Mounted transparencies can be ordered. Black-and-white prints from color negatives can be made on Kodak Panalure Paper, which is expressly designed for the purpose.

Kodak Ektacolor Films can be developed to color negatives by the user or by processors. Colored couplers are incorporated in the emulsion layers at the time of manufacture, and the unused couplers remaining in the film after development provide automatic masking for color correction. Since the colored couplers in Kodak Ektacolor Films correct for the dyes in the negative, color prints and transparencies of excellent quality can be made without the supplementary masking procedures usually required for best results in reproductions from positive color transparencies.

Kodacolor Film is supplied in a single type suitable for exposure either in daylight or with clear flash lamps. Development of the film to negatives can be done by the user or by a Kodak or independent laboratory. Kodacolor Prints and Enlargements, as well as Kodacolor Transparencies, are supplied by Kodak on orders placed through dealers; prints and enlargements on Kodak Ektacolor Paper or Kodak Ektacolor Professional Paper, and transparencies on Kodak Ektacolor Print Film or Kodak Ektacolor Slide Film, can be made by others. Like Kodak Ektacolor Films, Kodacolor Film contains colored couplers to improve the quality of color reproductions.

NOTICE: Kodak color films will be replaced with unexposed film if defective in manufacture, labeling, or packaging, or if damaged or lost by us or any subsidiary company. Except for such replacement, the sale or subsequent handling of these films for any purpose is without warranty, guarantee, or other liability of any kind.

Like other dyes, the dyes used in Kodak color films, prints, enlargements, and duplicates may change in time. These products, therefore, will not be warranted against any change in color.

FILTER DATA

Kodak offers several series of filters designed to fill almost any need which may arise in the exposure of color films. This section describes the filters suitable for use on a camera or enlarger lens. The Kodak Color Printing Filters (Acetate), which are not intended for use in the path of image-forming light, are described in the Data Book *Printing Color Negatives.*

KODAK LIGHT BALANCING FILTERS

Two series of Kodak Wratten Filters, known as Kodak Light Balancing Filters, are useful for changing the color quality of the exposing light in order to secure proper color balance with artificial-light films. The use of filters in the No. 82 (Bluish) series is equivalent to raising the temperature of a tungsten source, while the use of filters in the No. 81 (Yellowish) series is equivalent to lowering it.

The term "color temperature" is often applied to the numbers, such as 3200 K and 3400 K, which are used in connection with tungsten lamps. For photographic purposes, this term should be used with caution, or avoided entirely. It designates only the *color* of the source

KODAK LIGHT BALANCING FILTERS

Color	Wratten Number	Exposure Increase in Stops*	Color Temperature of Source		Mired Interval
			Converted to 3200 K	Converted to 3400 K	
Bluish	82C + 82C	1 ⅓	2490 K	2610 K	−89
	82C + 82B	1 ⅓	2570 K	2700 K	−77
	82C + 82A	1	2650 K	2780 K	−65
	82C + 82	1	2720 K	2870 K	−55
	82C	⅔	2800 K	2950 K	−45
	82B	⅔	2900 K	3060 K	−32
	82A	⅓	3000 K	3180 K	−21
	82	⅓	3100 K	3290 K	−10
No Filter Necessary			3200 K	3400 K	—
Yellowish	81	⅓	3300 K	3510 K	9
	81A	⅓	3400 K	3630 K	18
	81B	⅓	3500 K	3740 K	27
	81C	⅓	3600 K	3850 K	35
	81D	⅔	3700 K	3970 K	42
	81EF	⅔	3850 K	4140 K	52

*These values are approximate. For critical work, they should be checked by practical test, especially if more than one filter is used.

and not the spectral energy distribution or its photographic effect. Color designates only the appearance of the light as seen by a human observer and in general has little, if any, relationship to spectral energy distribution. Thus, it is not sufficient for a filter to provide merely a certain change in color temperature. For use with a Type B color film, for example, the filter must also convert the spectral-energy distribution of the source to very nearly the distribution of a tungsten lamp actually operated at 3200 K.

Color-temperature values for various daylight conditions tend to be misleading when the attempt is made to apply them to color photography. Since "two-point" color-temperature meters read only the ratio between red and blue light and do not adequately measure spectral energy distribution, their use should be confined to tungsten sources, or sources having this type of energy distribution.

The conversion effect of a Light Balancing Filter can be expressed in terms of the color temperature of the tungsten source that it will convert to a desired color temperature, as shown in the fourth and fifth columns of the table. These color temperatures can also be expressed in *micro*reciprocal *d*egrees, or Mireds, obtained by dividing the color temperature value into 1,000,000. The conversion effect of the filter can then be expressed as a Mired interval, as in the sixth column. The Decamired, another unit sometimes used, equals ten Mireds.

To cover the lowest color temperatures shown in the table, it is necessary to use combinations of two filters of the No. 82 series. Since the highest color temperatures shown in the table are above the practical operating range of tungsten lamps, the conversion information is actually more applicable to flash bulbs. In this connection, it should be mentioned that the *filter recommendations for flash bulbs do not necessarily coincide with those which would be predicted on the basis of color temperature.* The reason is that variations in sensitivity with time of exposure may change the color balance of multilayer color films, thus changing the filter requirements.

KODAK COLOR COMPENSATING FILTERS

THESE filters are used to make changes in the over-all color balance of photographic results obtained with color films, and to compensate for deficiencies in the quality of the light by which color films must sometimes be exposed. They can be used singly, or in combination, to introduce almost any desired correction. Such corrections are often required, for example, with unusual light sources, or when heat-absorbing or opal glass is used in an optical system. If several filters are used together over a camera or enlarger lens, definition and contrast may be

KODAK COLOR COMPENSATING FILTERS

Peak Density	Yellow (Absorbs Blue)	Exposure Increase in Stops*	Magenta (Absorbs Green)	Exposure Increase in Stops*	Cyan (Absorbs Red)	Exposure Increase in Stops*
.025	CC025Y	—	CC025M	—	CC025C	—
.05	CC05Y†	—	CC05M†	1/3	CC05C†	1/3
.10	CC10Y†	1/3	CC10M†	1/3	CC10C†	1/3
.20	CC20Y†	1/3	CC20M†	1/3	CC20C†	1/3
.30	CC30Y	1/3	CC30M	2/3	CC30C	2/3
.40	CC40Y†	1/3	CC40M†	2/3	CC40C†	2/3
.50	CC50Y	2/3	CC50M	2/3	CC50C	1
Peak Density	**Red (Absorbs Blue and Green)**	**Exposure Increase in Stops***	**Green (Absorbs Blue and Red)**	**Exposure Increase in Stops***	**Blue (Absorbs Red and Green)**	**Exposure Increase in Stops***
.025	CC025R	—	—	—	—	—
.05	CC05R†	1/3	CC05G	1/3	CC05B	1/3
.10	CC10R†	1/3	CC10G	1/3	CC10B	1/3
.20	CC20R†	1/3	CC20G	1/3	CC20B	2/3
.30	CC30R	2/3	CC30G	2/3	CC30B	2/3
.40	CC40R†	2/3	CC40G	2/3	CC40B	1
.50	CC50R	1	CC50G	1	CC50B	1 1/3

*These values are approximate. For critical work, they should be checked by practical test, especially if more than one filter is used.
†Similar Kodak Color Printing Filters (Acetate) are available. For further information, see the Kodak Data Book *Printing Color Negatives*.

adversely affected by scattering of the light. Hence, it is best to use the minimum number of filters that will produce the desired correction. Filters used in the image-forming light system should be clean and free from scratches or other defects.

The density of each Kodak Color Compensating (CC) Filter is indicated by the two numbers in the filter designation, and the color is indicated by the final letter. In each case, the density is measured at the wavelength of maximum absorption; hence, the term *peak density* in the table. Thus, for example, the density of a yellow filter is given for blue light. The density values do not include the density of the gelatin in which the filter dye is coated, nor do they include the density of the glass in which a filter may be mounted.

The uniform density spacing of these filter series is an aid in predicting the photographic effects of filter combinations. In the red, green, and blue series, each filter contains the same dyes, in approximately the same amounts, as the two corresponding yellow and magenta, yellow and cyan, or magenta and cyan filters.

KODAK WRATTEN FILTERS

THE following filters are designed for specific purposes in color work:

Kodak Skylight Filter (No. 1A), Kodak Photoflood Filter (No. 80B) and Photoflash Filter (No. 80C) for Kodak Daylight Type Color Films, and the Kodak Daylight Filters—for Kodak Type A Color Films (No. 85), Type B Color Films (No. 85B), and Type F Color Films (No. 85C).

SPECIAL APPLICATIONS OF FILTERS

In addition to purposes for which specific filters are recommended, Kodak Light Balancing and Color Compensating Filters can be used:

1. To introduce deliberate departures from normal color balance, either to enhance the mood of the picture or to satisfy the personal preference of the photographer.

2. For critical work with multilayer color films, to compensate for variations in color balance caused by normal manufacturing variations or by causes beyond the scope of manufacturing control.

3. To correct an undesirable over-all tint of color in a transparency which is to be duplicated or printed in color. The correction attainable in this way is limited to slight changes.

4. To modify the color balance of small transparencies which show over-all tints of color in viewing or projection. For this purpose, pieces of gelatin filters can be mounted in glass slides with the transparencies.

5. To balance light sources used for color printing and duplicating, and to control the color balance of the results.

6. To compensate for peculiar absorptions, as in taking color pictures under water or through tinted windows.

STABILITY OF FILTERS

In manufacturing some of the filters listed in this Data Book, it is necessary to use dyes which are only moderately stable and which may, in time, change color. Since all dyes are fugitive to some extent, prolonged exposure of filters to daylight, particularly direct sunlight, should be avoided. Extreme temperatures and high relative humidities should also be avoided, because they may accelerate a change in color or cause physical damage to the filter. (Similarly, filters used in color printing may change color or become damaged as a result of the light and heat emitted by the light source used in printing.)

NOTE: Any filter should be tested photographically before it is used on an important job, no matter how recent the date of purchase.

FILTER SIZES AVAILABLE

All of the filters listed are regularly supplied in 2- and 3-inch lacquered gelatin film squares. Some of the more commonly used filters are also regularly supplied in unmounted 2- and 3-inch "B" glass squares and in "B" glass disks mounted in metal rims (series sizes) for use with Kodak Combination Lens Attachments.

On special order, all of the filters can be obtained: (1) in other sizes of gelatin film squares, (2) in series sizes not regularly stocked, (3) in other sizes of unmounted squares cemented in "B" glass, and (4) in unmounted circles cemented in "B" glass. Orders should be placed through Kodak dealers. In the case of special-order filters cemented in glass, several weeks may be required for delivery.

HANDLING AND CARE OF FILTERS

Filters which have become scratched, dirty, or fingerprinted should never be used in the path of image-forming light. Otherwise, serious loss of definition may occur.

Gelatin Film Filters are coated with a lacquer which protects the surface, but does not affect optical performance. However, they should be touched only at the edges, and they should be handled and cut while held between sheets of paper. If necessary, finger marks, grease, or water drops can be removed as described below.

Gelatin filters can be used conveniently at the lens in Kodak Gelatin Filter Frames, which are available in sizes to hold 2-, 3-, and 4-inch gelatin filter squares. The three sizes of Filter Frames (or filter squares of the same sizes cemented in "B" glass) fit, respectively, the Series 6, 8, and 9 Kodak Gelatin Filter Frame Holders. A Filter Frame Holder, in turn, is held on the lens by a Series 6, 8, or 9 Kodak Adapter Ring of the proper diameter. Lenses requiring Series 5 and Series 7 Adapter Rings can be fitted, respectively, with Series 6 and Series 8 Filter Frame Holders by use of Series 5-6 and Series 7-8 Step-Up Rings.

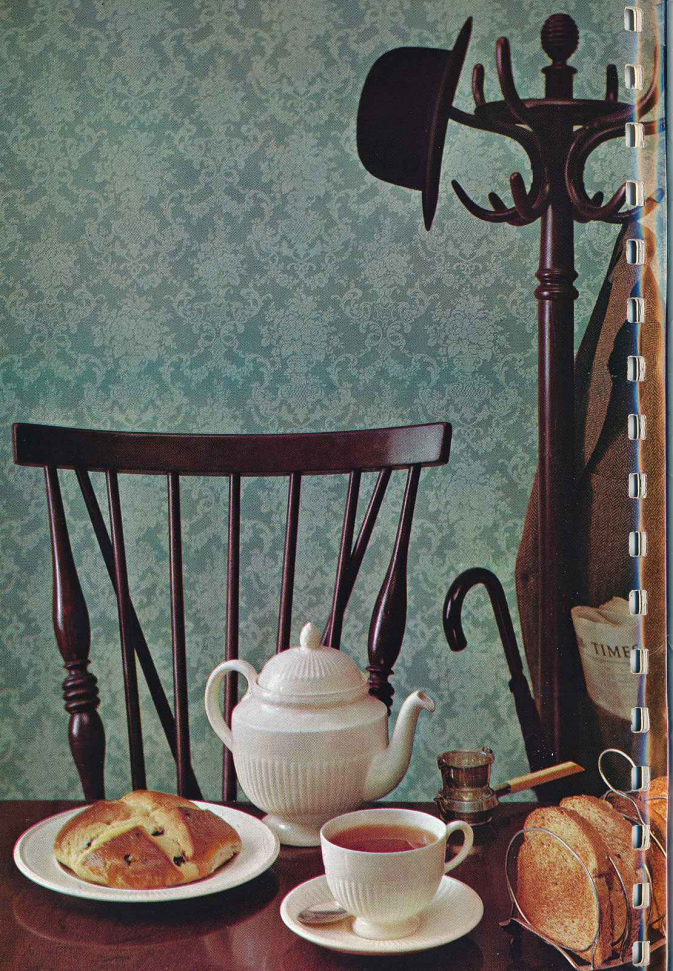
For temporary use, a gelatin filter can be mounted in cardboard, a disk of the filter can be cut to fit between lens elements, or the filter can simply be taped over the lens.

Cemented Filters are precision units and should be treated as carefully as fine lenses. They should never be subjected to excessive heat.

Cleaning. Both lacquered gelatin film filters and cemented filters can be cleaned as follows: First brush away any grit or dust. Then wipe the surface gently with Kodak Lens Cleaning Paper or a clean, soft, lintless cloth. If moisture is necessary, breathe on the surface or use a small amount of Kodak Lens Cleaner.

NOTE: Kodak Lens Cleaner should not be allowed to touch the edges of a cemented filter.

Storage. Filters should be stored in dust-free containers in a cool, dry place. Cemented filters are most conveniently stored in the boxes in which they are sold.



PROCESSING

THE most important point to be emphasized in connection with color-film processing is *strict adherence to the instructions for mixing solutions and carrying out the processing steps.* The mixing and processing operations are not difficult, yet they are exacting in the sense that the steps must be standardized carefully if repeatable results are to be obtained. *No variations based on past experience with other films and processes should be introduced.*

The purpose of this section is to give information supplementing that packed with Kodak Ektachrome Film Processing Kits and Kodak Color Processing Kits, Process C-22. Primary emphasis is on the processing of sheet films, especially color-negative films and Ektachrome Films designed for Process E-3.

PROCESSING EQUIPMENT

IN general, sheet color films should be processed in hanger and tank equipment recommended for use with photographic solutions. Film hangers with retaining edges wider than those of Kodak Film and Plate Developing Hangers No. 4A are not entirely satisfactory for use in processing Kodak sheet films. In the case of Kodak Ektachrome Film in sheets, hangers having wider edges may effectively mask a considerable portion of the film during the reversal exposure. The result is a fairly wide greenish border in the processed transparency, unless the hanger is rotated in such a way that all of the film surface is fully exposed to light.

When positioned on each end of a Kodak Developing Hanger Rack No. 40, Kodak Hanger Separators prevent hangers from swinging during processing and also maintain even spacing between hangers.

Roll films can be processed on reels in small tanks, such as the Nikor Roll-Film Tank or Kodak Day-Load Tank. Or a number of reels can be loaded in a basket-type rack. The Kodak Processing Rack (for Nikor Roll-Film Reels) fits in a Kodak Hard Rubber Tank (3½-gallon capacity) and accommodates 30 reels for 135 or 828 film, 24 reels for 127 film, or 18 reels for 120 or 620 film. The reels can be intermixed as required. For large-scale processing, deep-tank equipment, such as the Kodak Rack and Tank Color Film Processor, Model 10E, is recommended.

Processing hangers and reels must be free from corrosion or chemical deposits. A solution made according to the formula for Kodak Tray

MAURICE BAUMAN EPITOMIZES A VENERATED BRITISH INSTITUTION ON KODAK EKTACHROME FILM, TYPE B (PROCESS E-3).

Cleaner TC-1 can be used to remove chemical deposits; the cleaned hangers and reels should then be washed thoroughly in water. After processed and dried film has been removed, hangers and reels should be thoroughly washed before they are used again.

Hard-rubber, glass, chemical stoneware, glazed ceramic ware, red brass, and some types of plastic tanks are satisfactory for processing films. Stainless-steel tanks can be used if the joints are welded; folded-joint or soldered construction should be avoided. A stainless-steel tank used for bleach should be lined with lead or a tested plastic material if the solution is to be stored in the tank. If the tank is not lined with lead or plastic, the bleach should be transferred to a bottle after each use, and the tank should be washed out carefully to prevent corrosion. If it is not possible to provide temperature control during processing, the use of tanks made of a material (such as hard rubber) having low heat conductivity will help minimize changes in the temperatures of the solutions. Kodak Pamphlet No. K-12 *Construction Materials for Photographic Processing Equipment* is available on request from the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.

For Ektachrome Film, a No. 2 photoflood lamp is used to make the reversal exposure. Since a lamp of this type becomes quite hot in use and will shatter if liquid is accidentally allowed to splash on its surface, the lamp should be shielded by a sheet of glass or transparent, colorless plastic. Other light sources, such as fluorescent lamps, can also be used for the reversal exposure if they provide equivalent illumination.

AGITATION

Proper agitation is important throughout color processing, but it is especially critical during the initial development step. Depending on the processing equipment and the particular color process, the recommended agitation techniques will vary. Instructions packed with the Kodak color-processing kit or chemicals being used should be consulted.

