

KODAK
DATA BOOK



4th Edition

35¢

KODACHROME

AND KODACOLOR FILMS



Kodachrome and Kodacolor Films

A Kodak Data Book with a Dual Purpose

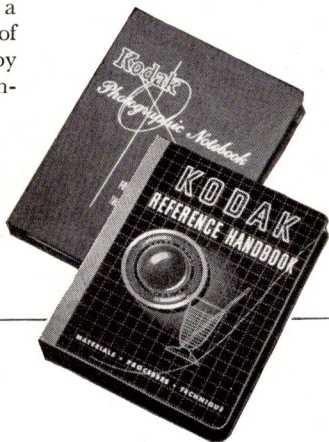
As a Data Book, KODACHROME AND KODACOLOR FILMS offers instructions for making still pictures with Kodachrome Films for 35mm and Kodak Bantam cameras, motion pictures with Kodachrome Films for Ciné-Kodak and other 8mm and 16mm cameras, and still pictures with Kodacolor Film for Kodak and other roll-film cameras.

With the removal of its cover, KODACHROME AND KODACOLOR FILMS provides owners of the *Kodak Reference Handbook* with a punched replacement unit for any Color Films section bearing no edition designation or one earlier than that indicated at the bottom of the contents page in this book.

Kodak Reference Handbook—A comprehensive, multi-ring, reference book containing information on a large group of Kodak materials and equipment used for color and black-and-white photography. Sections included consist of the latest printings of Kodak Data Books (without covers) on Kodak Lenses, Range Finders, and Shutters; Kodak Films (black-and-white); Filters and Pola-Screens; Kodachrome and Kodacolor Films; Kodak Papers; Processing and Formulas; and Copying.

Kodak Photographic Notebook—A loose-leaf, multi-ring binder containing five index separators, a quantity of notebook paper, and a list of special photographic articles which are available without charge. Especially designed to serve as a supplement to the *Kodak Reference Handbook*, the *Notebook* can be made into a valuable personal file of photographic information by following the suggestions included with the binder.

The Kodak Reference Handbook and the Kodak Photographic Notebook (as well as all of the Kodak Data Books) are on sale at Kodak dealers.



KODACHROME AND KODACOLOR FILMS

	<i>Page</i>
KODAK COLOR FILMS AND PRINTS	3
CARE AND STORAGE OF FILMS	5
Package Protection of Unexposed Films	5
Storage of Unexposed Films	5
Handling Exposed Films	6
Storage of Processed Films	6
GENERAL OUTDOOR PICTURE SUGGESTIONS	7
Types of Picture Subjects	7
Color of Subjects	7
Lighting	8
Effective Use of Sunlight . . . Supplementary Lighting	
KODACHROME PHOTOGRAPHY	13
Types of Film	13
Cameras and Adapters	13
Kodak Filters and Pola-Screens	14
Determining Exposure	16
Kodak Exposure Guides . . . Exposure Meters	
Special Daylight Subjects	18
Artificially Lighted Subjects	21
Existing Lighting . . . Photoflood and Photoflash Lighting	
. . . Lighting Contrast . . . Color Schemes	
Showing and Care of Kodachrome Pictures	29
Projectors Recommended . . . Kodak Slide Mounting Materials . . .	
Cleaning Transparencies . . . Cleaning and Waxing Motion-Picture Film . . .	
Removing Lacquer from Transparencies . . . Applying Kodak Film Lacquer	
Kodachrome Prints and Duplicates	32
Kodachrome Print Sizes . . . Selecting Transparencies for Kodachrome Prints . . .	
Comparing Kodachrome Prints with Transparencies . . . Care of Kodachrome Prints . . .	
Kodachrome Duplicates	
Black-and-White Prints	37
Black-and-white Negatives	
How the Kodachrome Process Works	38
Exposure of the Three Kodachrome Layers . . . Reproduction of Colors in Projection	
Data Sheets	40
Special Kodak Motion-Picture Services	48
Copying Service . . . Kodachrome Titles	
Kodak Dye Transfer Process	48
KODACOLOR PHOTOGRAPHY	51
Cameras	51
Kodak Filters and Pola-Screens	52
Exposure in Daylight	52
Artificially Lighted Subjects	53
Return of Film for Development—Kodacolor Prints	53
Data Sheet	56
How the Kodacolor Process Works	58

Copyright 1948 (also 1941, 1942, 1943, 1944, 1945, 1946, and 1947).
Eastman Kodak Company

FOURTH EDITION, 1948



Color Films
and Prints

Care and Storage
of Films

Outdoor Picture
Suggestions

KODACHROME

Types of Film
and Equipment

Determining
Exposure

Special
Daylight Subjects

Artificially
Lighted Subjects

Showing and Care
of Pictures

Kodachrome Prints
and Duplicates

Black-and-White
Prints

The Kodachrome
Process

Data Sheets

KODACOLOR

Equipment

Exposure

Development—
Kodacolor Prints

Data Sheet

The Kodacolor
Process



Kodachrome Prints from Kodachrome transparencies are supplied without margins in sizes ranging from $2\frac{1}{4}$ by $3\frac{1}{4}$ inches to 8 by 11 inches. Kodacolor Prints from Kodacolor negatives are made to a standard width of approximately $2\frac{1}{8}$ inches plus margins, the print lengths being dependent upon the proportions of the original negatives.

KODAK COLOR FILMS AND PRINTS

THE Eastman Kodak Company now manufactures four color films for amateur, advanced amateur, and professional use: Kodachrome, Kodacolor, Kodachrome Professional, and Kodak Ektachrome Films.

Kodachrome Film, Daylight Type and Type A (for artificial light), is supplied for making pictures with Kodak Bantam cameras, 35mm still cameras such as the Kodak 35, and Cine-Kodak and other 8mm and 16mm motion-picture cameras.

After exposure, Kodachrome Film is processed to positive color transparencies by one of the Kodachrome Processing Laboratories listed in the instruction sheet packed with the film. Film can be sent for processing through a Kodak dealer or directly to the nearest laboratory; the cost is included in the original price of the film.

Unless otherwise specified, Kodachrome Film K828 and K135 having picture areas measuring 28 by 40 mm and 24 by 36 mm,* respectively, is returned after processing in individual 2 by 2-inch Kodak Ready-Mounts. These are known as Kodaslide transparencies and are ready for projection in Kodaslide or other projectors.

Kodachrome Film exposed in amateur motion-picture cameras is returned on reels ready for projection in a projector such as a Kodascope Eight or Kodascope Sixteen.

Kodacolor Film is used much like black-and-white film in roll-film cameras. It is available in five popular sizes, designated as C127, C120, C620, C116, and C616. Exposure in sunlight is recommended.

After being exposed, Kodacolor Film is sent for development through Kodak dealers. The cost of the film includes development to color negatives, but does *not* include Kodacolor Prints, although prints can be ordered at the same time that the film is sent for development.

Kodachrome Professional Film, Daylight Type and Type B (for artificial light), is supplied in standard sheet-film sizes. It yields positive color transparencies which can be viewed by transmitted light or projection and are well suited to reproduction by photographic or photo-mechanical color printing methods. Processing at a Kodak laboratory is included in the price of the film. The processed transparencies are returned in individual Kodapak Sleeves.

Kodak Ektachrome Film, Daylight Type and Type B (for artificial light), is similar to Kodachrome Professional Film in most respects,

*Kodachrome transparencies on Kodachrome Film K828 and K135 having picture areas other than 28 by 40 mm or 24 by 36 mm are returned in strips, uncut.

but is intended for processing by the user. All the chemicals for preparing a complete set of processing solutions are available in prepared form in the Kodak Ektachrome Processing Kit. The Eastman Kodak Company does not maintain a processing service for Ektachrome Film.

Kodachrome Prints are full-color enlargements on a white cellulose acetate base. They are available on order through Kodak dealers. Four sizes ranging from $2\frac{1}{4}$ by $3\frac{1}{4}$ to 8 by 11 inches can be made from original 28 by 40-mm and 24 by 36-mm transparencies.

Black-and-white prints of Kodachrome transparencies or motion-picture frames can also be made. For such prints it is first necessary to make (or have a photofinisher make) black-and-white negatives from the transparencies or individual frames.

Kodacolor Prints are full-color photographic prints on paper. They are made from Kodacolor negatives on order through Kodak dealers. Each print is made to a standard width of approximately $2\frac{7}{8}$ inches, plus margins. The length depends on the proportions of the negative.

Kodachrome Professional Prints are full-color prints on a white cellulose acetate base which are made from original transparencies on Kodachrome Professional Film or Kodak Ektachrome Film. All orders are handled through Kodak dealers.

Kodachrome Duplicates (in various sizes) of original still Kodachrome transparencies and (on 16mm film) of 16mm Kodachrome originals are supplied on order through Kodak dealers. Enlarged, reduced, or same-size duplicates are also supplied from most sizes of original transparencies on Kodachrome Professional Film and Kodak Ektachrome Film. Duplicates of 8mm Kodachrome originals are not available.

This Data Book discusses primarily Kodachrome and Kodacolor Films and prints from them. For detailed information on Kodachrome Professional Film and Kodak Ektachrome Film, see the Kodak Data Book *Ektachrome and Kodachrome Professional Films*, on sale at Kodak dealers.

NOTICE: Kodachrome transparencies and Kodacolor negatives are handled with great care while in our possession. If either are damaged by us or any associate company, they will be replaced with unexposed Kodachrome or Kodacolor Film. Except for such replacement, Kodachrome transparencies and Kodacolor negatives will be accepted for making duplicates or prints without warranty, guarantee, or other liability of any kind. The dyes in Kodachrome transparencies, duplicates, and prints, and in Kodacolor negatives and prints, like other dyes, may change in time. These products will not be replaced or otherwise warranted against any change in color.

CARE AND STORAGE OF FILMS

KODACHROME and Kodacolor Films can yield their finest results only if they are handled and stored properly before exposure, between exposure and processing, and after processing.

PACKAGE PROTECTION OF UNEXPOSED FILMS

FILMS regularly packed for domestic use are amply protected to withstand normal handling and humidities commonly encountered in temperate zones through the expiration dates stamped on the film cartons. Regular packing is also sufficiently moisture-resistant to provide protection for films to be taken on short trips to tropical regions.

Films not regularly packed in sealed containers should have special packing* if they are to be subjected to harmful gases or are to be taken for prolonged periods of time into regions having sustained high relative humidity. Special packing is available on order through Kodak dealers.

Neither regular nor special packing is heatproof. Films in either regular or special packing, sealed or opened, should not be placed near steampipes or other sources of heat, or left on top floors of uninsulated buildings or in automobile compartments where they may be subjected to excessive heat.

When the seal of any film package is broken, the protection originally provided is no longer effective. For this reason, a film package should not be opened until shortly before the film is to be used.