Simple and uniform agitation can be provided by using bursts of nitrogen gas bubbles that work their way up through the processing solutions. Equipment available for this purpose includes the Kodak Intermittent Gaseous Burst Valve and the Kodak Gas Distributor (for Kodak Hard Rubber Tank, 8 x 10), which divides the gas supplied by the system evenly over the bottom of the tank. Nitrogen is available in compressed form in large, cylindrical tanks. To complete the gaseous-burst agitation system, a pressure-reducing valve and interconnecting pipe and tubing are necessary.

If the film-processing volume is sufficiently large, gaseous-burst agitation can be economically provided for all solutions to help standardize the process and to enable two or more batches of film to be processed in sequence at the same time. Since there is no oxidation problem with solutions other than developers, compressed air can be used instead of nitrogen with these solutions. Where gaseous agitation is not provided, the film can be agitated manually.

Further information on gaseous-burst agitation is presented in Kodak Pamphlet No. E-57 *Gaseous Burst Agitation in Processing,* available on request from the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.

REPLENISHMENT

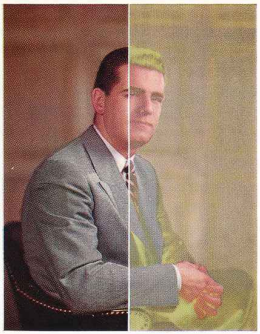
As processing solutions are used, either additional development time and other adjustments are required or the solutions must be replenished. A processor who finds that his film-processing volume necessitates replacing solutions more often than once each week should consider replenishment as a more economical and controllable system. Proper use of replenishers increases the capacity of the working solutions to a maximum and increases their life considerably. There is also a saving of mixing time. Also, improved control of color balance and speed is obtained by making gradual compensation for the use and aging of the solutions.

WASHING

Adequate washing facilities are important. Preferably, the rate of water flow should be about 0.4 gallon per minute per square foot of film processed; 0.3 is considered minimum. That is, satisfactory washing is achieved under average processing conditions by a complete change of water about every minute. When separate wash tanks are provided, each should have a minimum flow rate providing a complete change of water every 3 minutes or, for the final wash, two full changes every 3 minutes. To help prevent processing solutions from contaminating each other, use wash tanks that allow the top bars of the film hangers to be submerged.

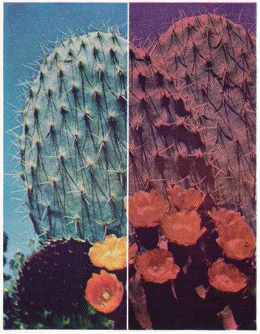
TEMPERATURE CONTROL

Temperature tolerances, particularly those for the developers, are critical, and appreciable deviation from them may result in speed and color-balance changes. In addition, physical defects such as reticulation of the emulsion or frilling along the edge of the film are apt to occur if the temperature of the solutions is too high.



Partial reversal caused by light fog in First Developer. The shadows are affected more than the highlights.

Contamination of Color Developer with Fixing Bath. Principal change is marked desaturation of reds.



Clearing Bath omitted after the Color Developer step. Red is added over all of the photograph.

Yellowish stains caused by Bleach which was allowed to splash on film after Color Developer step.

These are some of the more spectacular faults produced by incorrect processing. In each case, the left-hand side of the picture shows the result obtained with recommended processing.

EFFECTS OF ERRORS IN PROCESSING KODAK EKTACHROME FILM

Ektachrome Processing Errors (Process E-3)

APPEARANCE OF FILM	POSSIBLE CAUSES
Dark Over-All	Inadequate time, temperature, or agitation in First Developer. First Developer underreplenished, exhausted, or diluted.
Dark-Brown Image, Visible by Reflected Light on Emulsion Side	Inadequate bleaching and fixing due to exhausted solutions or shortened times.
Light Over-All	Excessive time, temperature, or agitation in First Developer. First Developer overreplenished. Film fogged by light.
Magenta Areas and Streaks (usually irregular, with soft outline, and appearing at random locations on film)	Uneven or insufficient agitation in the First Developer or Color Developer, caused by: 1. Leaks in gaseous-burst system. 2. Plugged holes in gas distributor. 3. Film hangers too close together. 4. Warped film hangers. 5. Low gas pressure. 6. Gas distributor not level. 7. Film buckled in hanger.
Magenta Edge Markings	Restricted development due to film sticking to hanger channels or contacting adjacent film hangers.
Bluish-Magenta	Exhausted solutions. Color Developer underreplenished.
Greenish-Yellow Edge Markings	Nonuniform washing after Hardener. Nonuniform agitation in First Developer.
Green (especially in maximum-density areas)	Reversal exposure inadequate or omitted.
Green Edge Markings	Insufficient reversal exposure inside film-hanger channels.
Reticulation and/or Frilling (occurs most often when low-salt or soft water is used for the rinse after the First Developer and the wash after the Color Developer)	Soft wash water. Increase hardness by adding 1 gram of hydrated magnesium sulfate (Epsom salts) to each liter of wash water used after the First or Color Developer. Higher-than-recommended wash-water temperatures and extended time in First Rinse.

A more complete listing of processing errors and their possible causes is presented in Kodak Pamphlet No. E-60, *Quality Control in the Processing of Kodak Ektachrome Film (Process E-3)*, which is available on request from the Eastman Kodak Company, Rochester 4, N. Y.

In no case should the temperature of the First Developer be allowed to vary more than ½ degree Fahrenheit from the recommended temperature. The use of an accurate thermometer, such as the Kodak Process Thermometer, is recommended.

It is also quite important to control the temperature of the wash water. For example, with Ektachrome Film it is desirable that the temperature of the rinsing and washing operations be within the range of 73 F to 77 F. Washing tends to become less efficient as the temperature is reduced; also some carry-over of chemicals from one solution to another may occur and result in stain on the transparencies. It should also be noted that processing racks which have been cooled in wash water of lower than normal temperatures may tend to cool the following chemical solutions excessively.

When color films are used only in small quantities, it is possible to get along with manual adjustment of temperature. For example, the drain of the darkroom sink can be fitted with a standpipe, and water from an ordinary mixing faucet can be allowed to overflow from the washing tank and surround processing tanks to the level of the standpipe. With such an arrangement, a thermometer placed in the water flow and near the developer must be watched constantly to make sure that varying loads on the water-supply lines do not change the temperature of the mixture.

When color films must be processed on a production basis, a more accurate and dependable temperature-control system is almost a necessity in preventing mistakes and delays. One such system, which will pay for itself by saving time and materials, uses a thermostatic water mixer. For a single 3½-gallon processing line, the mixer should have a capacity of at least 3 gallons per minute, should normally control the water temperature within plus or minus ½ degree F or less, and should recover quickly from pressure variations in the hot- and cold-water lines. These requirements are met by the Kodak Thermostatic Mixing Valve Unit.

With a thermostatic mixing valve, the temperature of the existing cold-water supply in the summer months must, of course, be at least as low as and preferably lower than the temperature required of the mixture. In areas where the cold water is warmer than the temperature required of the mixture, an auxiliary cooling system is necessary. This, in turn, necessitates a few additional fittings to permit switching the unit from the normal use of existing hot- and cold-water supplies to the use of cold and artificially cooled water. Also, some communities have codes requiring that check valves, such as that on the Kodak Thermostatic Mixing Valve Unit, be installed in mixing-valve supply lines.

PREPARING SOLUTIONS

It is desirable to mix the solutions in a mixing container, such as a stainless-steel pail or tank or a Kodak Chemical Storage Tank (Tenite Polyethylene), rather than in the processing tanks themselves. This procedure is a safeguard against leaving any undissolved chemical particles in the corners of processing tanks. A propeller-type electric mixer is helpful in assuring rapid yet thorough mixing. However, care should be taken to avoid using the shaft at an angle which whips an excessive amount of air into the solution. The mixing pail and all other items contacting the solutions should be thoroughly rinsed with water before each solution is prepared.

To help avoid contamination, mix color-film processing solutions in the order in which they are used in processing. No more than one solution should be mixed at a time in a single area. Carefully follow the mixing instructions given on each container of processing chemicals. Improper mixing can cause off-color results, and may also impair the keeping qualities of the solutions. It is particularly important to start mixing in the required volume of water. Clean, sediment-free tap water should be used for mixing all solutions; if necessary, it should be filtered. Nominally priced filters are available for attachment to water taps; larger units can be installed in water-supply lines.

When the solutions are left in the processing tanks, use floating lids and dust covers to keep out impurities and to minimize aerial oxidation. If the solutions have not been used for 8 hours or more, stir them thoroughly before processing is resumed. Check the temperatures of all solutions, particularly the developers, just before use.

For maximum life, unused or partially used developers or developer replenishers should be stored in full, stoppered bottles. In tanks with floating lids, the developer life is significantly reduced. Other processing solutions will last 8 weeks either in full, stoppered bottles or in tanks with floating lids. When the storage life is used up, the solutions must be discarded unless a replenishment system is used. Processing solutions should be prepared in quantities which will allow their full utilization before the storage time is exhausted.

Precautions in Mixing Developers. When mixing developers for Kodak color processes, the total volume of water should be in the mixing tank before any chemicals are added; that is, if a 3½-gallon batch is being mixed, there should be a full 3½ gallons of water at the proper temperature in the tank before any chemicals are added to the water. Bottles containing liquid chemicals should be rinsed carefully with water from the mixing vessel so that all of the concentrated liquid is transferred to the solution. Some of the liquid chemicals do not mix

readily with water; it is a good idea to use a propeller-type electric mixer and to stir for a few minutes after the liquid has seemingly dissolved. The liquid is not completely dissolved if oil-like particles or droplets are floating on the surface. After a homogeneous solution has been obtained by mixing, add the remainder of the chemicals slowly, stirring them until they are completely dissolved.

After the developer solution in Process C-22 has been prepared, its temperature between processings should not be allowed to fall too low, because, below 68 F, some of the ingredients may precipitate out in crystalline form and the quality of processed film may be affected. If much precipitation has occurred, it is best to discard the solution and mix a new batch. If only a slight amount of precipitation occurs, it can be ignored.

INCREASED SPEED

To obtain one full-stop speed increase on Kodak High Speed Ektachrome Films, merely increase the time in the First Developer to 13 minutes; no other changes are necessary.

The color balance is generally not affected to any great degree by this change; therefore, no filter compensation is necessary with High Speed Ektachrome Film, Daylight Type or Type B, when it is processed for increased speed.

Although the quality obtained with the modified process is usually satisfactory, the normal exposure and processing should be used except under emergency conditions. Processing for increased speed lowers the maximum density and raises the contrast, thereby decreasing exposure latitude. Also, there may be some color desaturation and some increase in graininess. It is always a good idea to make a practical test on film of the same emulsion number and to analyze the results to make sure they are satisfactory before attempting to take pictures that cannot be reshot.

VIEWING WET TRANSPARENCIES

EKTACHROME transparencies of satisfactory density and color balance appear somewhat opaque and too warm in color balance while they are still wet. When it is necessary to evaluate transparencies without waiting for them to dry, the opalescence that causes these effects can be eliminated temporarily by bathing the transparencies in Kodak Rapid Fixer Concentrate (undiluted, without hardener solution). Treat the transparencies for 1 minute after the Fixing Bath (Step 12 in Processes E-2 and E-3); then, after viewing them, continue normally with the 8-minute wash.

VIEWING NEGATIVES

BECAUSE colored couplers are left in the film to provide color-correction masks, developed Ektacolor and Kodacolor negatives have a strong over-all orange cast. This color, which appears as a minimum density even in the edges masked off by the film holder, is normal and should be disregarded in appraising a negative. The effective printing colors of the negative are complementary to those of the original subject.

It is difficult to judge either the individual colors or the general color balance in a color negative. Saturated colors are distinguishable; for example, yellow is reproduced as purple, red as green, etc.; but it is almost impossible to ascertain exactly how pastel tints, cool colors, and near-neutrals will be reproduced in the print. However, the relationships among the three negative records may vary slightly from one subject or processing to another and still be well within the range of adjustment when printing these negatives.

Judging Negative Exposure. After the color negative has been processed and dried, it is desirable to check the exposure. Generally speaking, the same criteria can be used for judging color negatives as are used for black-and-white negatives: The highlights should not be blocked up and there should be sufficient detail in the shadow areas.

To help evaluate the exposure of a color negative, a side-by-side comparison can be made between the color negative and an ordinary black-and-white negative of the same subject. To simulate the orange appearance of the color negative, an unexposed but processed sheet of Ektacolor Film can be placed over the black-and-white negative. In addition, the negatives can be viewed through a green separation filter (Wratten No. 61), which will further reduce color differences. Minor color differences will remain; but in areas such as the forehead of a portrait subject, it will be easy to compare densities.

With a Kodak Color Densitometer a more precise check on the exposure level can be made. Depending somewhat on the nature of the subject and lighting, a normally exposed color negative *read through the red filter* should have the following approximate densities:

The Kodak Neutral Test Card (gray side) receiving the same illumination as the subject	0.70 to 0.80
The darkest step (lightest in negative) of a Kodak Gray Scale receiving the same illumination as the subject	0.20 to 0.30
The highest diffuse density in a normally lighted forehead	1.00 to 1.20

Negatives having densities much below those listed above will be underexposed and will not yield prints of satisfactory shadow saturation. The exposure latitude of Kodacolor and Ektacolor Films allows densities above those listed.

The recommended developing time should not be changed in an attempt to alter the contrast of certain subjects. Overdevelopment does not increase contrast appreciably, but it may cause unequal increases in fog in all three emulsion layers.

PROCESSING FAULTS

Reversal Films. Properly handled, Kodak Ektachrome Films give results of outstanding quality. It is possible through errors in processing, however, to upset the normal color balance with consequent off-color results. To help in recognizing processing faults in Process E-3, a partial list is given on page 15.

Color-Negative Films. Since it is difficult to appraise color negatives, certain processing defects may not be evident until the negatives are printed. One of these is an over-all reddish fog. Such fog is objectionable because it imparts a greenish cast to the shadows of the print. If present, this defect may have been caused by any of the following:

1. Overdevelopment caused by a higher-than-normal temperature or a prolonged developing time.

2. Handling the film under a green safelight. Kodak Ektacolor Films should always be loaded and processed in complete darkness.

3. Contamination of the Developer by Fixer.

4. Omitting the Hardener and Fixer, or shortening the time of any of the steps between the Developer and the Bleach. Actually, these errors impart a reddish stain to the negative, rather than a true fog, but the stain and fog appear much alike.

It may be helpful to keep on hand an unexposed but normally processed sheet of Ektacolor Film. The minimum density of any negative suspected of fog or stain can then be checked against this standard.

PROCESSING CONTROL

Some means of controlling volume film processing to maintain quality and uniformity is desirable. Use of a Kodak Quality Control System for Kodak Color Films and Papers is recommended. It provides a means of determining the uniformity of processing, the extent of shifts in color balance, what steps can be taken to correct for such shifts, the condition of the processing solutions, and the ability of the operators to follow processing recommendations correctly.

STORAGE AND CARE

All photographic films are perishable products which are damaged by high temperatures and high relative humidities. Color films are more seriously affected than black-and-white films, because heat and moisture usually affect the three emulsion layers to different degrees, thus causing a change in color balance as well as a change in over-all film speed and contrast. *Adverse storage conditions may cause much larger changes in the color quality and speed of the film than any permissible variation in manufacturing.* Moisture at any temperature may also cause various physical defects, such as mottle and sticking.

In general, poor keeping conditions are more harmful to exposed but unprocessed film than they are to unexposed film. However, proper storage is necessary both before and after exposure, particularly in satisfying the critical requirements of professional work. When climatic conditions are moderate, the required precautions are few and simple. Greater care is necessary under hot and humid conditions.

PROTECTION PROVIDED BY PACKAGE

Since high relative humidities alone are usually more harmful than high temperatures alone, it is fortunate that the package can protect unexposed film against moisture. Kodak color films are sold in sealed foil envelopes, gasketed screw-cap cans, or taped cans. With the exceptions discussed below, these prevent all but a negligible amount of water-vapor transfer, even under the most humid conditions.

A small amount of leakage through the closure of a taped can is unavoidable, and this leakage is more serious in relation to a small amount of film. Rolls of 8mm or 50-foot 16mm film should therefore be given additional water-vapor protection, by tightly sealing as many rolls as possible in a can or jar, when they must be kept longer than a month in a region having high relative humidity. Such regions include not only those commonly thought of as tropical, but also any localities where relative humidities of 70 percent or higher prevail, as in a number of areas of the continental United States.

STORAGE OF FILMS IN ORIGINAL PACKAGE

Protection from Humidity. Except for 8mm rolls and 50-foot 16mm rolls, Kodak color films require no additional protection against high relative humidities until the package is opened. *Do not open the package until the film is to be used,* because the protection originally pro-

vided will then be ineffective. Without additional protection, do not store film in 8mm rolls or 50-foot 16mm rolls in damp basements, iceboxes, refrigerators, or other places where the relative humidity is high. The ideal relative humidity is between 40 and 60 percent, preferably nearer 40 percent.

Note that it is the *relative* humidity, not the *absolute* humidity, that determines the moisture content of films. Absolute humidity refers to the amount of water vapor actually present in the air, and is expressed in weight of water per given volume of air. Relative humidity is the ratio, expressed as a percentage, of the amount of water vapor actually present in the air to the amount the air will hold when saturated at the same temperature. Relative humidity is best measured with a sling psychrometer. In a small storage chamber, a calibrated humidity indicator, such as those sold for home use, is satisfactory.

Protection from Heat. Regardless of the type of packaging, do not leave films near steampipes or other sources of heat. In warm weather, do not leave them on the top floors of uninsulated buildings or in closed automobile compartments.

When films intended for normal use must be kept for several months, store them at 45 to 55 F in the main compartment of a refrigerator. Storage at temperature above 70 F for more than 4 weeks may lead to perceptible changes in speed and color balance. During summer heat (over 75 F), store films in an icebox or mechanical refrigerator, preferably the latter. Rolls of 8mm film and 50-foot rolls of 16mm film should be given additional protection before they are placed in an icebox or refrigerator.

When films are intended for critical use, requiring the most uniform results, store them at 0 to –10 F in a freezing unit. This type of storage arrests changes in film characteristics almost completely for long periods of time. However, the effects of adverse keeping conditions between removal from refrigeration and exposure, or between exposure and processing, may cause unsatisfactory results in spite of the low-temperature storage. Films should therefore be used before expiration date even if they have been stored in this way.

Some have thought that the moisture in the air inside a sealed package must condense on the film surfaces when the package is placed in cold storage. Actually, very little air is sealed into the package, and the quantity of moisture in this air is so low that its effect is negligible. *CAUTION:* When film that has been refrigerated is opened, moisture from outside the package may condense on the film surfaces. To avoid possible damage to the film, packages removed from cold storage should be allowed to reach approximate room temperature before they

are opened. The following suggested times are for single packages, standing on end or on edge. Cold packages stacked flat on top of each other require much longer times to warm up.

Type of Kodak Color Film Package	Warm-Up Times (Hours)	
	For 25 F Rise	For 100 F Rise
Roll film, including 828	½	1
135 magazines	1	1½
10-sheet box	1	1½
50-sheet box	2	3
16mm, any length	1	1½
35mm, any length	3	5

Protection from Harmful Gases. Films not packaged in sealed foil envelopes or screw-cap cans must be kept away from industrial gases, motor exhausts, and vapors of formaldehyde, solvents, cleaners, and mildew or fungus preventives. The adhesive tape used for sealing 8mm and 16mm rolls is not impermeable to all harmful gases. Sealing films in a friction-top can or jar will provide protection not afforded by the package itself.

Protection from X-rays. In hospitals, industrial plants, and laboratories, all films, regardless of the type of packaging, must be protected from x-rays, radium, and other radioactive materials. For example, films stored 25 feet away from 100 milligrams of radium require the protection of 3½ inches of lead around the radium.

Use Before Expiration Date. If possible, films should always be used before the expiration date stamped on each box. Films kept past this date may require ½ to 1 stop more than normal exposure, and color rendering may also be unsatisfactory. The magnitude of changes in the film is largely dependent on the conditions of storage. Proper storage conditions decrease the rate of the changes inherent in the perishable nature of sensitized products, but they do not eliminate them.

PROTECTING FILMS AFTER OPENING PACKAGE

WHEN a film package is opened, the film is no longer protected from harmful gases (see above). Depending on the quantity and form of the film, it reaches equilibrium with the surrounding air in a period of time varying from about an hour to a number of days. Under humid conditions, *films should be exposed and processed as quickly as possible after the package is opened.* High relative humidity and high temperature often cause undesirable changes in the latent image, and *it is particularly important that exposed films be kept no longer than absolutely necessary before processing.*

Under adverse conditions, films should not remain in the camera or holders longer than necessary. A carrying case containing film should be protected from direct sunlight, because the temperature inside the case may rise extremely high, even in a temperate region. Similarly, films should never be left in closed automobiles parked in the sun, because the temperature may rise quickly to the neighborhood of 140 F. A few hours under such conditions, either before or after exposure, is likely to have serious effects on color quality.

Moisture may condense on lenses or films taken from air-conditioned buildings or automobiles into much warmer and more humid outside air. Condensation may also occur on lenses or films brought inside from cold outdoor conditions. Under cold picturetaking conditions, film may snap or perforations may be ripped if film is advanced too rapidly.

Color films which are to be processed by a commercial processing laboratory should be shipped to the laboratory immediately after exposure. In warm or humid weather, air mail or air express is recommended.

Special provision must be made for keeping exposed films cool and dry if adverse climatic conditions (temperature above 75 F or relative humidity above 60 percent) are to be expected before processing. Films exposed in a humid atmosphere should not be resealed in the original packages or other containers unless they are first dried. If the weather is warm as well as humid, the desiccating chamber should be kept cool during the drying period. In warm weather, exposed films, whether dried or not, should be stored in a refrigerator (if available) until they can be processed or shipped to a processing laboratory. For a day or so, the films need not be sealed, but unsealed films should be placed as far as possible from the cooling coils.

Static. Rapidly pulling sheet film out of the container, pulling out filmholder slides quickly, advancing and rewinding roll film too rapidly, and careless handling of film just before processing can produce discharges of static electricity and marks on the processed film. Such static discharges most commonly occur when the relative humidity is low. Marks produced by static can appear as lightning streaks, small dots, or general or localized fogging. Faster films are more susceptible to effects of static than are slower-speed films. During dry weather, careful handling of the film and equipment, such as when advancing or rewinding film in the camera, will minimize static discharges.

DESICCATING FILMS

In temperate climates, the desiccation of films is seldom necessary. The following instructions apply primarily in exceptionally humid regions.

The most desirable method of storing unprocessed or processed films

Continued after Data Sheets

DATA SHEETS FOR KODAK COLOR FILMS

December 1961

Improvements in products are constantly being made with the result that published recommendations must be changed from time to time. Since it is impractical to change all publications simultaneously, discrepancies in recommendations occasionally occur. While both instruction sheets and Data Sheets are dated, the instructions packed with the film in use should be considered as the primary source of information.

KODACOLOR FILM

A dual-purpose color negative film supplied in standard roll-film sizes and designed for exposure in daylight or with clear flash bulbs. The negatives can be used to obtain Kodacolor Prints and Enlargements, or they can be printed on Kodak Ektacolor Professional Paper or Kodak Ektacolor Paper. Transparencies can be made on Kodak Ektacolor Print Film or Kodak Ektacolor Slide Film. Kodacolor Transparencies in 2 x 2-inch mounts can be ordered from Kodacolor negatives in 24 x 36mm, 28 x 40mm, 1⅝ x 1⅝-inch, and 2¼ x 2¼-inch sizes.

Exposure Indexes: The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values.

Light Source	Index	With Filters Such as:
Daylight	**32/3.5°**	None
Photoflood*	**20/2.5°**	Kodak Light Balancing Filter No. 82A
3200 K Lamps*	**16/2°**	Kodak Light Balancing Filter No. 82C

*Enough light must be provided for an exposure of ½ second or shorter.

Light Sources: Kodacolor Film does not require the use of filters when it is exposed either in daylight or with clear flash bulbs. However, either source should be used alone, not mixed with illumination differing in color quality. Blue flash bulbs should not be used as the sole light source indoors, but they are recommended for supplementing daylight.

To avoid large changes in the filter pack used later during color printing, bring all negatives to approximately the same balance by means of filters over the camera lens. One way of working is to expose without a filter when clear flash bulbs are used. Negatives exposed by daylight or electronic flash can be brought close to the same balance as negatives exposed with regular flash bulbs by the use of the Kodak Wratten Filter No. 85C for daylight or the No. 85 for electronic flash. With the No. 85C, use a Daylight Exposure Index of 25/3° or the same lens settings given in the Daylight Exposure Table.

Daylight Exposure Table: Lens openings at 1/50 or 1/60 second.

For the hours from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
f/16	f/11†	f/5.6	f/4	f/4
Exposure Values				
14	13‡	11	10	10

*Subject shaded from the sun but lighted by a large area of sky.
†f/5.6 or ‡EV11 for back-lighted close-up subjects.

Supplementary Flash Outdoors: In clear sunlight, lighting contrast is frequently excessive, particularly with nearby side- or back-lighted subjects. More pleasing results are obtained by using blue flash bulbs to illuminate the shadows. In the following table, note the choice in flash-to-subject distance range offered by the choice of shutter time and lens opening. Consult your camera manual for any shutter speed limitation that may apply. With flash fill-in, use the same settings for front, side, or back lighting.

Flash Bulb No.	Flash-to-Subject Distance	Lens Opening	Shutter Speed
M5B, M25B, 5B, 25B, 6B or 26B	9 to 15 ft 7 to 12 ft	f/11 f/16	1/50–1/60 1/25–1/30
M2B	6 to 9 ft	f/16	1/25–1/30

Note: Ranges are given because the amount of fill-in light is a matter of personal preference. At camera-to-subject distances less than those in the table, use an extension cord to keep the flash reflector at the proper distance, or use one or more thicknesses of white handkerchief over the reflector to reduce excessive fill-in light.

Flash Exposure Guide Numbers: Divide the proper guide number by the flash-to-subject distance in feet to determine the lens opening for average subjects. With dark subjects, use 1 stop larger. These openings apply to all surroundings except small white rooms; in such rooms, use 1 stop smaller.

Synchronization:	X or F		M		Focal-Plane Shutters	6‡ or 26‡
Between-Lens Shutters	AG-1* M2†	M25†	M5† 5,‡ 25‡	2§ or 22§		
1/25–1/30	80	120	120	180	1/50	95
1/50–1/60	—	110	110	160	1/100	60
1/100–1/125	—	—	95	140	1/250	40
1/200–1/250	—	—	70	100	1/500	28

Bowl-shaped Polished Reflector Sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: These values are intended only as guides. They may be changed to suit individual conditions of use. Cameras having X or F synchronization can use M5, No. 5 or 25 flash bulbs at 1/25 or 1/30 second.

Caution: Since bulbs may shatter, use a flash guard over the reflector. *Do not flash bulbs in an explosive atmosphere.*

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment. It is based on use of the Kodak Wratten Filter No. 85.

Effective Candlepower-Seconds Output	700	1000	1400	2000	2800	4000	5600	8000
Guide Number for Trial	24	28	35	40	50	55	70	80

Processing: Kodacolor Films are developed by Kodak and other laboratories on orders placed through photo dealers, but the charge for this service is not included in the price of the film. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.* All the chemicals for preparing a complete set of processing solutions are available in prepared form in the Kodak Color Processing Kit, Process C-22, sold in 1-pint and 1-gallon sizes. Mixing directions and step-by-step processing instructions are included. Kodak Color Film Processing Chemicals, Process C-22, are also supplied separately in larger sizes.

Film Sizes Available: (For all cameras accommodating roll film in these sizes.) 135, 828, 127, 120, 620, 116, 616.

KODAK EKTACOLOR FILM TYPE S (Short Exposure)

Code Notch

A sheet film designed for making color negatives at exposure times of 1/10 second or shorter. It can be exposed by clear flash without a filter or, with appropriate filters, by daylight or electronic flash illumination. Colored couplers in the film provide automatic color correction and make excellent quality in color reproductions possible without supplementary masking. The negatives can be printed on Kodak Ektacolor Professional Paper or by the Kodak Dye Transfer Process. They can also be used to make positive color transparencies on Kodak Ektacolor Print Film or black-and-white prints on Kodak Panalure Paper.

Exposure Index: *Daylight*—**25/3°** (with a No. 85C Filter)

The first number is for use with meters marked for American Standard (ASA) Speeds or Exposure Indexes. The second number, the Speed Value, is for use with meters marked for these values.

Caution: Do not expose Kodak Ektacolor Film, Type S, for times longer than 1/10 second, because the resulting negatives may contain color-reproduction errors that cannot be corrected satisfactorily in the printing operation. For long exposures, use Ektacolor Film, Type L.

Light Sources and Filters: To avoid large changes in the filter pack used later during color printing, bring all negatives to approximately the same balance by means of filters over the camera lens. One way of working is to expose without a filter when clear flash bulbs are used. Negatives exposed by daylight or electronic flash can be brought close to the same balance as negatives exposed with regular flash bulbs by the use of the Kodak Wratten Filter No. 85C for daylight or the No. 85 for electronic flash.

The use of photoflood or 3200 K lamps is recommended only if sufficient illumination can be obtained to permit an exposure of 1/10 second or shorter. The Exposure Index is 20/2.5° with photoflood lamps and a Kodak Light Balancing Filter No. 82A; 16/2° with 3200 K lamps and a No. 82C.

Standardized Exposure Conditions: If all negatives are exposed with the same light source, the use of filters over the camera lens is not necessary. Likewise, the use of filters with different light sources is not necessary if variations in negative balance can be tolerated in color printing.

Inclusion of Gray Card in Scene: As an aid in determining the exposures required in making prints from Ektacolor negatives, a neutral gray card having a reflectance of about 18%, such as the gray side of the Kodak Neutral Test Card, should be photographed with the subject. If possible, the card should be placed along the edge of the scene area in such a position that it receives the full subject lighting but does not interfere with the actual picture and can be trimmed off the final prints. Otherwise, the card should be photographed, with the full subject lighting, on a separate sheet of Ektacolor Film, which should be processed at the same time as the negatives of the subject.

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number (see instructions in following section) for use with specific equipment. It is based on the use of the Kodak Wratten Filter No. 85.

Effective Candlepower-Seconds Output	700	1000	1400	2000	2800	4000	5600	8000
Guide Number for Trial	24	28	35	40	50	55	70	80

Caution: Do not use shutter speeds longer than 1/50 second; otherwise, results may be influenced by illumination other than the electronic flash.

Flash Exposure Guide Numbers: Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Lens openings determined in this way apply to the use of a single flash bulb in all surroundings except small rooms with very light walls, ceilings, and furnishings. If two bulbs are used at the same distance to light the same area, or if the room is small and very light, use 1 stop smaller.

Between-Lens Shutters	Synchronization					No. 3 or 50 in 12-inch Bowl Reflector	Focal-Plane Shutters	2A§ 31§
	X or F		M					
	AG-1* M2†	M25†	M5† 5,‡ 25‡	11§ 40§	2§ 22§			
Open, 1/25	80	120	120	150	180	275	1/50	100
1/50	—	110	110	130	160	(Use 1/25	1/100	70
1/100	—	—	95	110	140	or	1/250	45
1/200	—	—	70	90	100	slower)		

Bowl-shaped Polished Reflector Sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: These values are intended only as guides. They must be changed to suit individual variations in synchronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Daylight Exposure Table: Lens openings at 1/50 second with the Kodak Wratten Filter No. 85C.

For the hours from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
f/16	*f*/11†	*f*/5.6	*f*/4	*f*/4

*Subject shaded from the sun but lighted by a large area of sky.
†For back-lighted close-up subjects, use *f*/5.6.

Processing: Kodak Ektacolor Film, Type S, is *not* processed by the Eastman Kodak Company. Chemicals for processing solutions are supplied in prepared form in the Kodak Color Processing Kit, Process C-22, which is available in a 1-gallon size. The individual components are also available separately.

Film Sizes Available: (For all cameras accommodating sheet film in these sizes.) Inch sizes: 2¼ x 3¼, 3¼ x 4¼, 4 x 5, 5 x 7, and 8 x 10.

KODAK EKTACOLOR FILM TYPE L (Long Exposure)

Code Notch

A sheet film designed for making color negatives at exposure times of 1/5 second to 60 seconds with 3200 K lamps or, with appropriate filters, by photoflood or daylight illumination. Colored couplers in the film provide automatic color correction and make excellent quality in color reproductions possible without supplementary masking. The negatives can be printed on Kodak Ektacolor Professional Paper or by the Kodak Dye Transfer Process. They can also be used to make positive color transparencies on Kodak Ektacolor Print Film or black-and-white prints on Kodak Panalure Paper.

Exposure Index: *3200 K Lamps*—**16/2°** (for a 5-second exposure)

The effective exposure index depends upon the illumination level and exposure time. The first number given in each case is for use with meters marked for American Standard (ASA) Speeds or Exposure Indexes. The second number, the Speed Value, is for use with meters marked for these values.

Light Source	Kodak Wratten Filter No.	Exposure Time	Effective Exposure Index
3200 K	None	1/5 sec	25/3°
3200 K	None	1 sec	20/2.5°
3200 K	None	30 sec	10/1.5°
3200 K	None	60 sec	10/1.5°
Photoflood	81A	5 sec	12/2° (with filter)
Daylight	85B	1/5 sec	20/2.5° (with filter)

Set the meter calculator tentatively for an exposure index of 16, which applies to a 5-second exposure. Calculate a tentative exposure time for the desired lens opening. If this time is much shorter or much longer than 5 seconds, select from the table the effective exposure index which applies. Use this value to determine the correct exposure time at the desired lens opening.

Caution: Do not expose Kodak Ektacolor Film, Type L, for times shorter than 1/5 second or longer than 60 seconds, because the resulting negatives may contain color-reproduction errors that cannot be corrected satisfactorily in the printing operation. For short exposures, use Ektacolor Film, Type S.

Light Sources and Filters: To avoid large changes in the filter pack used later during color printing, it is usually desirable to bring all negatives to approximately the same balance by means of filters over the camera lens. One way of working is to expose without a filter when 3200 K lamps are used. Negatives exposed by photoflood or daylight illumination can be brought close to the same balance as negatives exposed with 3200 K lamps by use of the filters listed in the table above.

Inclusion of Gray Card in Scene: As an aid in determining the exposures required in making prints from Ektacolor negatives, a neutral gray card having a reflectance of about 18%, such as the gray side of the Kodak Neutral Test Card, should be photographed with the subject. If possible, the card should be placed along the edge of the scene area in such a position that it receives the full subject lighting but does not interfere with the actual picture and can be trimmed off the final prints. Otherwise, the card should be photographed, with the full subject lighting, on a separate sheet of Ektacolor Film, which should be processed at the same time as the negatives of the subject.

Processing: Kodak Ektacolor Film, Type L, is *not* processed by the Eastman Kodak Company. Chemicals for processing solutions are supplied in prepared form in the Kodak Color Processing Kit, Process C-22, which is available in a 1-gallon size. Prepared chemicals to make the individual solutions are also available in larger sizes. Complete processing instructions are included with processing kits and developer packages.

Film Sizes Available: (For all cameras accommodating sheet film in these sizes.) Inch sizes: 2¼ x 3¼, 3¼ x 4¼, 4 x 5, 5 x 7, 8 x 10, and 11 x 14.

KODAK EKTACHROME FILM DAYLIGHT TYPE (PROCESS E-3)

Code Notch

A color sheet film balanced for exposure in sunlight and designed for reversal processing to produce positive color transparencies. The transparencies can be viewed by transmitted light or projection, and can be printed in color by photomechanical methods, the Kodak Dye Transfer Process, or on Kodak Ektachrome Paper. This film is also available as Kodak Ektachrome Professional Film, Daylight Type (Process E-3) in rolls EP620 and EP120.