STORAGE OF UNEXPOSED FILMS

FILMS not packed in sealed containers should not be stored unprotected in places where the relative humidity cannot be controlled, such as damp basements or refrigerators containing food or liquids in open containers. If storage in such places is necessary for keeping films cool, the films should first be sealed in cans or jars.

It is desirable to store films where the relative humidity can be kept between 40 and 60 per cent, preferably near 40 per cent. A moderate temperature with low relative humidity, e.g., 60°F with 40 per cent relative humidity, is better than a low temperature with high relative humidity, e.g., 40°F with 80 per cent relative humidity.

It is always advisable to check the relative humidity of the storage chamber by means of wet- and dry-bulb thermometers.

*Special packing is commonly referred to as "tropical packing." It is unnecessary for Kodachrome Film and black-and-white films in 8mm and 16mm magazines, and in 35mm cartridges, because the regular packing of films in these forms is highly moisture-resistant.

During summer heat in temperate or tropical zones, refrigerated storage is recommended for keeping films cool, provided they are packaged in sealed containers or are sealed in cans or jars. Where possible, the following storage temperatures should be maintained:

For storage periods up to	2 months	6 months	12 months
Keep films below	75°F	60°F	50°F

To avoid condensation on cold film surfaces, film packages kept in cold storage should be removed several hours (preferably 24 hours) before they are to be opened for use.

Films not in sealed packages, cans, or jars must be kept away from formaldehyde, industrial gases, motor exhaust, and vapors of solvents.

In hospitals or industrial plants, films must be protected from x-rays and radium. Information on this subject is available on request.

HANDLING EXPOSED FILMS

FILMS should be processed as soon as possible after they have been exposed. If immediate processing is not convenient, the exposed materials must be kept cool and dry. Films may be resealed in their original packages only if they are first dried. Drying can be accomplished by storing the films in a can or jar with a desiccating agent such as silica gel, rice dried by browning in an oven, or dried tea leaves. The drying agent should be separated from the films by a porous partition. Two Davison Silica Gel Air Dryers,* four ounces of silica gel, or two pounds of dried rice or tea leaves will dry ten 100-foot rolls of 16mm Kodachrome Film, while half these quantities will dry 20 rolls of 35mm or Bantam films, or 12 rolls of Kodacolor Film.

STORAGE OF PROCESSED FILMS

KODACHROME and Kodacolor Films, after processing, should be kept cool and dry, i. e., below 70°F and 50 per cent relative humidity. Storage in warm attics and damp basements should be avoided. Neither Kodachrome nor Kodacolor Film should ever be purposely humidified. Ideal conditions, for maximum life, involve storing films in sealed, lighttight, desiccated containers at 40°F or slightly lower.

The Kodaslide Sequence File (wood) and the Kodaslide File Box (metal) are recommended for storing mounted transparencies. These hold about 115 and 145 Kodaslides, respectively, or about 45 and 53 glass-bound 2 by 2-inch slides. Kodak Negative Files containing 100 leaves are recommended for storing Kodacolor negatives. Kodascope Reels and Cans are available for storing motion-picture films.

*Davison Silica Gel Air Dryers are supplied through many photographic dealers by the Davison Chemical Corporation, Baltimore 3, Maryland, U.S.A.

GENERAL OUTDOOR PICTURE SUGGESTIONS

THE following general suggestions apply to the use of both Kodachrome and Kodacolor Films in making pictures outdoors in daylight. Information which applies specifically to one film or the other is given in separate sections of this book. Recommendations on taking pictures in artificial light are also given separately.

TYPES OF PICTURE SUBJECTS

KODAK exposure instructions for Kodachrome and Kodacolor Films divide outdoor picture subjects into the following classifications:

Average—Light and dark objects combined in approximately equal proportions. Normal exposure is recommended.

Light—Beach and snow scenes, light-colored flowers, people in white clothing, light-colored buildings and subjects of similar character. A half stop* *less* exposure is recommended than for average subjects.

Dark—Dark foliage, deep-colored flowers, dark animals, dark-colored buildings, and like subjects. A half stop *more* exposure is recommended than for average subjects.

Shaded—People, gardens, and other subjects in the open shade (lighted by open sky—not under trees, porch roofs, etc.).

Groups of people to be photographed should be all in the sunlight or all in the shade, not partly in sunlight and partly in shade. Precautions such as this are necessary because color films and printing papers can accommodate only a rather limited range of subject brightnesses.

COLOR OF SUBJECTS

In general, Kodak color films provide a close reproduction of the colors of the light which is reflected from a subject into the camera. Nevertheless, the photographer is sometimes surprised to see for the first time in a picture colors which were actually present but unnoticed in the original scene.

These unnoticed colors are due largely to the effects of the lighting conditions and the surroundings. Thus, while shadows on a sunny day look simply dark to most people, they actually are blue, and appear so in the picture, because the light that does reach them comes largely from the blue sky. A person standing in the early morning or late afternoon sunlight appears normal in color, but this early or late sunlight

*A "stop" is the interval separating the *f*-numbers in the following series, some or all of which may appear on a lens: 2, 2.8, 4, 5.6, 8, 11, 16, or 22. If the recommended stop for an average subject is *f*/11, setting the lens opening pointer midway between *f*/11 and *f*/16 provides a half stop less exposure.

is orange, and as a result the picture will come out too orange. If a girl stands close to a green hedge, her complexion may look perfectly natural, yet the green light reflected into the camera by her face and arms may produce an unnatural greenish effect in the picture.