Important: These instructions are based on average emulsions used under average conditions. Information applying to film of a specific emulsion number is given on the supplementary data sheet packed with the film.

ASA Speed: *Daylight*—**50/4°** (See supplementary data sheet packed with the film.)

The first number is for use with meters marked for American Standard (ASA) Speeds or Exposure Indexes. The second number, the Speed Value, is for use with meters marked for these values.

Daylight Exposure Table: Basic settings for average emulsions.

For the hours from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
1/50 at *f*/22	1/50 at *f*/16†	1/50 at *f*/8	1/50 at *f*/5.6	1/50 at *f*/5.6

*Subject shaded from the sun but lighted by a large area of sky.
†For back-lighted subjects, use *f*/8.

Light Sources: In general, best color rendering is obtained in clear or hazy sunlight. Other light sources may not give equally good results even with the most appropriate filters. The filters listed are suggested for trial.

The bluish cast which is otherwise evident in pictures taken in shade under a clear blue sky can be minimized by use of the Kodak Skylight Filter, which requires no increase in exposure. This filter is also useful for reducing bluishness in pictures taken on an overcast day and in distant scenes, mountain views, sunlit snow scenes, and aerial photographs.

Light Source	Kodak Filter
Bluish daylight (open shade)	Skylight (Wratten No. 1A)
Blue flash bulbs	None
Blue photoflood lamps (not recommended)	
Electronic flash tubes	See supplementary data sheet packed with film

Supplementary Flash Outdoors: In clear sunlight, lighting contrast is frequently excessive, particularly with nearby side- or back-lighted subjects. A more desirable lighting ratio is obtained by using blue flash bulbs to illuminate the shadow areas with light approximating daylight in color quality. The flash must be accurately synchronized by means of a flash shutter or a correctly adjusted synchronizer. The following table applies to clear sun and sky conditions and to average subjects and surroundings. With flash fill-in, use the same settings for front, side, or back lighting.

Bulb No.	Bowl-Shaped Reflector Size	Distance	Lens Opening	Shutter Time
5B or 25B	3-inch	5 to 8 ft	*f*/22	1/25
M5B or M25B	3-inch	{ 8 to 12 ft	*f*/22	1/25
5B or 25B	4-inch	{ 12 to 18 ft	*f*/16	1/50
11B, 40B, 22B, or 2B	6- to 7-inch	12 to 18 ft 16 to 22 ft	*f*/22 *f*/16	1/25 1/50

Note: Distance ranges are given because the desired amount of fill-in light is largely a matter of personal preference. Shutter synchronization must be suitable for the type of bulb used.

Flash Exposure Guide Numbers: Although intended for supplementing daylight, blue flash bulbs can be used in an emergency as the sole light source. The results should not, however, be expected to match the color quality of pictures made on either Daylight Type or Type B film with the source of light for which it is balanced. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Between-Lens Shutters	Synchronization					No. 3B or 50B in 12-inch Bowl Reflector
	X or F		M			
	AG-1B* M2B†	M25B†	M5B,† 5B‡ 25B‡	11B§ 40B§	2B§ 22B§	
Open, 1/25	85	110	110	140	160	260
1/50	—	100	100	120	140	(Use 1/25
1/100	—	—	90	110	120	or
1/200	—	—	70	90	100	slower)

Bowl-Shaped Polished Reflector Sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: *These values are intended only as guides for average emulsions.* They must be changed to suit individual variations in synchronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, the use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment. It is based on the use of the filter suggested on the supplementary data sheet.

Effective Candlepower-Seconds Output	350	500	700	1000	1400	2000	2800	4000	5600	8000
Guide Number for Trial	28	35	40	45	55	65	80	95	110	130

Caution: Do not use shutter speeds longer than 1/50 second; otherwise, results may be influenced by illumination other than the electronic flash.

Processing: All the chemicals for preparing a complete set of processing solutions are available in the Kodak Ektachrome Film Processing Kit, Process E-3. Individual components are also available separately.

Film Sizes Available: (For all cameras accommodating sheet film in these sizes.) Inch sizes: 2¼ x 3¼, 2½ x 3½, 3¼ x 4¼, 4 x 5, 5 x 7, 8 x 10, and 11 x 14. Centimeter sizes: 4.5 x 6, 6.5 x 9, 9 x 12, 4.5 x 10.7, and 6 x 13. Also available in rolls EP620 and EP120 under the name, Kodak Ektachrome Professional Film, Daylight Type (Process E-3).

KODAK EKTACHROME FILM TYPE B (PROCESS E-3)

Code Notch

A color sheet film balanced for exposure with 3200 K lamps and designed for reversal processing to produce positive color transparencies. The transparencies can be viewed by transmitted light or projection, and can be printed in color by photomechanical methods, the Kodak Dye Transfer Process, or on Kodak Ektachrome Paper.

Important: These instructions are based on average emulsions used under average conditions. Information applying to film of a specific emulsion number is given on the supplementary data sheet packed with the film.

ASA Speed:

Light Source	ASA Speed	With filters such as:
3200 K Lamps	**32/3.5°** for a ½-second exposure	None
Photoflood Lamps	**25/3°** for a ½-second exposure	No. 81A
Daylight	**25/3°** for a 1/50-second exposure	No. 85B

The first number given after each light source is for use with meters marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters marked for these values. These settings apply to incident-light readings taken from the subject position, and to reflected-light readings from the camera position. For interior scenes, take a reading from the camera position only if both subject and background have about the same brightness. Otherwise, take the reading from a gray card of 18% reflectance‡ held close to the subject, facing halfway between the camera and the main light. Divide the ASA Speed by 2 if the reading is taken from the palm of the hand or the subject's face; divide it by 5 if the reading is taken from a white card of 90% reflectance.‡ Set the meter calculator as for a normal subject. When a card or the palm of the hand is used, or when incident-light readings are made, allow ½ stop more exposure for dark subjects, ½ stop less for light subjects.

‡The Kodak Neutral Test Card, which has a gray side of 18% reflectance and a white side of 90% reflectance, is recommended. In daylight, follow the instructions packaged with the card.

Copying and Close-Up Work: In copying, the use of a gray card as described above is recommended for determining exposures. *Whenever the subject is closer than 8 times the focal length of the lens, allowance should be made for the decrease in effective lens opening due to bellows extension.* The effective lens opening is easily determined with a *Kodak Master Photoguide.*

Light Sources: In general, best color rendering is obtained with 3200 K lamps operating at their rated voltage. If the voltage varies much from the normal, a color change will occur. Stock voltage ratings for 3200 K lamps are 115, 120, and 125. The lamps are available in a variety of wattages and types.

Other light sources may not give equally good results even with the most appropriate filters. The filters listed here are suggested for trial.

Unless a special effect is desired, light sources having different color qualities must not be mixed. In particular, avoid mixing tungsten light and daylight. Also avoid the use of discolored or unevenly polished reflectors.

3200 K Reflectorflood Lamp Exposure Table: Based on the use of two lamps, fill-in light close to camera at lens level, main light 2 to 4 feet higher and at 45° from camera-subject axis.

Lens Opening at ½-Second Exposure			f/16	f/11	f/8	f/5.6	f/4
Lamp-to-Subject Distance in Feet	R-7 Reflectorflood	Main Light	4½	6	8½	12	17
		Fill-in Light	6	8½	12	17	24
	R-32 Reflectorflood	Main Light	5½	7½	10½	15	21
		Fill-in Light	7½	10½	15	21	30

Note: These values are intended only as guides for use with new lamps and average emulsions. They may vary with light or dark subjects, and some increase in exposure may be required after the lamps have burned for about 10 hours. Use of the table gives a lighting ratio of about 3:1. For a 2:1 ratio, move the fill-in light in to the same distance from the subject as the main light and use ½ stop smaller lens opening.

Flash Exposure Guide Numbers: (*See Supplementary Data Sheet packed with the film.*) These figures are based on use of the Kodak Light Balancing Filter No. 81C. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Between-Lens Shutters	Synchronization					No. 3 or 50 in 12-inch Bowl Reflector	Focal-Plane Shutters	2A§ 31§
	X or F		M					
	AG-1* M2†	M25†	M5† 5,‡ 25‡	11§ 40§	2§ 22§			
Open, 1/25	85	130	130	160	200	300	1/50	110
1/50	—	120	120	150	170	(Use 1/25	1/100	75
1/100	—	—	100	130	140	or	1/250	50
1/200	—	—	75	100	120	slower)		

Bowl-Shaped Polished Reflector Sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: *These values are intended only as guides for average emulsions.* They must be changed to suit individual variations in synchronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, the use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Lens openings determined in this way apply to use of a single flash bulb in all surroundings except small rooms with very light walls, ceilings, and furnishings. If two bulbs are used at the same distance to light the same area, or if the room is small and very light, use 1 stop smaller.

Processing: All the chemicals for preparing a complete set of processing solutions are available in the Kodak Ektachrome Film Processing Kit, Process E-3. Individual components are also available separately.

Film Sizes Available: (For all cameras accommodating sheet film in these sizes.) Inch sizes: 2¼ x 3¼, 2½ x 3½, 3¼ x 4¼, 4 x 5, 5 x 7, 8 x 10, and 11 x 14. Centimeter sizes: 4.5 x 6, 6.5 x 9, 9 x 12, 4.5 x 10.7, and 6 x 13.

KODAK EKTACHROME FILM
DAYLIGHT TYPE (PROCESS E-2)

A color film designed for use in miniature and roll-film cameras and balanced for exposure in sunlight. Processed by reversal, it yields positive transparencies for projection or color printing. The transparencies can be used to obtain Kodachrome Prints and Enlargements and can also be printed on Kodak Ektachrome Paper, by the Kodak Dye Transfer Process, or by photomechanical methods.

ASA Speed: *Daylight*—**32/3.5°** *Photoflood*—12/2°*

*With the Kodak Photoflood Filter for Kodak Daylight Type Color Films (Wratten No. 80B).

The first number given after each light source is for use with meters marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values. These settings apply to reflected- or incident-light readings, properly made, of average subjects. Certain reflected-light meters should be pointed downward to minimize the effect of the sky.

Daylight Exposure Table: Lens openings at 1/50 or 1/60 second.
For the hours from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
f/16	*f*/11†	*f*/5.6	*f*/4	*f*/4
Exposure Values				
14	13‡	11	10	10

*Subject shaded from the sun but lighted by a large area of clear, unobstructed sky.
† *f*/5.6 or ‡EV11 for back-lighted close-up subjects.

Fill-in Flash: Blue flash bulbs are helpful in lightening the harsh shadows usually found in making close-ups in bright sunlight. A typical exposure is *f*/16 at 1/25 second (EV13 at 1/30), with the subject 8 to 10 feet away. For more information about fill-in flash, see the Kodak Data Book *Flash Pictures* or the *Kodak Master Photoguide*, sold by Kodak dealers.

Light Sources: In general, best color rendering is obtained in clear or hazy sunlight. Other light sources may not give equally good results even with the most appropriate filters. The bluish cast which is otherwise evident in pictures taken in shade under a clear blue sky can be minimized by use of the Kodak Skylight Filter, which requires no increase in exposure. This filter is also useful for reducing bluishness in pictures taken on an overcast day and in distant scenes, mountain views, sunlit snow scenes, and aerial photographs.

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment. It is based on exposure without a filter, although a Kodak Light Balancing Filter No. 81A may give better color balance with a new portable unit. Open up the lens about ⅓ stop if the filter is used.

Effective Candlepower-Seconds Output	350	500	700	1000	1400	2000	2800	4000
Guide Number for Trial	28	35	40	45	55	65	80	95

Flash Exposure Guide Numbers: Although intended for supplementing daylight, blue flash bulbs can be used in an emergency as the sole light source. The results should not, however, be expected to match in color quality pictures made on either Daylight Type or artificial-light film with the source for which it is balanced. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

For Blue Flash Bulbs or Clear Bulbs with 80C Filter

Synchronization:	X or F		M		Focal-Plane Shutter Speed	6B‡ or 26B‡
Shutter Speed	AG-1B* M2B†	M25B†	M5B,† 5B,‡ or 25B‡	2B§ 22B§		
1/25–1/30	70	90	90	130	1/50	75
1/50–1/60	—	80	80	120	1/100	45
1/100–1/125	—	—	70	100	1/250	28
1/200–1/250	—	—	55	80		

Bowl-shaped polished reflector sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: These values are intended only as guides. They must be changed to suit individual variations in sychronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, the use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Processing: Your dealer will arrange to have this film processed by Kodak or any other laboratory offering this service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.* All the chemicals for preparing a complete set of processing solutions are available in prepared form in the Kodak Ektachrome Film Processing Kit, Process E-2, which comes in various sizes. Mixing directions and step-by-step processing instructions are included. The film should be processed on a reel that has at least half the end surfaces open.

Film Sizes Available:

E135 20-exposure magazines (normal picture size—24 x 36 mm).
E828 8-exposure rolls (normal picture size—28 x 40 mm).
E404 100-foot rolls 35mm, perforated and frame-numbered.
E620, E120, and E127 rolls.

KODAK EKTACHROME FILM TYPE F (PROCESS E-2)

A color film designed for use in miniature and roll-film cameras and balanced for exposure with clear flash bulbs. Processed by reversal, it yields positive transparencies for projection or color printing. The transparencies can be used to obtain Kodachrome Prints and Enlargements and can also be printed on Kodak Ektachrome Paper, by the Kodak Dye Transfer Process, or by photomechanical methods.

ASA Speed:

Light Source	ASA Speed	With Filters Such as:
Photoflood Lamps	**16/2°**	No. 82A
3200 K Lamps	**12/2°**	No. 82C
Daylight	**16/2°**	No. 85C

The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values. These settings apply to incident-light meter readings taken from the subject position, and to reflected-light readings taken from a gray card of 18% reflectance§ held close to the subject, facing halfway between the camera and the main light. They also apply when a reflected-light reading of the scene is taken from the camera position, provided both subject and background have approximately the same brightness. The ASA Speed should be divided by 2 if the reading is taken from the palm of the hand or the subject's face, or divided by 5 if the reading is taken from a white card of 90% reflectance.§ Set the meter calculator as for a normal subject.

When a card or the palm of the hand is used, or when incident-light readings are made, allow ½ stop more exposure for dark subjects, ½ stop less exposure for light subjects.

§The Kodak Neutral Test Card, which has a gray side of 18% reflectance and a white side of 90% reflectance, is recommended for this purpose.

Copying and Close-Up Work: In copying, the use of a gray card as described above is recommended for determining exposure. If the camera lens is extended for focusing on a subject closer than 8 times the focal length of the lens, allow for the decrease in effective lens opening. A *Kodak Master Photoguide* furnishes an easy means of determining the effective lens opening.

Photoflood Exposure Table: (Based on use of the Kodak Light Balancing Filter No. 82A.) For two new reflector-type photoflood lamps at the same distance from the subject: fill-in light close to camera at camera height; main light on other side of camera at 45° to camera-subject axis and 2 to 4 feet higher than fill-in light.

Lamp-to-Subject Distance	3½ ft	4½ ft	5½ ft	8 ft
Lens Opening at 1/25 Second	*f*/4.5	*f*/3.5	*f*/2.8	*f*/2

Note: *This table is for new lamps only.* After burning lamps 1 hour, use ½ stop larger; after 2 hours, 1 full stop larger.

Flash Exposure Guide Numbers: Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects. These lens openings apply to all surroundings except small white rooms; in such surroundings, use 1 stop smaller.

Synchronization:	X or F		M			
Between-Lens Shutters	AG-1* M2†	M25†	M5† 5‡ or 25‡	2§ or 22§	Focal-Plane Shutters	6‡ or 26‡
1/25–1/30	80	120	120	180	1/50	95
1/50–1/60	—	110	110	160	1/100	60
1/100–1/125	—	—	95	140	1/250	40
1/200–1/250	—	—	70	100	1/500	28

Bowl-shaped polished reflector sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: These values are intended only as guides. They must be changed to suit individual variations in synchronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Daylight Exposure Table: For average subjects in daylight from 2 hours after sunrise to 2 hours before sunset. A filter such as the Kodak Daylight Filter for Kodak Type F Color Films, No. 85C, must be used to insure proper color balance for daylight pictures.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
Set Shutter at 1/50 or 1/60 Second and Lens Opening at:				
f/11	*f*/8†	*f*/4	*f*/2.8	*f*/2.8
Exposure Values				
13	12‡	10	9	9

*Subject shaded from the sun but lighted by a large area of clear, unobstructed sky.
†*f*/4 or ‡EV10 for back-lighted close-up subjects.

Processing: Processing service for this film is available, through dealers, from numerous laboratories, including those of Eastman Kodak Company. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.* All the chemicals for preparing a complete set of processing solutions are available in prepared form in the Kodak Ektachrome Film Processing Kit, Process E-2. Mixing directions and step-by-step processing instructions are included. The film should be processed on a reel that has at least half the end surfaces open.

Film Sizes Available:

EF135 20-exposure magazines (normal picture size—24 x 36 mm).
EF828 8-exposure rolls (normal picture size—28 x 40 mm).
EF404 100-foot rolls, 35mm, perforated and frame-numbered.
EF127, EF120, and EF620 rolls.

KODAK HIGH SPEED EKTACHROME FILM DAYLIGHT TYPE (PROCESS E-2)

A color reversal film recommended for color photograpny of fast action, interiors lighted by daylight and other dimly lighted subjects, close-ups which require the utmost depth of field, etc. It is color-balanced for exposure to daylight, blue flash bulbs, and electronic-flash illumination. No filters are required with any of these light sources. In general, this film is preferable to the Type B film for fluorescent illumination, and acceptable color rendering is obtained without a filter. When processed, this film produces positive color transparencies suitable for projection, direct viewing, or as originals for color prints.

ASA Speed: *Daylight*—**160/5.5°**

The first number is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number, the Speed Value, is for use with meters and cameras marked for these values.

Because of its extreme speed, this film is easy to overexpose under bright sunlight conditions.

Exposure of this film with photoflood or 3200 K lamps is not recommended because of the heavy filtration required. With these light sources, use Kodak High Speed Ektachrome Film, Type B.

Most shutters, *except focal-plane shutters*, have the higher speed settings calibrated for the maximum lens openings. They are relatively more efficient at smaller lens openings, and so pass more light than calculated. Therefore, under lighting conditions which call for small lens openings at high shutter speeds, use an opening ½ stop smaller than that indicated by an exposure meter. The following table makes allowance for this shutter efficiency effect.

Daylight Exposure Table: For average front-lighted subjects in daylight from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
Lens Opening with Blade-Type Shutter† at 1/200 or 1/250 Second				
f/22	*f*/16‡	*f*/8	*f*/5.6	*f*/5.6
Exposure Values				
17	16§	14	13	13

*Subject shaded from sun but lighted by a large area of clear, unobstructed sky. Use a filter, such as the Kodak Skylight Filter (No. 1A), to minimize the bluishness of pictures made in open shade.
†**With focal-plane shutters,** use ⅓ stop larger opening.
‡*f*/8 or §EV14 for back-lighted close-up subjects.

Fill-in Flash: Blue flash bulbs are also helpful to lighten harsh shadows sometimes found when making close-ups in bright sunlight. A typical exposure is *f*/22 at 1/100 second, with the subject 8 to 10 feet away. Electronic flash is a good fill-in source for this film, as it can be synchronized more easily than flash bulbs at 1/100 second. For more information about fill-in flash, see the Kodak Data Book *Flash Pictures* or the *Kodak Master Photoguide*, sold by Kodak dealers.

Flash Exposures: Use *blue flash bulbs* without a filter—or clear flash bulbs with a filter, such as the Kodak Photoflash Filter for Kodak Daylight Type Color Films (Wratten No. 80C).

Flash Exposure Guide Numbers: Although intended for supplementing daylight, blue flash bulbs can be used in an emergency as the sole light source. The results should not, however, be expected to match in color quality pictures made on either Daylight Type or artificial-light film with the source for which it is balanced. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Synchronization →	X or F		M			
Shutter Speed	AG-1B* M2B†	M25B†	M5B,† 5B‡ or 25B‡	Focal-Plane Shutter Speed	6B‡ or 26B‡
1/25–1/30	150	200	200	1/50	160
1/50–1/60	—	180	180	1/100	100
1/100–1/125	—	—	150	1/250	60
1/200–1/250	—	—	120	1/500	45

Size of bowl-shaped polished reflector: *2-inch; †3-inch; ‡4- to 5-inch.

Caution: Since bulbs may shatter when flashed, the use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment.

Output of Unit (in Effective Candlepower-Seconds)	350	500	700	1000	1400	2000	2800	4000
Guide Number	60	70	85	100	120	140	170	200

Processing: Your dealer can arrange to have this film processed by Kodak or any other laboratory offering this service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.* All the chemicals for preparing a complete set of processing solutions are available in prepared form in the Kodak Ektachrome Film Processing Kit, Process E-2.

Film Sizes Available: EH-135 20-exposure magazines.

KODAK HIGH SPEED EKTACHROME FILM TYPE B (PROCESS E-2)

A color reversal film balanced for exposure with 3200 K tungsten lamps. It is a special-purpose, high-speed film intended primarily for use under existing tungsten light conditions. With most types of fluorescent lighting or arc lamps, Kodak High Speed Ektachrome Film, Daylight Type, will give more satisfactory results. When processed, this film produces positive color transparencies suitable for projection, direct viewing, or as originals for color prints.

ASA Speed:

Light Source	ASA Speed	With Filters Such as:
3200 K Lamps	**125/5°**	None
Photoflood Lamps	**100/5°**	No. 81A
Daylight	**80/4.5°**	No. 85B

The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values.

3200 K Reflectorflood Lamp Exposure Table: Based on the use of two lamps, fill-in light close to camera at lens level, and main light 2 to 4 feet higher and at 45° from camera-subject axis.

Lens Opening at 1/50 Second			*f*/5.6	*f*/4	*f*/2.8	*f*/2
Lamp-to-Subject Distance in Feet	R-7 Lamp	Main Light	5	7	10	14
		Fill-in Light	7	10	14	20
	R-32 Lamp	Main Light	6	9	12	18
		Fill-in Light	9	12	18	25

Note: These values are intended only as guides. They give a lighting ratio of about 3 to 1. For a 2 to 1 ratio, move the fill-in light in to the same distance from the subject as the main light and use a ½-stop smaller lens opening.

Trial Exposure Settings for Existing-Light Subjects

Sports Arenas

about 30 to 40 foot-candles of incident illumination: 1/50 sec at *f*/2.0

Work Areas—Store Interiors

about 60 to 80 foot-candles of incident illumination: 1/50 sec at *f*/2.8

Basic Daylight Exposure: With a filter such as Kodak Daylight Filter for Kodak Type B Color Films. No. 85B, for average subjects in bright sunlight: *f*/11 at 1/100 or 1/125 second

Flash Exposure Guide Numbers: Based on the use of the Kodak Light Balancing Filter No. 81C. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects.

Synchronization:	X or F		M			Focal-Plane Shutters	6‡ 26‡
Shutter Speed	AG-1* M2†	M25†	M5† 5,‡ 25‡	11§ 40§	2§ 22§		
1/25–1/30	160	240	240	300	350	1/50	190
1/50–1/60	—	220	220	260	320	1/100	120
1/100–1/125	—	—	190	230	270	1/250	80
1/200–1/250	—	—	140	180	210	1/500	55

Size of bowl-shaped polished reflector: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment. It is based on the use of the Kodak Daylight Filter for Kodak Type B Color Films, No. 85B.

Effective Candlepower-Seconds Output	350	500	700	1000	1400	2000	2800	4000
Guide Number for Trial	40	50	60	70	85	100	120	140

Processing: Your dealer can arrange to have this film processed by Kodak or any other laboratory offering this service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.* All the chemicals for preparing a complete set of processing solutions are available in prepared form in the Kodak Ektachrome Film Processing Kit, Process E-2.

Film Sizes Available: EHB-135 20-exposure magazines.

KODACHROME FILM, DAYLIGHT TYPE

A color film designed for use in miniature still cameras and balanced for exposure in sunlight. Processed by reversal, it yields positive transparencies for projection or color printing. The transparencies can be used to obtain Kodachrome Prints and Enlargements and can also be printed on Kodak Ektachrome Paper, by the Kodak Dye Transfer Process, or by photomechanical methods.

ASA Speed: *Daylight*—**10/1.5°** *Photoflood*—5/.5°*

*With the Kodak Photoflood Filter for Kodak Daylight Type Color Films (Wratten No. 80B).

The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values. These settings apply to reflected- or incident-light readings, properly made, of average subjects. Certain reflected-light meters should be pointed downward to minimize the effect of the sky.

Daylight Exposure Table: Lens openings at 1/50 or 1/60 second.

For the hours from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
Between *f*/8 and *f*/11	Between *f*/5.6 and *f*/8†	Between *f*/2.8 and *f*/4	Between *f*/2 and *f*/2.8	Between *f*/2 and *f*/2.8
Exposure Values				
12.5	11.5‡	9.5	8.5	8.5

*Subject shaded from the sun but lighted by a large area of clear, unobstructed sky.
†Lens opening between *f*/2.8 and *f*/4 or ‡EV9.5 for back-lighted close-up subjects.

Fill-in Flash: Blue flash bulbs are helpful in lightening the harsh shadows usually found in making close-ups in bright sunlight. A typical exposure is between *f*/8 and *f*/11 at 1/25 second (EV11.5 at 1/30), with the subject 8 to 10 feet away. For more information about fill-in flash, see the Kodak Data Book *Flash Pictures* or the *Kodak Master Photoguide*, sold by Kodak dealers.

Light Sources: In general, best color rendering is obtained in clear or hazy sunlight. Other light sources may not give equally good results even with the most appropriate filters. The bluish cast which is otherwise evident in pictures taken in shade under a clear blue sky can be minimized by use of the Kodak Skylight Filter, which requires no increase in exposure. This filter is also useful for reducing bluishness in pictures taken on an overcast day and in distant scenes, mountain views, sunlit snow scenes, and aerial photographs.

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment. It is based on exposure without a filter, although a Kodak Light Balancing Filter No. 81A may give better color balance with a new portable unit. Open up the lens about ⅓ stop if the filter is used.

Effective Candlepower-Seconds Output	350	500	700	1000	1400	2000	2800	4000	5600	8000
Guide Number for Trial	15	18	22	26	30	35	45	50	60	75

Flash Exposure Guide Numbers: Although intended for supplementing daylight, blue flash bulbs can be used in an emergency as the sole light source. The results should not, however, be expected to match in color quality pictures made on either Daylight Type or artificial-light film with the source for which it is balanced. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Synchronization:	X or F		M		
Between-Lens Shutters	AG-1B* M2B†	M25B†	M5B† 5B‡ or 25B‡	Focal-Plane Shutters	6B‡ or 26B‡
1/25–1/30	40	50	50	1/50	40
1/50–1/60	—	45	45	1/100	24
1/100–1/125	—	—	40		
1/200–1/250	—	—	30		

Bowl-shaped polished reflector sizes: *2-inch; †3-inch; ‡4- to 5-inch.

Note: These values are intended only as guides. They must be changed to suit individual variations in synchronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, the use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Processing: Your dealer can arrange to have this film processed by Kodak or any other laboratory offering such service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory, and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.*

Rolls and Magazines Available for Still Cameras:

K828 8-exposure rolls (normal picture size—28 x 40 mm).
K135 20- and 36-exposure magazines (normal picture size—24 x 36 mm).

KODACHROME FILM, TYPE F

A color film designed for use in miniature still cameras and balanced for exposure with clear flash bulbs such as the No. 5 and 25. Processed by reversal, it yields positive transparencies for projection or color printing. The transparencies can be used to obtain Kodachrome Prints and Enlargements, and can also be printed on Kodak Ektachrome Paper, by the Kodak Dye Transfer Process, or by photomechanical methods.

ASA Speed:

Light Source	ASA Speed	With Filters Such as:
Daylight	**10/1.5°**	No. 85C
Photoflood Lamps	**12/2°**	No. 82A
3200 K Lamps	**10/1.5°**	No. 82C

The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values. These settings apply to incident-light meter readings taken from the subject position, and to reflected-light readings taken from a gray card of 18% reflectance* held close to the subject, facing halfway between the camera and the main light. They also apply when a reflected-light reading of the scene is taken from the camera position, provided both subject and background have approximately the same brightness. The ASA Speed should be divided by 2 if the reading is taken from the palm of the hand or the subject's face, or divided by 5 if the reading is taken from a white card of 90% reflectance.* Set the meter calculator arrow as for a normal subject.

When a card or the palm of the hand is used, or when incident-light readings are made, allow ½ stop more exposure for dark subjects, ½ stop less exposure for light subjects.

*The Kodak Neutral Test Card, which has a gray side of 18% reflectance and a white side of 90% reflectance, is recommended for this purpose.

Copying and Close-Up Work: In copying, the use of a gray card as described above is recommended for determining exposures. If the camera lens is extended for focusing on a subject closer than 8 times the focal length of the lens, allow for the decrease in effective lens opening. A *Kodak Master Photoguide* furnishes an easy means of determining the effective lens opening.

Photoflood Exposure Table: (Based on use of the Kodak Light Balancing Filter No. 82A.) For two new reflector-type photoflood lamps at the same distance from the subject: fill-in light close to camera at camera height; main light on other side of camera at 45° to camera-subject axis and 2 to 4 feet higher than fill-in light.

Lamp-to-Subject Distance	5½ ft	8 ft	10 ft	13 ft	16 ft	22 ft
Lens Opening at ½ Second	f/8	f/5.6	f/4.5	f/3.5	f/2.8	f/2

Note: *This table is for new lamps only.* After burning lamps 1 hour, use ½ stop larger; after 2 hours, 1 full stop larger.

Flash Exposure Guide Numbers: Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects. These lens openings apply to all surroundings except small white rooms; in such rooms, use 1 stop smaller.

Synchronization:	X or F		M			
Between-Lens Shutters	AG-1* M2†	M25†	M5† 5‡ or 25‡	2§ or 22§	Focal-Plane Shutters	6‡ or 26‡
1/25–1/30	65	95	95	140	1/50	80
1/50–1/60	—	85	85	130	1/100	50
1/100–1/125	—	—	75	110	1/250	30
1/200–1/250	—	—	60	85		

Bowl-shaped Polished Reflector Sizes: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: These values are intended only as guides. They must be changed to suit individual variations in synchronization, battery, reflector, and bulb position in the reflector.

Caution: Since bulbs may shatter when flashed, use of a flash guard over the reflector is recommended. *Do not flash bulbs in an explosive atmosphere.*

Daylight Exposure Tables: For average subjects in daylight from 2 hours after sunrise to 2 hours before sunset. A filter such as the Kodak Daylight Filter for Kodak Type F Color Films (Wratten No. 85C) should be used on the camera lens.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
Set Shutter at 1/50 or 1/60 Second and Lens Opening at:				
Between f/8 and f/11	Between f/5.6 and f/8†	Between f/2.8 and f/4	Between f/2 and f/2.8	Between f/2 and f/2.8
Exposure Values				
12.5	11.5‡	9.5	8.5	8.5

*Subject shaded from the sun but lighted by a large area of clear, unobstructed sky.
†Lens opening between f/2.8 and f/4 or ‡EV9.5 for back-lighted close-up subjects.

Processing: Your dealer can arrange to have this film processed by Kodak or any other laboratory offering such service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.*

Rolls and Magazines Available for Still Cameras:

KF828 8-exposure rolls (normal picture size 28 x 40 mm).
KF135 20- and 36-exposure magazines (normal picture size 24 x 36 mm).

KODACHROME PROFESSIONAL FILM, TYPE A

A color film designed for use in miniature still cameras and balanced for exposure with photoflood lamps. Processed by reversal, it yields positive transparencies for projection or color printing. The transparencies can be used to obtain Kodachrome Prints and Enlargements, and can also be printed on Kodak Ektachrome Paper, by the Kodak Dye Transfer Process, or by photomechanical methods.

ASA Speed:

Light Source	ASA Speed	With Filters Such as:
Photoflood Lamps	**16/2°**	None
3200 K Lamps	**12/2°**	No. 82A.
Daylight	**10/1.5°**	No. 85. With this filter, the exposure for average subjects in bright sunlight is 1/50 or 1/60 second with lens set between *f*/5.6 and *f*/8.

The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values. These settings apply to incident-light meter readings taken from the subject position, and to reflected-light readings taken from a gray card of 18% reflectance* held close to the subject, facing halfway between the camera and the main light. They also apply when a reflected-light reading of the scene is taken from the camera position, provided both subject and background have approximately the same brightness. The ASA Speed should be divided by 2 if the reading is taken from the palm of the hand or the subject's face, or divided by 5 if the reading is taken from a white card of 90% reflectance.* Set the meter calculator arrow as for a normal subject.

When a card or the palm of the hand is used, or when incident-light readings are made, allow ½ stop more exposure for dark subjects, ½ stop less exposure for light subjects.

*The Kodak Neutral Test Card, which has a gray side of 18% reflectance and a white side of 90% reflectance, is recommended for this purpose.

Copying and Close-Up Work: In copying, the use of a gray card as described above is recommended for determining exposures. If the camera lens is extended for focusing on a subject closer than 8 times the focal length of the lens, allow for the decrease in effective lens opening. A *Kodak Master Photoguide* furnishes an easy means of determining the effective lens opening.

Photoflood Exposure Table: For two new reflector-type photoflood lamps at the same distance from the subject: fill-in light close to camera at camera height; main light on other side of camera at 45° to camera-subject axis and 2 to 4 feet higher than fill-in light.

Lamp-to-Subject Distance	3½ ft	5 ft	7 ft	10 ft	14 ft	20 ft
Lens Opening at ½ Second	*f*/16	*f*/11	*f*/8	*f*/5.6	*f*/4	*f*/2.8

Note: *This table is for new lamps only.* After burning lamps 1 hour, use ⅓ stop larger; after 2 hours, 1 full stop larger.

Flash Exposure Guide Numbers: (Based on the use of a filter such as the Kodak Light Balancing Filter No. 81C for all flash bulbs listed.) Divide the proper guide number by the flash bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Synchronization:	X or F		M		Focal-Plane Shutters	6‡ or 26‡
Between-Lens Shutters	AG-1* M2†	M25†	M5† 5‡ or 25‡	2§ or 22§		
1/25–1/30	50	80	80	110	1/50	60
1/50–1/60	—	70	70	100	1/100	40
1/100–1/125	—	—	60	90	1/250	24
1/200–1/250	—	—	45	70		

Bowl-shaped polished reflectors: *2-inch; †3-inch; ‡4- to 5-inch; §6- to 7-inch.

Note: These values are intended as guides. They may be changed to fit individual conditions of use. *See your camera manual for recommended bulbs and shutter speed settings.*

Caution: Since bulbs may shatter, use a flash guard over the reflector. *Do not flash bulbs in an explosive atmosphere.*

Processing: Your dealer can arrange to have this film processed by Kodak or any other laboratory offering such service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.*

Sizes Available: *KA135 36-exposure magazines* (normal picture size—24 x 36 mm).

KODACHROME II FILM, DAYLIGHT TYPE

A color film designed for use in miniature still cameras and balanced for exposure in sunlight. Processed by reversal, it yields positive transparencies for projection or color printing. The transparencies can be used to obtain Kodachrome Prints and Enlargements and can also be printed on Kodak Ektachrome Paper, by the Kodak Dye Transfer Process, or by photomechanical methods. It is faster than the Kodachrome Film supplied for many years and has improved sharpness and image quality.

ASA Speed: *Daylight*—**25/3°** *Photoflood*—12/2°*

*With the Kodak Photoflood Filter for Kodak Daylight Type Color Films (Wratten No. 80B).

The first number given after each light source is for use with meters and cameras marked for American Standard (ASA) Speeds or Exposure Indexes. The second number in each pair, the Speed Value, is for use with meters and cameras marked for these values. These settings apply to reflected- or incident-light readings, properly made, of average subjects. Certain reflected-light meters should be pointed downward to minimize the effect of the sky.