There are two reasons why such color effects are more difficult to recognize in viewing the original scene than in viewing a color photograph: First, we commonly think of the color of a real subject as characteristic of it under all circumstances, and therefore do not expect any change. Second, in viewing the original scene the eye tends to reduce disturbing illumination color by adapting to it. The film has no such power of adaptation. Fortunately, however, the color photographer can train himself to detect these neglected color effects in the original scene and take steps to prevent their appearance in the color photograph. The experienced worker avoids unnatural effects and achieves beautiful realistic colors by exposing his film in the most favorable lighting and surroundings.

LIGHTING

LIGHTING the majority of subjects for effective outdoor pictures in color requires only slightly more care than lighting for black-and-white snapshots. However, some knowledge of the effects of various daylight conditions is helpful in producing the best possible results. The pictures reproduced on page 11, while made indoors, demonstrate the effects of some of the lighting conditions described below.

Effective Use of Sunlight

An outdoor subject to be photographed in color is usually most effectively lighted by midmorning or midafternoon sunlight. During the middle of the day, with the sun directly overhead, pictures of people will show heavy unattractive shadows under the eyes, the nose, and the chin.

Up to two hours after sunrise and from two hours before sunset until sunset, the angle of the sun results in a predominance of the color orange. Such light is not recommended for making pictures of people. For pictorial treatment of scenic subjects, however, the special lighting effects and warmth of colors obtainable at these periods of the day may be very desirable. Pictures taken just after sunrise and just before sunset may require from one-half to two stops greater exposure than that recommended for midday sunlight.

Hazy sunlight provides an excellent opportunity for making pleasing color portraits since eye, nose, and chin shadows are soft, and there is less tendency for subjects to squint than in bright sunlight. In Kodak exposure tables and guides, hazy sunlight refers to haze which is

sufficiently dense to permit the sun to be viewed directly without discomfort, yet not dense enough to blot out its outline. Hazy sunlight requires one stop more exposure than bright sunlight.

Open shade, defined as an area shaded from the sun but open to the sky, is sometimes used for close-ups because of the pleasing softness of the lighting. Open-shade lighting avoids both squinting and shadow problems. It requires about three full stops more exposure than that recommended for bright sunlight. With Kodachrome Film, a filter should be used to prevent excessive bluishness; see page 14.

Front lighting of a subject to be photographed in sunlight with Kodachrome or Kodacolor Film is recommended because, in addition to being an effective type of lighting, it offers no exposure problem. Such lighting is obtained by facing the subject toward the sun and taking the picture from a position where the sun is behind and slightly to one side of the camera.

Side lighting and back lighting of a subject require more careful consideration of exposure than front lighting and should be supplemented by the use of a reflector or supplementary flash lighting as described below, especially in close-ups, to obtain satisfactory color rendition in both light and shadow areas. Either side or back lighting is frequently preferable to front lighting for portrait work because the tendency on the part of the subject to squint is greatly reduced.

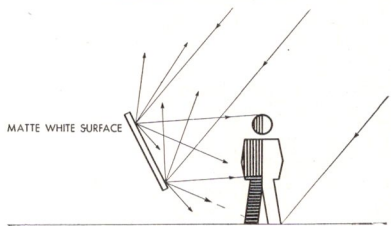
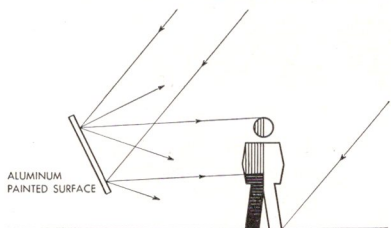
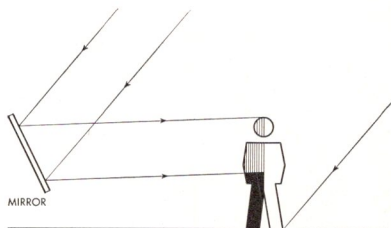
An average side-lighted subject requires a half stop more exposure than is required for front lighting if the highlight areas are more important than the shadows; a full stop if the shadow areas are of greater importance. A back-lighted close-up with important shadow detail may need three to four times more exposure (one and one-half to two stops larger) than a front-lighted subject. However, one stop larger is usually sufficient for a back-lighted subject which is more than 25 feet from the camera, because in this case shadow areas in the picture tend to be smaller and less important. With either side or back lighting, the lens must be shielded from the direct rays of the sun; the use of a lens hood is recommended.

Supplementary Lighting

Supplementary lighting includes the use of reflecting surfaces and synchronized flashlamps for illuminating shadow areas in sunlit scenes, thus reducing lighting contrast to a more desirable level. It is a type of lighting which is frequently valuable in making close-ups of people and flowers or other small objects, especially when the subject is side- or back-lighted.

Reflectors can be classified as natural or movable. Natural reflectors include sidewalks, white walls, light-colored sand, white sails, and snow. Highly-colored natural reflectors should be avoided because they will tint some areas of the subject with their own color.

A mirror or a chrome-plated ferrotype tin is the most efficient type of movable reflector in that it reflects in a single direction most of the light reaching it. This type of reflector is especially valuable when it must be placed at some distance from the subject, but requires careful handling because the reflected light is almost as intense as sunlight.

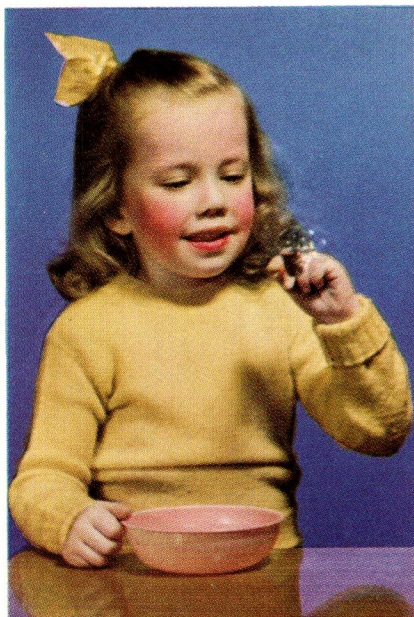


Another type of reflector is exemplified by an aluminum painted surface such as a projection screen or a surface covered with metal foil which has been crumpled and then flattened out. Such surfaces also reflect a large proportion of the light in one direction, but in a more diffused manner. To be most effective, they should be placed at a distance from the subject which is no greater than four times the width of the reflector. Aiming this type of reflector can be simplified by watching the spot of light reflected from a small mirror attached parallel to the reflecting surface. The mirror is removed during picture taking.

A very diffuse type of reflector can be improvised readily. White paper, white cardboard, composition board painted with a flat white paint, or white sheeting will serve. Such surfaces reflect light in all directions and thus give uniform lighting, but they are really effective only at a distance no greater than the width of the reflector.

Beaded projection screens are not recommended as reflectors, because they reflect most of the light back toward the source.

Supplementary flash with Photoflash Lamps No. 5B and 22B avoids the necessity of having an assistant or standards to hold a reflector at a fixed angle. Flashlamps are also more portable and repeatable in intensity. Exposure information is given in the Data Sheets.



Front lighting. Simple and effective.



Top lighting. Presents shadow problems.



Back lighting combined with reflector.



Open shade. Desirable for portraits.



KODACHROME PHOTOGRAPHY

THE information in this section applies specifically to Kodachrome photography and includes discussion of the types of film available, equipment necessary for making transparencies or movies, daylight and artificial light exposures, and other subjects.

TYPES OF FILM

Two types of Kodachrome Film are available for use in miniature still cameras and motion-picture cameras:

Kodachrome Film, Daylight Type

Kodachrome Film, Type A

Kodachrome Film, Daylight Type, gives the best color rendition of subjects in bright sunlight on a clear day, that is, in illumination which is the equivalent of noon sunlight plus sky light. Kodachrome Film, Type A, is color balanced for use with Photoflood or similar lamps. Such lamps have a color temperature of about 3400°K. (Color temperature is the temperature, expressed in degrees Kelvin, to which a "black body" must be heated to emit light of the color required.)

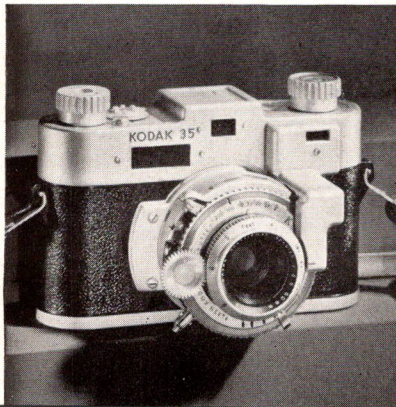
CAMERAS AND ADAPTERS

In the moderately priced group of 35mm cameras for making Kodachrome transparencies, the Eastman Kodak Company offers the Kodak 35 camera in two models. The "35's" are versatile miniatures with fast, color-corrected Lumenized lenses, which produce brilliant color images. They take 20- or 36-exposure rolls of Kodachrome Film.

The Kodak Flash Bantam *f*/4.5 camera, which uses 8-exposure rolls of Kodachrome Film, is also recommended for making color pictures.

Several models of 8mm and 16mm Cine-Kodak cameras are available for the amateur and professional movie maker. All are of time-proved quality and produce excellent color movies.

Two popular Kodak cameras for making Kodachrome pictures. Left—Kodak 35 *f*/3.5 with Range Finder. Uses 20- and 36-exposure K135 Kodachrome Films. Right—Cine-Kodak Magazine 8 with *f*/1.9 lens. Loads in three seconds with Kodachrome Film magazines. Attached Cine-Kodak Universal Guide. Both cameras have Lumenized lenses.



Bantam and 35mm Kodachrome Adapters make it possible to use miniature-camera films with a Kodak Recomar 18 or 33, with a Camera Back Adapter for the Kodak Precision Enlarger, and with most other cameras (not including the Kodak Medalist) which accept Kodak Combination Film and Plate Holders. The adapters are ideal for flower and nature photography, portraits, copying, photomicrography, and telephoto work. They are attached to the camera in the same manner as a film-pack adapter.

KODAK FILTERS AND POLA-SCREENS

THE color filters commonly used in black-and-white photography cannot be used with Kodachrome Film. If one of these filters is used, the pictures will show an over-all cast of the same color as the filter. The filters below are for special purposes in Kodachrome photography.

Kodachrome Haze Filter (Kodak Wratten No. 1). A colorless filter which absorbs all ultraviolet rays of wave length shorter than 380 m μ . It is used with Kodachrome Film, Daylight Type, to reduce bluishness in distant scenes and pictures taken on an overcast day or in shade illuminated by blue sky. Since the effect of the filter is slight with ordinary subjects, it can be left on the camera lens for all outdoor pictures. Use of the filter requires no increase in exposure.