Daylight Exposure Table: Lens openings at shutter speeds stated.

For the hours from 2 hours after sunrise to 2 hours before sunset.

Bright or Hazy Sun on Light Sand or Snow	Bright or Hazy Sun (Distinct Shadows)	Cloudy Bright (No Shadows)	Heavy Overcast	Open Shade*
Shutter at 1/100 or 1/125 Second			Shutter at 1/50 or 1/60 Second	
f/11	*f*/8†	*f*/4	*f*/4	*f*/4
Exposure Values				
14	13‡	11	10	10

*Subject shaded from the sun but lighted by a large area of clear, unobstructed sky.
†*f*/4 or ‡EV11 for back-lighted close-up subjects.

Fill-in Flash: *Blue* flash bulbs help to lighten the harsh shadows usually found in making close-ups in bright sunlight. A typical exposure is *f*/16 at 1/25 or 1/30 second (EV13 at 1/30), with the subject 8 to 10 feet away. For more information about fill-in flash, see the Kodak Data Book *Flash Pictures* or the *Kodak Master Photoguide*, sold by Kodak dealers.

Light Sources: In general, best color rendering is obtained in clear or hazy sunlight. Other light sources may not give equally good results even with the most appropriate filters. The bluish cast which is otherwise evident in pictures taken in shade under a clear blue sky can be minimized by use of the Kodak Skylight Filter, which requires no increase in exposure. This filter is also useful for reducing bluishness in pictures taken on an overcast day and in distant scenes, mountain views, sunlit snow scenes, and aerial photographs.

Electronic Flash Guide Numbers: This table is intended as a starting point in determining the correct guide number for use with specific equipment. It is based on exposure without a filter, although a Kodak Light Balancing Filter No. 81A may give better color balance with a new portable unit. Open up the lens about ⅓ stop if this filter is used.

Guide Numbers for Electronic Flash										
Effective Candlepower-Seconds Output	350	500	700	1000	1400	2000	2800	4000	5600	8000
Guide Number	24	30	35	40	50	60	70	80	100	120

Flash Exposure Guide Numbers: Although intended for supplementing daylight, blue flash bulbs can be used in an emergency as the sole light source. The results should not, however, be expected to match in color quality pictures made on either Daylight Type or artificial-light film with the source for which it is balanced. Divide the proper guide number by the bulb-to-subject distance in feet to determine the lens opening for average subjects. Use ½ stop larger for dark subjects; ½ stop smaller for light subjects.

Synchronization →	X or F		M		Focal-Plane Shutter Speed	6B‡ or 26B‡
Shutter Speed	AG-1B* M2B†	M25B†	M5,† 5B‡ or 25B‡			
1/25–1/30	60	80	80		1/50	65
1/50–1/60	—	—	70		1/100	40
1/100–1/125	—	—	65			
1/200–1/250	—	—	50			

Bowl-shaped polished reflector sizes: *2-inch; †3-inch; ‡4- to 5-inch.

Caution: Since bulbs may shatter, use a flash guard over the reflector. *Do not flash bulbs in an explosive atmosphere.*

Processing: Your dealer can arrange to have this film processed by Kodak or any other laboratory offering this service. Some laboratories, including Kodak, also provide direct mail service whereby you can mail exposed film to the laboratory and have it returned directly to you. See your dealer for the special mailing devices required. *Do not mail film without an overwrap or special mailing device intended for this purpose.*

Rolls and Magazines Available for Still Cameras:
KR135 20- and 36-exposure magazines (normal picture size—24 x 36 mm).
KR828 8-exposure rolls (normal picture size—28 x 40 mm).

Use of Kodak Filters with Kodak Reversal Color Films

December, 1961—*for current recommendations, see film instructions*

LIGHTING CONDITIONS	Kodachrome and Kodak Ektachrome Films DAYLIGHT TYPE	Kodachrome Professional Film TYPE A	Kodak Ektachrome Film TYPE B	Kodachrome and Kodak Ektachrome Films TYPE F
Daylight. Clear or hazy sun casting sharp or soft shadows.	No filter needed	Daylight Filter for Kodak Type A Color Films (No. 85)	Daylight Filter for Kodak Type B Color Films (No. 85B)	Daylight Filter for Kodak Type F Color Films (No. 85C)
Daylight. Bluish—open shade or overcast. No shadows.	Skylight (No. 1A)	No. 85	No. 85B	No. 85C
Daylight. Distant scenes, mountain and aerial photography.	Skylight (No. 1A)	No. 85	No. 85B	No. 85C
Electronic Flash Tubes (in new portable units)	See Data Sheet	Not recommended	Not recommended*	Not recommended
Blue Flash Bulbs	No filter needed	Not recommended	Not recommended	Not recommended
Blue Photoflood Lamps	Not recommended	Not recommended	Not recommended	Not recommended
Photoflood Lamps	Photoflood Filter for Kodak Daylight Type Color Films (No. 80B)†	No filter needed	Light Balancing No. 81A	Light Balancing No. 82A
3200 K Lamps	No. 80B + No. 82A‡	No. 82A	No filter needed	Light Balancing No. 82C
Clear Flash Bulbs (except SM and SF)	Photoflash Filter for Kodak Daylight Type Color Films (No. 80C)	Light Balancing No. 81C	No. 81C (see film instructions)	No filter needed
SM and SF Flash Bulbs	Not recommended	No filter needed	Not recommended	Light Balancing No. 82B

*With Kodak High Speed Ektachrome Film, Type B, use a No. 85B filter.

†This light source is not recommended for use with Kodak High Speed Ektachrome Film, Daylight Type, or daylight-type films designated for Process E-3.

‡This light source is not recommended for use with Kodachrome II Film, Daylight Type; Kodak High Speed Ektachrome Film, Daylight Type; or daylight-type films designated for Process E-3.

Kodacolor Film is intended for exposure in daylight or with clear flash bulbs and does not require the use of filters with these light sources. However, either source should be used alone, not mixed with illumination differing in color quality. Blue flash bulbs should not be used indoors as the sole light source, but they are recommended for softening shadows when nearby subjects are photographed in bright sunlight.

Kodak Ektacolor Film, Type L (long exposure), is balanced for exposure with 3200 K lamps. Filter suggestions for other commonly used light sources are packaged with the film. Filter suggestions for Type S (short exposure) film are also given in the instructions packaged with the film.

under humid conditions involves mechanical air conditioning with fully automatic relative humidity control. However, the installation of a suitable air-conditioning system costs several thousand dollars. Such an expense is usually justified only in laboratories where air conditioning will also be an aid to normal operations or in buildings in which it is also necessary to preserve a large number of valuable processed films.

An alternative is an electrically operated refrigerating dehumidifier controlled by a humidistat. This type of installation provides less accurate control of humidity, but is adequate for dehumidifying a single room, and the cost is measured in hundreds rather than thousands of dollars. Suitable units are available from Frigidaire Division, General Motors Corporation, Dayton 1, Ohio; Fresh'nd-Aire Company, Division Cory Corporation, 3200 West Peterson Avenue, Chicago 45, Illinois; and Walton Laboratories, 1186 Grove Street, Irvington 11, New Jersey.

When no automatic method of humidity control can be adopted, an inexpensive expedient is the use of silica gel with manual reactivation.

Use of Silica Gel. Activated silica gel is an efficient desiccating agent for drying films, and is supplied in bulk by a number of chemical supply houses. Prepared drying units such as Davison Silica Gel Air Dryers are also available from some photographic dealers and (by the dozen) from the Davison Chemical Corporation, Baltimore 3, Md. These are perforated metal containers holding about 1½ ounces of silica gel, with a color indicator which turns from blue to pink when the desiccant needs reactivation.

Silica gel lasts indefinitely and can be reactivated by heating to a temperature between 300 and 400 F in a vented oven or over a fire. In this temperature range, ½ hour is sufficient to reactivate small quantities; large quantities require 2 or 3 hours. To prevent reabsorption of moisture, allow the hot silica gel to cool in a closed metal container. Then, if the desiccant is not to be used immediately, seal the container.

For drying from equilibrium at 80 percent to equilibrium at 40 percent relative humidity, Kodak color films require approximately the amounts of freshly activated silica gel given in the following table. Larger sizes or quantities of film, or more humid conditions, require proportionately greater amounts. The drying time depends primarily

Quantity of Kodak Color Film	Quantity of Silica Gel	Approximate Drying Time
10 sheets 5 x 7-inch (plus interleaving paper and cardboard stiffeners)	1 oz	1 week
20 rolls 620 or 120	5 oz	2 weeks
20 magazines 135 or rolls 828	1 oz	2 weeks
10 rolls 16mm x 100 feet	5 oz	2 weeks

on the bulk and form of the film; it can be shortened somewhat by doubling or tripling the listed amounts of silica gel.

Calcium chloride is not recommended as a desiccant because it dusts when dry, liquefies when moist, and is corrosive. Rice dried by browning in an oven or dried tea leaves can be used, but they have only about one-eighth the moisture absorbency of silica gel.

Desiccating Procedure. Drying is best carried out by placing the film and desiccant in a lighttight metal container which can be hermetically sealed by a friction lid, rubber gasket, or adhesive tape. If the desiccant is in bulk form, use a porous separator, such as thin paper or fine muslin, to prevent dust from reaching the film. An alternative is to solder the bottoms of two cans together all the way around. Punch holes through the two bottoms; place the film in one section and the desiccant in the other; and seal both compartments.

The cardboard stiffeners in the film package should also be dried if they are to be repacked with the film. Magazines of 135 film, spools of 828 film, and rolls of motion-picture film should be removed from their individual cans before they are placed in the desiccating chamber. Space should be left between the film units to permit air circulation.

After drying, the films can be resealed in the original container or some other moisture-tight can having a secure closure. In the case of sheet film, aluminum foil wrapping is satisfactory if the ends are folded double and all joints are sealed with waterproof adhesive tape.

Films to be shipped to a processing laboratory should not be delayed unnecessarily for drying, but should be shipped together with drying units inside a sealed can. Desiccants in bulk form should not be shipped with the film because of the danger of dust.

CARE OF PROCESSED FILMS

All dyes are fugitive to some extent. The dyes used in Kodak color films are as stable as is consistent with the optical and chemical requirements of the color processes. The primary factors affecting their life are moisture, light, and heat. For maximum permanence, processed color films should therefore be stored where it is dry, dark, and cool. Small amounts of acidic gases, such as hydrogen sulfide and sulfur dioxide, sometimes present in the air in industrial regions, may cause slow fading of dyes. Where these contaminants are known to occur, films should be protected from them. Color films should never be stored with films on nitrate base, which gives off acidic gases as it decomposes.

Protection from Heat and Humidity. Processed films should be stored on the main floors of buildings; never in basements, which may be damp, nor in attics, which may be hot. A relative humidity of 25 to 50 percent

and a temperature of 70 F or less are best. A relative humidity under 25 percent should be avoided with motion-picture films, because excessive brittleness may result. Color films should never be humidified purposely, except under carefully controlled conditions.

It must be emphasized that *high relative humidities are more dangerous than elevated temperatures*, because of the possibility of fungus growth. In localities where inside relative humidities of 60 percent or higher prevail, it may be advisable to build a moistureproof box in which to store a film collection with silica gel. Make the box of metal, or wood lined with metal, sealing all joints with solder or by other means. Provide a rubber gasket to make a tight-closing lid, and arrange the films to permit adequate circulation of air within the box.

Protection from Physical Damage. Color transparencies and negatives should be kept as clean and dust-free as possible. They should never be touched with the fingers except at the edges. Sheet- and roll-film originals should be kept in transparent Kodapak Sleeves, which are sold by Kodak dealers for protection against dirt and finger marks. At relative humidities above 60 percent (not a recommended condition), shiny spots may occur on the emulsion surface of an original stored in contact with a sleeve or, in fact, any smooth surface.

Although the spots are generally not visible in prints, they can, if desired, be considerably reduced by washing and drying the original. Keep the water between 65 and 75 F and limit the washing time to a few minutes. Then treat the film as directed in the step before drying in the processing instructions, drain it carefully, and dry it.

If Kodapak Sleeves are not used, roll-film originals are best stored in envelopes with side seams. The paper and adhesive should meet the requirements of American Standard PH4.20-1958. A variety of containers for 2 x 2 and stereo slides are offered by Kodak dealers.

Color films can be protected from fingerprints, light scratches, and to a considerable extent from fungus damage by use of a suitable protective lacquer. A lacquered surface is more readily cleaned, and in cases of minor damage it is possible to restore the surface by removing the old lacquer and applying new (see next section). In Kodak processing laboratories, 2 x 2 and stereo slides are lacquered on the emulsion side; Kodacolor negatives are lacquered on both sides.

Color films should not be stored in the presence of moth-preventive chemicals, such as paradichlorobenzene, which tends to crystallize on the films and which may damage the adhesive used in mounts. Paraformaldehyde, often used for protection against fungus growth, may seriously affect color balance. The solvents and chemicals used in insecticidal and fungicidal sprays may be harmful to films and mounts.

On the other hand, insects such as book lice and silverfish sometimes attack emulsion surfaces, especially when films are stored near old books.

Cleaning Transparencies and Negatives. Light dust or lint particles can be removed from color films with a clean, dry, camel's-hair brush. Light fingerprints or oily smudges can be removed by applying Kodak Film Cleaner sparingly on a plush pad or a wad of cotton.

If the protective lacquer on a transparency or negative has become scratched or marred, it should be removed before the film is relacquered. Most Kodachrome transparencies and Kodacolor negatives that have been processed by Kodak laboratories are coated with a lacquer which is removable in a 3 percent solution of sodium bicarbonate. Dissolve 30 grams in a liter of water or a level tablespoonful in a pint of water. Using the solution at 60 to 70 F with agitation, treat a Kodachrome transparency for 1 minute, or a Kodacolor negative for 4 minutes. Then rinse the film for 1 minute in cold running water at 60 to 70 F, preferably about 60 F; bathe it in Kodak Photo-Flo Solution or wipe it carefully with a soft viscose sponge; and hang it up to dry in a dust-free place. When the film is completely dry, apply Kodak Film Lacquer as directed on the label.

Projection of Slides. The projection life of a color slide depends upon the amount of light and heat from the projection lamp falling on the slide and upon the total continuous and intermittent projection time. Color slides can be projected many hundreds of times without appreciable change, but prolonged projection with high-wattage lamps will shorten the life. Projection times longer than 1 minute should be avoided. The heat-absorbing glass should never be removed, and a lamp of higher wattage than recommended for the projector should not be used.

When glass-bound slides are used in high-wattage projectors, moisture may condense on the inside of the glass. This difficulty can usually be eliminated by storing slides with activated silica gel.

CRITICAL USE

WHENEVER he requires the best possible results, the user of Kodak color films should make a test exposure. The reasons why a test exposure is necessary and the technique of interpreting the test result are the subject of this section.

In preparing the following material, an attempt has been made to explain, in logical fashion, some of the aspects of professional work with color films that frequently confuse the practical photographer. The principles involved are actually quite simple. Failure to understand them properly can lead to misunderstanding of photographic results. Comprehending these principles will help the practical photographer handle color materials with greater skill.

Here, listed in the order of the time that they may occur, are the principal causes of speed and color-balance variations:

1. Manufacturing variations among different emulsion numbers.
2. Adverse storage conditions before exposure.
3. Illumination of incorrect color quality.
4. Differences in sensitivity with changes in illumination level and exposure time.
5. Variations in equipment (lenses, shutters, exposure meters, etc).
6. Adverse storage conditions between exposure and processing.
7. Nonstandard processing conditions.
8. Nonstandard viewing conditions.
9. Differences in personal judgment.

All except the first are beyond the scope of manufacturing control, and their effects cannot be predicted accurately. Also, the variations encountered in practical use of the film are apt to be a great deal larger than those permitted by manufacturing tolerances. These are the basic reasons why a test exposure should be made whenever speed and color-balance requirements are critical. A test exposure is even more essential in the case of reversal materials than in the case of color-negative materials, because with a reversal film it is not possible to make the density and color-balance adjustments that are permitted by a negative-positive system of color reproduction.

Some causes of variation are more generally understood than others. For example, most professional photographers realize the perishable nature of sensitized materials and are careful to avoid subjecting color films to heat and humidity, either before or after exposure. On the other

hand, all of the factors listed are important, whether familiar or not. No one of them should ever be overlooked in attempting to determine the cause of trouble when it occurs.

The photographer should also realize that two or more causes of variations may influence his results at the same time. To a considerable degree, the effects are additive, and when they occur in the same direction, transparencies are likely to be unsatisfactory unless proper compensation is made in advance. Only a test exposure under practical conditions of use will furnish the necessary information.

Detailed recommendations on storage can be found on pages 21-28. Other causes of speed and color-balance variations are discussed below.

MANUFACTURING VARIATIONS

A SPEED variation of 20 percent or more passes unnoticed in practical use of a black-and-white film. In a color film, where the performance of each emulsion layer is evaluated in terms of the other two, a much smaller variation in the speed of any one layer relative to the other two is immediately evident to the user.

Coating thickness is only one of the variables that must be controlled, but it provides some indication of the technical difficulties of making color films. Tests have shown that the thickness of each emulsion layer must be controlled within 4 or 5 percent; any larger variation would by itself use up the entire color-balance tolerance available.

Since a typical color emulsion is only 3 ten-thousandths of an inch thick, the net result is that a variation of 15 *millionths* of an inch is all that is allowable. And this kind of accuracy must be maintained in making successive coatings on a thin, flexible support in the dark!

Although every effort is made to achieve the greatest possible uniformity in the manufacture of Kodak color films for professional use, minor variations in the characteristics of any one product are unavoidable. Such variations are, of course, smallest among films of the same emulsion number.

Manufacturing Tests. At Kodak, the standardization of manufacturing operations is supplemented by an extensive testing and quality-control program. Only film that comes within narrow tolerances of matching the production aim point is shipped from the manufacturing plant.

The actual manufacturing specifications of quality tolerances are expressed in sensitometric terms, and necessitate measurements of such characteristics as speed, fog, contrast, color-contrast match, and maximum density. The basic requirements are, however, that the films conform at the time of shipment to the speed and color-balance standards stated on page 31, and that they have normal keeping characteristics.