Kodak Color Compensating (CC) Filters. Recommended for special purposes in color photography. They can be used singly or in combination to provide almost any desired color correction. The following eight series are supplied:

	<i>Yellow</i> CC21 to CC27	<i>Red</i> CC52 to CC57
<i>Bluish</i> CC3 to CC6	<i>Magenta</i> CC31 to CC37	<i>Green</i> CC62 to CC67
<i>Yellowish</i> CC13 to CC15	<i>Cyan</i> CC41 to CC47	<i>Blue</i> CC72 to CC77

Two of the yellowish filters, the CC14 and CC15, are used to produce warmer rendering than the Kodachrome Haze Filter in pictures made under bluish daylight conditions, such as overcast days and open shade. Color rendering becomes definitely warmer with the CC14 Filter, which requires $\frac{1}{4}$ to $\frac{1}{2}$ stop more exposure than that otherwise necessary, and still warmer with the CC15 Filter, which requires $\frac{1}{2}$ to $\frac{3}{4}$ stop more exposure than that otherwise necessary. Specific applications of some of the other Kodak CC Filters are given in the Data Sheets for Kodachrome Films.

Kodachrome Type A Filter for Daylight (Kodak Wratten No. 85). Orange in color and must be used if Kodachrome Film, Type A, is to be exposed in daylight. Sunlit pictures taken in this manner may be quite satisfactory. However, the Type A film and Type A filter combina-

tion is not recommended for general daylight use because: (1) With some subjects, and especially under overcast conditions, this combination does not produce as good color rendering as Kodachrome Film, Daylight Type, with no filter; (2) the Kodachrome Type A Filter is only moderately stable and may fade, particularly if subjected to sunlight for long periods.

For scenic photographs taken at high altitudes, Type A Film with the Kodachrome Type A Filter for Daylight affords somewhat better penetration of atmospheric haze (with consequent improvement in the rendition of color and distant objects) than Daylight Type Film with the Kodachrome Haze Filter. Since the Type A Filter absorbs ultraviolet radiation, the Haze Filter is never required in addition to it.

Kodachrome Filter for Photoflood (Kodak Wratten No. 80). Bluish in color and must be used if Daylight Type Kodachrome is to be exposed by Photoflood illumination. A film and filter combination suggested for emergency use only, because it requires four times the exposure for Type A Film with Photoflood, and the color rendition is not as good.

Kodak Pola-Screens are polarizing devices resembling gray filters. A Pola-Screen over the lens makes possible a darkened blue sky background for spectacular rendering of side-lighted subjects such as blossoms, trees, mountains, buildings, etc. The indicator handle of the Pola-Screen must point at the sun for greatest effect. An exposure increase of one and one-half stops for the Pola-Screen must be added to the normal half or full stop increase required because of side lighting (see page 9). When used in photographing distant scenes lighted from the side or overhead, the Pola-Screen has a haze-cutting effect. The Pola-Screen can also be used to subdue or eliminate oblique reflections from nonmetallic surfaces such as water, glass, wood, leaves, rocks, etc. The removal of surface reflections increases color saturation.

Pola-Screens are supplied in all series of Kodak Combination Lens Attachments, in W Mounts for Cine-Kodak 25mm, $f/1.9$ Lenses, and in metal cells $2\frac{1}{2}$, $3\frac{1}{2}$, and $4\frac{1}{2}$ inches in diameter for use (with the Kodak Pola-Screen Holder of appropriate size) with lenses having diameters from 2 to $5\frac{5}{8}$ inches.

The Kodak Pola-Screen Viewer, which fits over the indicator handle of the Pola-Screen, shows visually the effect which the Pola-Screen will have on the picture. The viewer fits all sizes of Pola-Screen except the $2\frac{1}{2}$, $3\frac{1}{2}$, and $4\frac{1}{2}$ -inch, which are intended for use with cameras which permit examination of the image on a ground glass.

The use of Pola-Screens with both sunlight and artificial light is described more fully in the Kodak Data Book *Filters and Pola-Screens*.

DETERMINING EXPOSURE

IN making color pictures in daylight or artificial light with Kodachrome Film, camera settings must be determined much more carefully than in black-and-white work. For most lighting conditions and subjects, reliable information is provided by Kodak exposure aids, which include Data Sheets, film instruction sheets, and the guides listed below.

Correctly exposed Kodachrome transparencies, when properly projected or viewed on a suitable illuminator, should have all colors fully represented unless the subject was too contrasty to record properly.

Underexposed transparencies appear dark, or even black.

Overexposed transparencies are light. The colors appear washed out. Because the film is developed by a reversal process, the greater the overexposure, the lighter is the finished picture.

Subjects often wrongly exposed are: Back-lighted subjects (commonly underexposed), open beach scenes (commonly overexposed), and scenes in the woods (frequently underexposed). Partially sunlit scenes in the woods are often difficult to photograph because of the great difference in brightness between the areas of sunlight and shade. In this and other cases of extreme brightness range, the exposure should be adjusted to favor the more important areas.

Kodak Exposure Guides

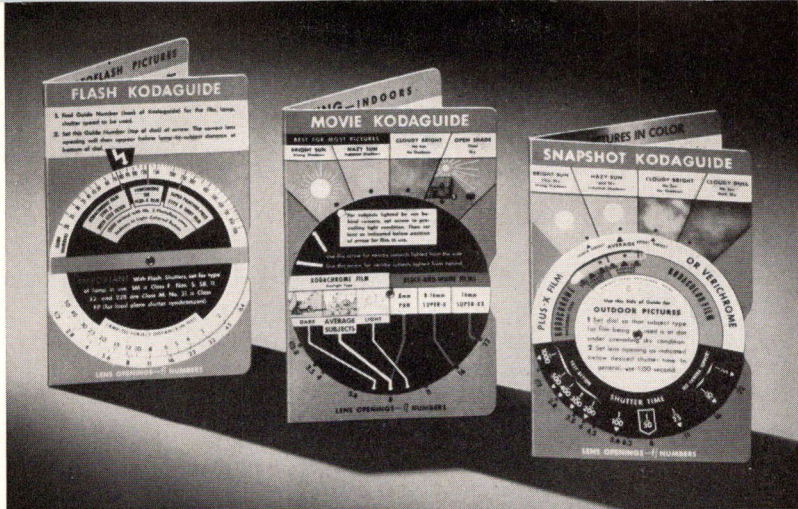
For Kodachrome photography under all but the most unusual lighting conditions, the following simple exposure guides are recommended:

Snapshot Kodaguide. Provides a quick method of determining still camera settings outdoors and indoors for Kodachrome and Kodak black-and-white films, and outdoors for Kodacolor Film. Includes illustrations of subject types and a lighting diagram for indoor pictures.

Flash Kodaguide. Enables the proper lens opening for any lamp-to-subject distance to be determined quickly. Includes Exposure Guide Numbers for various film, Photoflash Lamp, and shutter speed combinations, as well as helpful suggestions for flash pictures.

Movie Kodaguide. Provides a simple method of determining lens openings for the exposure of Cine-Kodak black-and-white films and Kodachrome Film outdoors in daylight or indoors by Photoflood Lamps.

Cine-Kodak Universal Guide. A metal, dial-type exposure calculator attached to Cine-Kodak cameras (see illustration, page 13). Exposure cards, supplied with Cine-Kodak films, are inserted in the guide so that exposures can be calculated for the particular film being used. The guide is also available as an accessory for pocket use.



Kodaguides—Most exposure problems encountered in making amateur still and motion pictures in color are easily solved with these dial-type, pocket-size calculators.

Exposure Meters

Photoelectric exposure meters can be of real help to the skilled worker, especially for unusual lighting conditions. The meter must be calibrated properly and used in accordance with instructions.

If good results are not being obtained with a meter, even though directions for its use are being strictly followed, the meter-camera combination should be checked by test exposures. By taking readings of many ordinary scenes and comparing the values the meter gives with the film exposure tables, a tentative meter setting can be selected. Test exposures can then be made of some of these subjects at the lens opening calculated with the meter, at one stop more, and at one stop less. The processed transparencies should be compared carefully to determine the best meter setting for the film used.

Exposure Index values, recommended as settings for meters using American Standard Exposure Indexes, will be found in the Data Sheets. For the various meters calibrated in Scheiner and DIN scales, different settings are required. The Scheiner settings for Kodachrome Film, Daylight Type, range between 17° and 25°, while meters calibrated in DIN frequently require 14/10°. In general, it is well to choose a tentative setting and make test exposures as explained above.

In daylight, certain exposure meters should be pointed downward to minimize the effect from the sky, if the manufacturer recommends this practice. The inclusion of an undue portion of sky may influence the meter so that underexposure results.

Meter readings on outdoor subjects in full sunlight that indicate lens openings smaller than f/11 for an amateur motion-picture camera, or exposures of less

than 1/50 second at f/8 with a 35mm or Kodak Bantam still camera, should be disregarded, because underexposure is almost certain to result.

In artificial light, the Exposure Indexes and recommended meter settings in the Data Sheets apply when a meter reading of the scene is taken from the camera position and the subject and background have about the same brightness. Meter readings can also be taken of the light reflected from a gray or white card of known reflectance substituted for the subject matter to be photographed.

If readings are taken from a gray card having a known reflectance of 18 per cent, the Exposure Indexes furnished in the Data Sheets for use with artificial light can generally be used without adjustment.

If a white card, such as the back of clean, white, double-weight, photographic paper (reflectance about 90 per cent) is used instead of a gray card having 18 per cent reflectance, the light reflected will be about five times as great. The meter readings or the Exposure Index must therefore be divided by 5. In the latter case, the new value can be rounded to the nearest figure on the meter calculator.

The card method is capable of yielding consistently good results, even if the composition or the lighting arrangement is unusual. However, when either a white or gray card is used, some allowance must be made for unusually light or dark subjects.

SPECIAL DAYLIGHT SUBJECTS

THERE are many subjects which require special information for exposure with Kodachrome Film, Daylight Type. Data on a number of such subjects are given in the following paragraphs.

Movie titles in color can be made as easily as black-and-white titles. White title cards in full sunlight require an exposure of $f/11$ on Kodachrome Film, Daylight Type (16mm and 8mm); colored cards require $f/8$ to $f/11$. Titles can also be made easily on Kodachrome Film, Type A, with the Cine-Kodak Titler and a Photoflood Lamp.

Flowers are treated as any normal outdoor subject in sunlight, and an exposure between $f/5.6$ and $f/8$ at 1/50 second is suggested. Close-ups of single blooms or clusters often require higher shutter speeds to stop the motion caused by light breezes; 1/100 at $f/4$ is suggested, although in making flower close-ups the depth of field required sometimes demands a small lens opening. In such cases the photographer must wait for the flower to become still and expose longer. With motion pictures, a slight wind motion is very desirable. Side lighting or back lighting to bring out the texture requires increased exposure unless reflectors are used to lighten the shadow side. If there is a patch of sunlight near

a shaded subject, the use of a reflector will partly counteract the greenish light in the woods. A gray or colored cardboard background, large enough to fill the picture area, can be used to isolate single flowers.