Differences in keeping characteristics among the various color-film products result in different expiration dating periods for different products.

Production tests are made at normal room temperature with illuminants equivalent in color quality to 3200 K tungsten lamps for Type B and Type L films; to photoflood lamps for Type A film; to clear flash bulbs for Type F and Type S films; and to average sunlight plus skylight for Daylight Type films. An exposure time of 5 seconds is used with Type L film; ½ second with Process E-3 Type B film; 1/50 second with Type S film; and 1/25 to 1/100 second with the various types of roll-film products. These times are considered representative of the major applications of the films. In all cases, films are processed in accordance with instructions.

Speed Tolerances. The manufacturing tolerances for Kodak color films for use in cameras require that each emulsion number fall within ½ stop of the rated speed. The pictures at the top of page 38 show the maximum variations in results that are to be expected from reversal films if no allowance is made for speed variation from the standard. Both the slow emulsion shown at the left and the fast emulsion shown at the right would look like the normal shown in the center with ½ stop more or less exposure.

Color-Balance Tolerances. The sensitivity of human vision to small color differences varies somewhat with the direction of the hue shift from the aim point. For this reason, the color-balance variation permitted in the manufacture of Kodak color films cannot be stated simply.

With Kodachrome and Kodak Ektachrome Films, however, the color-balance variations fall approximately within the range that can be corrected by one of the Kodak Color Compensating Filters CC10 over the camera lens. The range of these filters is illustrated on page 38.

In the case of Kodak Ektacolor Films, the color-balance variations fall within a range for which adjustment can easily be made in the printing process.

Supplementary Data. In order to provide the user with specific information, instructions giving effective speeds for individual emulsion numbers are packaged with Kodak Ektachrome Films in sheets and Kodak Ektachrome Professional Roll Film, Daylight Type. Also included with the Daylight Type films is a filter suggestion for exposures with electronic flash tubes. The supplementary data sheet packaged with the Type B film also gives speeds and filter suggestions for long exposure times.

Many photographers tape the supplementary data sheet to the outside of each box of sheet color film at the time it is opened. In this way, the information is kept available as long as the film is being used.

COLOR QUALITY OF ILLUMINATION

Most serious color workers are well aware that the films they use are balanced in manufacture for exposure to light of a certain color quality. Color-negative materials have considerable latitude in this respect, depending on how they are printed. With a transparency material, however, compensation must be made by use of a filter whenever the light source differs in color quality from that for which the film is balanced. Photographers sometimes fail to realize that light may be changed appreciably in color quality as it passes from source to subject to film. Discolored or dirty reflectors, greenish condenser lenses, and camera lenses that are tinted yellow or some other hue are all potential causes of off-color results.

ILLUMINATION LEVEL AND EXPOSURE TIME

Although it might reasonably be supposed that 1 unit of illumination falling on a film for 100 seconds would produce the same effect as 100 units of illumination for 1 second, this is not necessarily the case. As a practical matter, the effective sensitivity of a photographic emulsion varies with the illumination level and exposure time. This phenomenon is sometimes referred to as the "reciprocity effect."

At some particular illumination level, the effective sensitivity is at a maximum. A much lower illumination level has less effect, even though compensated by a corresponding increase in the exposure time. By the same token, a much higher illumination level also shows less effect, even though compensated by a correspondingly short exposure time.

With black-and-white films, the tendency toward loss of speed at abnormally low or high illumination levels is usually unimportant, because of wide exposure latitude. With reversal color films, the situation is entirely different. Allowance must be made not only for over-all loss of speed but also, by means of filters, for the change in color balance caused by differences in the amount of the speed change in the three emulsion layers.

A particular emulsion might give a result like that shown at the upper left of page 39 when exposed at a normal illumination level. If exposed at a low or very low illumination level without compensation for speed and color-balance changes, it might give results like the other pictures on the left-hand side of page 39. In this particular case, the balance tends to go bluish by approximately the equivalent of a Kodak CC10B Filter at a very long exposure time. The supplementary data sheet included with the film therefore suggests use of a Kodak CC10Y Filter when the exposure time must be as long as 30 seconds.

Suppose, however, that instead of being perfectly average or normal

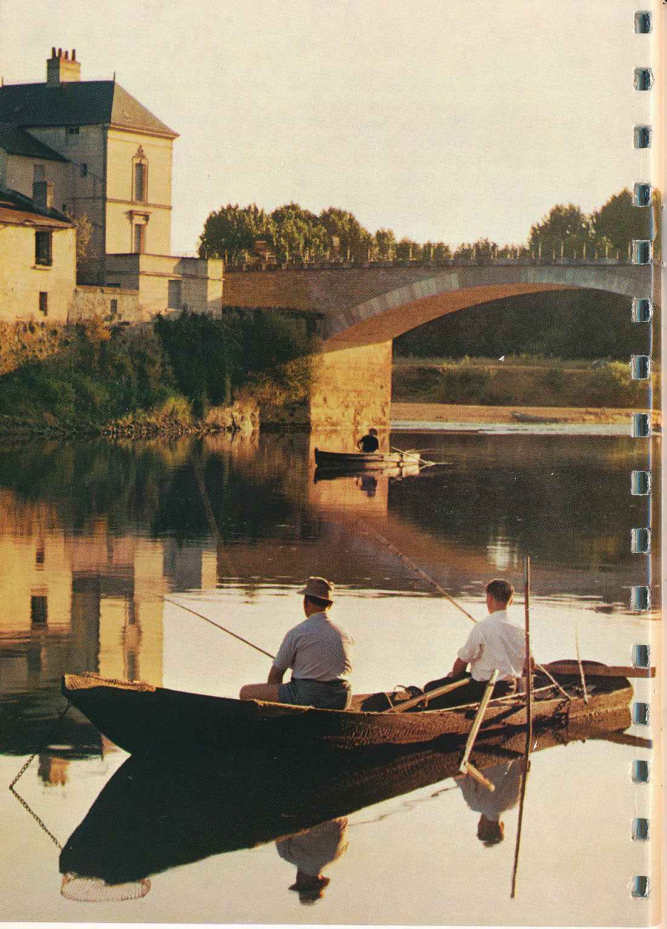
in color balance at a normal exposure time, this same emulsion tended to give yellowish results (still within the manufacturing tolerance range). Now, if the photographer used the CC10Y filter without making a test exposure first, he would get yellowish results and perhaps feel that the manufacturer had given him the wrong filter recommendation. What he might fail to realize is that the suggested filter is intended only to compensate for the effect of the low-level illumination. In other words, it is intended to help him produce essentially the same color balance at the long exposure time that he would obtain without a filter at the normal exposure time of ½ second. Unless the photographer evaluates, by means of a test exposure, the effect of the other possible causes of color-balance variation, he is not on solid ground in judging any filter recommendation or suggestion.

Determining Exposure Time. Frequently, long exposure times are occasioned by the necessity of using a small lens opening to get the required depth of field. In this situation, the lens cannot be opened up to compensate for the loss of film sensitivity at the low level of illumination falling on the film. Therefore, the exposure time must be lengthened. For the convenience of the photographer, the supplementary data sheet for Kodak Ektachrome Film, Type B, and the instruction sheet for Kodak Ektacolor Film, Type L, provide effective exposure indexes which take into account the loss of speed at low illumination levels. With a little experience, it is easy to estimate the time range into which the final exposure will fall. Calculating the proper exposure time at the desired lens opening is done by setting the exposure-meter calculator at the effective film speed for the approximate exposure time selected.

It is, however, necessary to make additional allowance for bellows extension whenever the subject is closer than eight times the focal length of the lens. Under these circumstances, the *f*-value shown by the lens-opening pointer no longer indicates the effective aperture. If this factor is ignored, an exposure error is introduced; for example, if the bellows is extended to produce 1:1 magnification, the underexposure will be equivalent to two camera stops.

The Kodak Master Photoguide, sold by Kodak dealers, shows effective *f*-values directly, providing the lens-to-film distance is measured. Some exposure meters are equipped with calculator dials which also enable effective *f*-values to be determined without computation. If the camera back is used in a fixed position, it may be convenient to equip the camera bed with a scale marked off in fractions of a stop. When the best focus position is determined, the *f*-value correction is obtained.

At very low illumination levels, the effective contrast of a photo-



LATE AFTERNOON FISHING ON THE RIVER VIENNE, FRANCE, WAS PHOTOGRAPHED ON KODAK EKTACOLOR FILM, TYPE S, BY LEE HOWICK, EASTMAN KODAK COMPANY.

graphic emulsion increases appreciably. For this reason, it is usually desirable to keep the lighting contrast (ratio of main light plus fill-in to fill-in alone) as low as possible.

Filter Compensation. As previously mentioned, filter suggestions for low illumination levels are given for exposure times of 5 and 30 seconds. At first glance, it might seem that the midpoint between 5 seconds and 30 seconds should be 17½ seconds (the arithmetic mean). For purposes of determining which filter suggestion to use, however, about 12 seconds (the geometric mean) should be regarded as the midpoint. The reason is that 12 seconds differs from 5 seconds and 30 seconds by the same factor, about 2½.

In general use, 30 seconds represents a practical limit; if exposure times beyond this are considered, pretesting may be necessary. It is not advisable to increase the strength of the filter further unless a practical test indicates the desirability of doing so.

PROCESSING CONDITIONS

Departures from recommended processing conditions may affect any or all of the characteristics of the image, and the changes may be different for different emulsion numbers of the same type of film. Even with the best control procedures, noticeable variations in color quality and effective film speed may be found among different laboratories, and from time to time within any one laboratory. Experience indicates that typical processing may involve speed variations of up to ½ stop plus or minus and color-balance variations of the order of a CC10 filter. The illustrations on page 38 show the magnitude of these variations.

Suppose, now, that an emulsion is reddish in color balance (but still within normal tolerances) at the time of shipment from the manufacturing plant. With ideal processing, it will give results like the picture at the upper right of page 39. In the unfortunate but not at all unlikely case that the processing also happens to be in the reddish direction, a result like the second picture will be obtained. Here the redness of the emulsion and the redness of the processing have reinforced each other to give a transparency that is too red to be satisfactory.

On the other hand, there is the possibility that the processing may be in the cyan direction and give a result like the picture at the lower right. Here the red balance of the emulsion and the cyan balance of the processing have cancelled each other, and the outcome is very satisfactory.

In practice, of course, the net effect of color-balance variations may be neither a straight reinforcement nor a cancellation. For example, an emulsion tending toward magenta in a process tending toward cyan would give a definitely blue result.

VIEWING CONDITIONS

THE conditions under which a color picture is viewed may have a marked effect on the apparent quality of the reproduction. A standard illuminator, such as the Kodak DeLuxe Transparency Illuminator, Model 2, should be used to judge transparencies intended for either photomechanical or photographic color reproduction. To be satisfactory, an illuminator must in general: (1) have a color temperature somewhere around 3800 K; (2) emit adequate amounts of light in the blue, green, and red regions of the spectrum which are related to the absorptions of the subtractive dyes used in color films; and (3) have a brightness of at least 100 candles per square foot.

In critical use, transparencies intended for projection should be judged by projection. Similarly, transparencies that are to be viewed on nonstandard display illuminators should be judged on the type of illuminator that is actually to be used and with surroundings which are similarly illuminated.

PERSONAL JUDGMENT

THE reproduction of a physical scene by means of a color transparency involves psychological factors in the response of the observer and therefore can never be "perfect" in any simple sense.

Like all subtractive materials, Kodak reversal color films exhibit color distortions whenever a transparency is critically compared with the original subject. In general, these distortions are insignificant and the photographic results are pleasing. In any specific case, however, satisfaction with the result is determined by the nature of the subject and the intentions of the photographer.

Since both of these factors are subject to wide variation and since the color balance of the manufacturing aim point is determined by the judgment of picture tests by a number of observers, it is obvious that an individual photographer may prefer a color balance which is quite different from that which the manufacturer considers acceptable. An important consequence of this fact is that *the manufacturer cannot specify a filter to be used for "normal" color balance on a specific emulsion*, even by ignoring the effects of adverse storage conditions, illumination of incorrect color quality, nonstandard processing conditions, and the various other factors that could affect the color balance of the results.

Basis of Filter Recommendations. Kodak recommendations and suggestions for the use of filters are based on practical picture tests. With the one exception of filters for electronic flash, the reference standard is an unfiltered picture made under the illumination for which the film

is balanced in manufacture (see page 31). This procedure eliminates personal color-balance preferences as a factor in judging the results obtained through the various filters being tested. It also eliminates the effects of normal variations in color balance from one emulsion number to another.

As previously indicated, many photographers prefer color balance that differs from the average determined by a group of observers. This fact must be taken into account in evaluating the merits of a filter recommendation or suggestion. For example, a photographer who likes warm color balance may find his results in flash pictures on Type B film are too cold. Before disagreeing with the filter suggestion, he should consider the strong possibility that he would not have liked any better an unfiltered picture taken with 3200 K lamps.

CONSUMER TESTS

IN view of the variations which cannot be evaluated by manufacturing tests and the possible extremes in individual working conditions, critical work with color films should be preceded by a test made as closely as possible under the conditions of final use, if possible on the actual subject. With reversal color films, such a test will indicate more reliably than any possible recommendation the proper color-correction filter and exposure for the subject at hand. The test should always be made on film of the same emulsion number as that to be used for the final exposure, kept under similar conditions before and after exposure. The emulsion number is stamped on each film box, and it is embossed on the code-notched edge of each sheet of film (except sizes narrower than 3¼ inches). The exposure time, light source, and processing conditions should be identical with those planned for the final work.

If the color balance of a test transparency on a reversal film is unsatisfactory, a first approximation toward finding the proper correction filter consists in selecting a Kodak Color Compensating Filter which gives a satisfactory appearance to the transparency when placed over it on a standard illuminator, such as the Kodak DeLuxe Transparency Illuminator, Model 2. For the most critical work, a confirming photographic test should be made with the filter so selected.

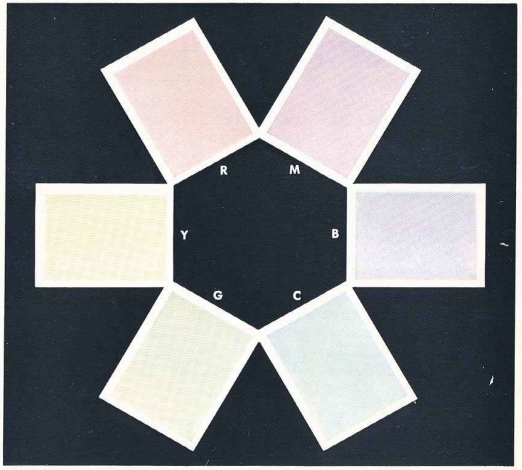
INSTRUCTION SHEETS

THE exposure and filter recommendations in instruction sheets and Data Sheets (see center section) are made for average emulsions and average conditions of use. They are based on extensive practical tests under the conditions specified, and in each case the results are compared with those obtained under the manufacturing test conditions.

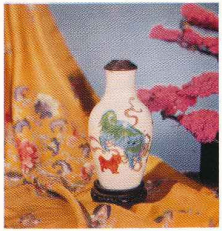
Made on film that was ½ stop slow, without exposure increase.

Made with normal exposure on an emulsion of normal speed.

Made on film that was ½ stop fast, without exposure decrease.

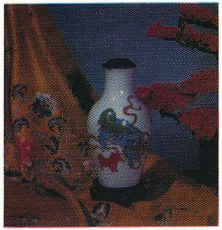


The Kodak Color Compensating Filters of CC10 strength. The color-balance variations permitted in the manufacture of Kodachrome and Kodak Ektachrome Films fall approximately within the range that can be corrected by using one of these filters over the camera lens.



Normal speed and color balance were obtained at a normal studio light level.

Without extra compensation, a long exposure with less light gave this result.



With even less light, the same emulsion was still bluer and badly underexposed.

Though within tolerances, this emulsion tended toward reddish balance.

Here reddish processing intensified the reddish balance of the emulsion.

Here cyan processing cancelled reddishness to give good color balance.

It should be borne in mind, however, that since each film is actually manufactured to give best results under one particular set of conditions, it may not give equally good results under other conditions.

Improvements in products and processes are constantly being made, with the result that published recommendations must be changed from time to time if they are to be of maximum value to the user of the film. Since it is impractical to change all publications simultaneously, discrepancies in recommendations occasionally occur. While both instruction sheets and Data Sheets are dated, the instructions packed with the film in use should be considered as the primary source of information.

To help the user of color films in sheet form to note changes in recommendations, instruction sheets for these materials are printed on paper of a different color whenever important changes are made. Careful rereading of the instructions is urged whenever an instruction sheet of a new color makes its appearance with the film in use.

COMBINING COLOR FILTERS

A COMMON source of difficulty in the exposure of color films is uncertainty as to how the various color-compensating filters should be added and subtracted to arrive at the simplest combination. There are two reasons why the number of separate filters used together should always be held to the minimum: first, to prevent scattering of light from impairing the definition of the pictures; and second, to eliminate neutral density, which serves only to increase the exposure without accomplishing any color correction.

If the color balance of a test transparency is not satisfactory, the extent of the filtering required to correct the color balance can be estimated by viewing the transparency through Kodak Color Compensating Filters. These filters are available in six colors: yellow, magenta, cyan, red, green, and blue. Each color is available in six densities: .05, .10, .20, .30, .40, and .50. The cyan, yellow, magenta, and red filters are also available in a density of .025.

The determination of filter combinations can usually be simplified by thinking of all the filters in terms of the subtractive colors. Bear in mind these relationships:

Red (absorbs blue and green) = yellow (absorbs blue) plus magenta (absorbs green)

Green (absorbs blue and red) = yellow (absorbs blue) plus cyan (absorbs red)

Blue (absorbs green and red) = magenta (absorbs green) plus cyan (absorbs red)

The following method of calculation is recommended:

1. Convert the filters to their equivalents in the subtractive colors—cyan, magenta, and yellow–if they are not already of these colors (for example, 20R = 20M + 20Y).

2. Add like filters together (for example, 20M + 10M = 30M).

3. If the resulting filter combination contains all three subtractive colors, cancel out the neutral density by removing an equal amount of each (for example, 10C + 20M + 20Y = 10M + 10Y + 0.10 neutral density; the neutral density can be eliminated).

4. If the filter combination contains two different filters of equal density, substitute the equivalent single red, green, or blue filter (for example, 10M + 10C = 10B).

Example: Suppose a test transparency was exposed with a Kodak CC10R Filter over the lens. On a Kodak DeLuxe Transparency Illuminator, Model 2, however, the test transparency is distinctly magenta in color balance. When viewed through a Kodak CC10G Filter, the transparency appears satisfactory in color balance. The problem, then, is to combine a CC10R and a CC10G.

Proceed as outlined above. First, convert the filters to subtractive terms:

CC10R	is equivalent to	CC10Y + CC10M
CC10G	is equivalent to	CC10C + CC10Y

The sum of the filters is CC10Y + CC10M + CC10C + CC10Y.

The presence of yellow, magenta, and cyan filters in the total means absorption of blue, green, and red, or in other words, neutral density. Since these filters are all the same strength, they can simply be cancelled out, leaving only CC10Y. This is the filter that should be used in exposing the final transparencies.

Of course, many determinations do not resolve themselves so easily, and the final combination may include two or even three filters. However, the four-step procedure given above is always applicable. Following it carefully will prevent the use of the wrong filters or a combination of filters heavier than necessary to obtain the desired color-balance adjustment.

Filter calculations can also be carried out conveniently with the CC Filter Computer, a dial-type calculator in the *Kodak Color Dataguide*, sold by Kodak dealers.

Exposure Increases for Filters. When the final transparencies are exposed, allowance must be made for any change in illumination caused by a change in the filters used. The published exposure increases for Kodak CC Filters provide a rough guide to the exposure adjustments required for a single filter. The exposure increase for two or more filters of different colors is best determined by practical test.

VIEWING TRANSPARENCIES

THE light from an illuminator for viewing positive color transparencies should appear "white" to the eye. An illuminator having fixed color quality cannot appear white under all of the various conditions of room illumination encountered in practice. On the other hand, a close approximation of the desired white appearance is obtained by using light of a color quality intermediate between that of a tungsten lamp and that of sunlight. A color quality equal to that of a black body at 3800 to 4000 K is satisfactory under most conditions.

In a dark room or in a room illuminated primarily by tungsten lamps, a color quality equal to that of a black body at a temperature as low as 3200 K can be used successfully. However, if some daylight enters the room, such an illuminator usually looks too yellow.

Actually, the color of the illuminator is not its most important characteristic. The primary requirement is that the illuminator emit light containing adequate amounts of energy in the blue, green, and red regions of the spectrum which are related to the blue, green, and red absorptions of the subtractive dyes used in the film. The spectral energy distribution of a black body at about 3800 K provides the desired blue, green, and red components and can be achieved by filtering the light of a tungsten lamp, as is done in the Kodak DeLuxe Transparency Illuminator, Model 2.

Another practical solution to constructing transparency illuminators is the use of suitable fluorescent lamps—including Macbeth Avlite, General Electric DeLuxe Cool White, Sylvania DeLuxe Cool White, and Westinghouse DeLuxe Cool White—in which the spectral energy distribution has been adjusted to give approximately the desired effect.

Kodak Opalized Glass or Kodak Background Sheeting is recommended for providing diffusion at the viewing surface of the illuminator without serious loss of light or changes in its color quality.

The illuminator should have a brightness of at least 100 candles per square foot. This value is satisfactory if the illuminator is to be used in a dimly lighted room; values up to about 160 candles per square foot may be desirable in a room into which a large amount of daylight enters. Kodak Pamphlets No. E-55, *Mounting and Displaying Large Color Transparencies and Prints*, and No. E-58, *Preparing Display Transparencies on Kodak Ektacolor Print Film*, discuss transparency illumination further and are available on request from the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.

PRINTS AND DUPLICATES

BELOW are described the various types of prints from color originals which can be made by use of Kodak materials or which are supplied by the Eastman Kodak Company on orders placed with Kodak dealers.

PRINTS FROM POSITIVE TRANSPARENCIES

Kodak Dye Transfer Process permits full-color photographic prints of excellent quality. Contact-size or enlarged color-separation negatives are first made from the transparency through red, green, and blue filters, as described in Kodak Pamphlet No. E-64, *Color Separation and Masking*, available on request from the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y. Each negative is then contact-printed or enlarged through the base of a separate sheet of Kodak Matrix Film. After development, the matrix films are washed with hot water to remove the gelatin in the unexposed areas, leaving on each matrix a positive relief image of gelatin.

After drying, the matrices are soaked in cyan, magenta, and yellow dye baths, and each absorbs dye in proportion to the thickness of the relief image. A color print is produced when the dye images are transferred, in register, to a sheet of Kodak Dye Transfer Paper, which is supplied in two surfaces, F and G, double weight only.

A high degree of control is provided the color worker throughout the process; both contrast and color balance can be adjusted to give the desired result. Complete instructions are contained in the Color Data Book *Kodak Dye Transfer Process*.

Kodachrome Prints and Enlargements are full-color photographic prints which are made from positive transparencies on orders placed through Kodak dealers. The table on the following page summarizes the various sizes available.

Kodacolor Prints and Enlargements (see page 48) are supplied from mounted 24 x 36mm, 28 x 40mm, 23 x 24mm (stereo), 24 x 24mm, 1⅝ x 1⅝-inch, and 2¼ x 2¼-inch Kodachrome and other color transparencies. A Kodacolor negative is made from the original. This negative is then printed to the desired size.

Kodak Ektachrome Paper is a multilayer paper designed for direct printing or enlarging from positive color transparencies. It is supplied in rolls and in sheets.

Exposure of this reversal material is made with white light modified by color-compensating filters to give satisfactory color balance. For

best results, filters such as the Kodak Wratten No. 2E and the Kodak Infrared Cut-Off Filter, No. 301, are also used. The first absorbs ultraviolet radiation; the second, a multiple-layer interference filter on glass, reflects unwanted long-wavelength radiation while transmitting light of the desired quality for color printing.

Kodak Ektachrome Paper can be processed with Kodak Color Print Processing Chemicals, Process P-111. Mixing directions and complete processing instructions are included with the chemicals. The chemicals are supplied separately in quantities to make 3½, 10, and 25 gallons.

SIZES OF KODAK COLOR PRINTS AND ENLARGEMENTS FROM TRANSPARENCIES

From:	You Can Order:
Standard miniature transparencies (24 x 36mm and 28 x 40mm)	Kodachrome Prints 2X (2½ x 3¼) and 3X (3½ x 5, including ¼-inch white borders) Kodachrome Enlargements 5 x 7 and 8 x 10 Kodachrome Enlargements, Special Sizes, up to and including 8 x 10 inches Kodacolor Prints Kodacolor Enlargements 5 x 7, 8 x 10, 11 x 14, 5 x 5, 7 x 10, 8 x 8, and 11 x 11
Super Slides (1⅝ x 1⅝-inch) and 2¼ x 2¼-inch transparencies (mounted or unmounted)	Kodacolor Prints Kodacolor Enlargements 5 x 7, 8 x 10, 11 x 14, 5 x 5, 7 x 10, 8 x 8, and 11 x 11
Stereo (23 x 24mm) and 24 x 24mm transparencies exposed on 35mm film	Kodacolor Prints Kodacolor Enlargements 5 x 7, 8 x 10, 11 x 14, 5 x 5, 7 x 10, 8 x 8, and 11 x 11 Kodachrome Prints 3X (3 x 3⅜) Kodachrome Enlargements 5 x 7 and 8 x 10 Kodachrome Enlargements, Special Sizes, up to and including 8 x 10 inches
Half-frame (18 x 24mm) transparencies and standard areas of roll- or sheet-film transparencies up to and including 4 x 5 inches	Kodachrome Prints 3X (3 x 4⅜) Kodachrome Enlargements 5 x 7 and 8 x 10 Kodachrome Enlargements, Special Sizes, up to and including 8 x 10 inches
8mm or 16mm motion-picture frames (color printing not recommended; original must be extremely sharp)	Kodachrome Enlargements, Special Sizes, up to 2¼ x 3¼ or 4 x 6 inches, respectively

Standard miniature (24 x 36mm and 28 x 40mm) and half-frame (18 x 24mm) transparencies must be mounted as regular 2 x 2-inch slides (in glass or cardboard). If received unmounted or in nonstandard mounts, such transparencies are mounted in standard cardboard mounts and a service charge is made.

Transparencies 24 x 24mm must be mounted as 2 x 2-inch slides by the customer. Stereo transparencies are accepted in regular stereo mounts, cardboard or glass. Sheet- or roll-film transparencies should not be in glass or cardboard mounts.

Occasionally, it is not possible to include all of the principal subject in a standard-size Kodachrome Enlargement of the size ordered. In such cases, a Kodachrome Enlargement, Special Size, is made from approximately the entire area of the transparency. From 24 x 36mm and 28 x 40mm transparencies, 5 x 7¼- and 7 x 10-inch enlargements are made instead of the regular 5 x 7- and 8 x 10-inch enlargements.

From square transparencies on roll film, stereo transparencies (23 x 24mm), and 24 x 24mm transparencies on 35mm film, a 5 x 5- or 8 x 8-inch Kodachrome Enlargement, Special Size, is made when objectionable cropping of the principal subject would occur in a regular 5 x 7- or 8 x 10-inch enlargement.

Kodachrome Enlargements, Special Sizes, are also made in accordance with special cropping requirements. The area to be enlarged should be indicated by masking tape or a paper overlay.

Kodachrome and Ektachrome Duplicates. Same-size duplicates are supplied from original color transparencies 24 x 36mm or smaller which

CUSTOMERS' KODACOLOR PRINTS COME OFF PRODUCTION DRYING EQUIPMENT AT KODAK LABORATORY.

are mounted in standard 2 x 2-inch mounts with central mask openings. Same-size duplicates are also supplied from either or both sides of mounted stereo pairs 24 x 36mm or smaller. Originals 28 x 40mm are reduced slightly so that the entire picture area is reproduced in the 24 x 36mm duplicate. Reduced-size duplicates (24 x 36mm) are available from 8 x 10 and smaller color transparencies.

Duplicates are not available from originals in strip form. They are made from transparencies in 2 x 2-inch mounts and are supplied in cardboard mounts except when they are ordered unmounted or when the original is smaller than 24 x 36mm.

Duplicates are also available from 8mm and 16mm Kodachrome originals. Orders for silent duplicates require no special preparation by the customer. However, a sound record submitted for printing must be either a 35mm or 16mm matched negative of high quality. To assure synchronization, the starting points on both the sound track and the picture film must be indicated clearly and accurately.

Stereo Mounting Service. If the service is requested when Kodachrome or Ektachrome Films are sent to a Kodak processing laboratory, standard 23 x 24mm pairs are mounted in cardboard stereo mounts. The spacing and size of the mount openings are generally suitable for viewing the pictures in hand viewers; extreme close-ups or pairs intended for stereo projection may require remounting.

Requirements for Reproduction. Sheet-film transparencies are generally intended for reproduction by photomechanical or other methods of color printing. Besides being suitable in pictorial respects, a transparency for reproduction must meet one essential technical requirement: It must show all important details clearly in both highlight and shadow areas. If the original was overexposed, highlight areas lack modeling and color saturation, and important details are lost. If the original was underexposed, shadow areas lack transparency, and important details are obscured by the maximum density of the film. Excessive lighting contrast may, of course, cause loss of detail at either or both ends of the tone scale.

Transparencies which appear satisfactory when viewed on an illuminator in a dimly lighted room do not necessarily print well, because they may contain a range of tones too great to be reproduced by any method of color printing. A closer approximation of the appearance of the picture which can be expected in a print is obtained by viewing the transparency in a brightly lighted room, without masking off the surrounding area of the illuminator surface.

For improved highlight detail in color prints, the original transparency should often be given slightly less than the normal exposure. The

most satisfactory results are obtained when the photographer works in close co-operation with the photomechanical worker or color printer who is to reproduce the transparencies. Photographers who are not familiar with the problems of color reproduction are urged to ask for and rely upon the advice of those experienced in this field.

Black-and-White Prints. Copy negatives of color transparencies from which black-and-white prints of high quality can be made are easily obtained by any of several methods: (1) Contact printing in a printing frame placed on the easel of an enlarger. With this arrangement, the enlarger furnishes a light source which can be controlled readily. (2) Enlarging the transparency onto a film held under glass on the easel. Care should be taken to prevent stray light from fogging the negative material. (3) Copying with a copying camera to make same-size or reduced negatives. This method requires a device by which the original can be transilluminated in front of the camera. All white light around the edges of the transparency should be masked off with opaque paper.

If the subject is to be reversed from left to right, as it would be in an original negative made with a camera, the copy negative must be exposed through the base of the transparency. Improved rendering of flesh tones can be obtained by use of the Kodak Wratten X2 Filter (No. 13). Contrast effects can be obtained by the use of other filters.

A panchromatic material should be used for the copy negative, and it should be developed to low contrast. Kodak Super-XX Panchromatic (Sheet) Film, developed in Kodak Developer D-76 for 5 minutes in a tray or 7 minutes in a tank at 68 F (20 C), is suggested. Improved tone reproduction can be obtained by using a highlight mask and single principal mask over the original as in Dye Transfer printing. In this case, the negative-development time should be increased enough to compensate for the contrast-reducing effect of the principal mask.

Color Internegatives. An intermediate color negative—such as one on Kodak Ektacolor Internegative Film or Kodak Ektacolor Film, Type L—made from a positive color transparency, can be used to prepare duplicate color transparencies on Kodak Ektacolor Print Film, color enlargements and contact prints on Kodak Ektacolor Paper, color prints by the Kodak Dye Transfer Process, photomechanical reproductions from either the negative or a color print, and black-and-white prints on Kodak Panalure Paper. The procedure for making internegatives on Kodak Ektacolor Film, Type L, is described in the Kodak Data Book, *Printing Color Negatives*. Information on the preparation of color internegatives on Kodak Ektacolor Internegative Film is available on request from the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.

PRINTS FROM COLOR NEGATIVES

Kodak Dye Transfer Process. Ektacolor and Kodacolor negatives are printed by the Dye Transfer Process in essentially the same manner as positive transparencies. However, the number of steps is reduced because the matrices can be printed directly from the negative. Kodak Pan Matrix Film is used, so that the required color separation can be obtained by exposing through red, green, and blue filters.

Kodak Ektacolor Print Film makes it possible to produce any size or quantity of color transparencies from an Ektacolor or Kodacolor negative. The quality of the results is generally better than can be obtained by direct duplication of an original positive transparency. Equally important, the amount of work and the expense of making transparencies on Ektacolor Print Film are substantially lower, as no supplementary masking procedures to correct the color rendering are necessary. Kodak Ektacolor Slide Film, available in 35mm x 100-foot rolls, can be used to make same-size transparencies from miniature color negatives or reduced-size transparencies from larger negatives.

Kodacolor Prints and Enlargements are full-color pictures on paper. They are made from Kodacolor negatives on orders placed through Kodak dealers. Kodacolor Prints 2R (2½ x 3½-inch) are made from standard 24 x 36mm or 28 x 40mm negatives only. Kodacolor Prints 3S (3½ x 3½-inch) are made from negative areas which are 1⅝ x 1⅝ inches and 2¼ x 2¼ inches. Kodacolor Prints 3R are available from standard-size rectangular negative areas, 24 x 36mm through 2½ x 4¼ inches. Prints are also made from cropped areas of negatives, provided the cropped area corresponds to a smaller standard negative size.

Kodacolor Enlargements are supplied in six standard sizes: 5 x 7, 8 x 10, 11 x 14, 5 x 5, 7 x 10, 8 x 8, and 11 x 11 inches. There is no additional charge for cropping a negative to a size indicated on the Kodak Enlarging Masking Guide.

The Kodacolor Process affords attractive color prints and enlargements at low prices. These products are intended principally for the amateur photographer.

Kodacolor Transparencies (24 x 36mm and 31 x 31mm) can be ordered through Kodak dealers. The 24 x 36mm transparencies are mounted in 2 x 2-inch mounts and are made from 24 x 36mm or 28 x 40mm Kodacolor negatives. The 31 x 31mm transparencies, also mounted in 2 x 2-inch mounts, are made from 1⅝ x 1⅝-inch or 2¼ x 2¼-inch negatives.

Kodak Ektacolor Paper and Kodak Ektacolor Professional Paper are multilayer papers designed for direct printing or enlarging from color negatives. They are supplied in rolls and in sheets.

Prints on Ektacolor Paper can be made with a single white-light exposure or with three separate exposures through red, green, and blue filters. In general, the white-light exposure method is easier, and it offers the advantage of permitting the same sort of dodging and burning-in control that is used in black-and-white enlarging.

Ektacolor Paper can be processed with the Kodak Color Print Processing Kit, Process P-122, which is supplied in sizes to make 1 gallon or 3½ gallons of each of the seven processing solutions. Mixing directions and complete processing instructions are included. The chemicals are also supplied separately in various sizes.

Black-and-White Prints. Kodak Panalure Paper is expressly designed for making black-and-white enlargements and contact prints from color negatives. The tone rendering on Panalure Paper is similar to that of prints made from black-and-white negatives on panchromatic film, and, of course, the monochromatic rendering can be altered as desired by using Kodak Color Compensating Filters. The paper has a warm-black image tone. It is available in one printing grade and in the following surfaces and stock weights:

F SW—White, glossy, smooth, single-weight
E DW—White, fine-grained, lustre, double-weight

Using this paper and Kodak Ektacolor Paper, commercial and portrait photographers can easily and economically furnish customers with both black-and-white and color prints from a single color negative.

Panalure Paper should be exposed to a tungsten light source, such as the No. 302 or the No. 212 lamp, in an enlarger equipped with a color-corrected lens. For best results, the paper should be developed in Kodak Dektol Developer diluted 1:2. To obtain lower contrast, use Kodak Selectol Developer diluted 1:1. For further reduction in contrast, use Kodak Selectol-Soft Developer diluted 1:1.