For close-ups beyond the range of ordinary cameras, Kodak Portra Lenses are recommended. Such lenses are available for both still and motion-picture cameras.

Architectural Interiors. These subjects require time exposures with the camera on a tripod. Because of the great variation in illumination, the exposure range method is suggested, for example, exposures of 15, 30, and 60 seconds at $f/16$. It is usually difficult to light a room with sufficient uniformity by daylight alone. Daylight (blue) Photoflood Lamps No. B1 and B2 are recommended to light the darker areas. If regular tungsten or Photoflood Lamps are added, the resulting Kodachrome transparencies will be yellowish in the parts so lighted.

Daylight Photoflood Lamps give very warm results when used with living models or independently of daylight, and are not satisfactory as the sole or principal light source. However, they are sometimes useful for supplementing daylight as described above. In this application, the use of a photoelectric exposure meter is recommended for balancing illumination and determining exposures.

A subject indoors near a window which receives direct light from the open sky should be about three or four feet from the window. The camera should view the subject from a position close to the window. The usual exposure for such a subject, if in direct sunlight, is $1/25$ second at $f/5.6$ or $f/8$ for still cameras, or normal speed at these apertures with motion-picture cameras. If the subject is *not* in direct sunlight, larger lens openings are required, and use of a Kodak CC14 or CC15 Filter may be desirable to prevent excessive bluishness.

Reflectors are recommended to increase the illumination in the shadows. The reflectors should be positioned carefully to lighten the principal shadows of the subject. A reflector may not be necessary if the window is behind the camera, because shadows will be less important.

Sunsets are photographed most effectively when the sun is partly or wholly obscured by a cloud. An unobscured bright sun may cause flare spots. Suggested camera setting: $1/50$ second at $f/4$. Less exposure makes the sunset appear further advanced; more exposure makes it appear as if it were at an earlier stage. The afterglow immediately following a sunset may require $1/25$ to $1/10$ second at $f/2$. Kodachrome movies of sunsets at an early stage can be made at normal speed and a lens opening of $f/5.6$.

Winter scenes. At first thought it might seem that color pictures of winter landscapes might be no more attractive and realistic than black-and-white pictures of the same scenes. Actually, however, there are a great many colors in winter landscapes, and snow scenes are especially pleasing. They should be treated as light-colored subjects.

Side-lighted and back-lighted subjects in open snow fields require little or no increase in exposure. In such scenes, the shadow areas are usually small and well illuminated by sunlight reflected from the snow. Open winter scenes without snow usually require about one stop more exposure than is normally recommended.

Beach scenes and distant landscapes in bright sun should be treated as light subjects. The exposure recommendation given in the Snapshot Kodaguide for such subjects is 1/50 second at $f/8$.

Tropical scenes. In some tropical areas, as in the West Indies, sunlight is frequently diffused by a light atmospheric haze. Under such conditions, no change in exposure over that for full sunlight is necessary. However, when the haze is heavy enough to permit a direct glance at the sun without discomfort, snapshots on Kodachrome Film, Daylight Type, should be made with the exposure recommendation for hazy sun as given in the Snapshot Kodaguide, viz., 1/50 second between $f/4$ and $f/5.6$ for average subjects; 1/50 second at $f/5.6$ for light subjects such as beach scenes, people in white clothing, light buildings, and subjects of similar character. For motion pictures at normal camera speed, the Movie Kodaguide recommends a lens setting of $f/5.6$ for average subjects; a half stop smaller for light subjects.

In the southwest United States and central Mexico, the atmosphere is often extremely clear with a resulting excessively high range of light intensities. If the exposure is calculated for the bright parts of scenes in such light, shadow areas will be rendered very dark. Full front lighting is strongly recommended under such light conditions with an exposure of 1/50 second at $f/8$ for still cameras and between $f/8$ and $f/11$ at normal camera speed for Cine-Kodak cameras. With side-lighted subjects having large shadow areas of more importance than highlight areas and with portrait subjects with overhead lighting, the exposure should be doubled (increased by one lens stop). If highlight and shadow areas are of equal importance, the exposure should be increased by only one-half a lens stop. For back-lighted subjects in which the highlight details are unimportant, the scene should receive four times as much exposure as the same scene with front lighting (two lens stops more exposure). In this instance, the shadow regions alone will receive correct exposure; highlight areas will be overexposed.

Aerial views on clear days at altitudes up to 3000 feet should be taken on Kodachrome Film, Daylight Type, with a Kodachrome Haze Filter over the camera lens. For pictures at altitudes above 3000 feet it is recommended that Kodachrome Film, Type A, be used with a Kodachrome Type A Filter for Daylight over the camera lens.

If Kodachrome Film, Daylight Type, is used without a filter, especially at heights above 3000 feet, pictures may appear somewhat blue. This effect is caused by aerial haze.

The basic exposure for aerial pictures made with still cameras on either of the two types of Kodachrome Film plus the recommended filter is 1/100 second at $f/4$ for scenes of average total reflectance in bright sunlight with no important shadows. For filming ground views from aloft with motion-picture cameras operated at 16 frames per second, a lens opening between $f/5.6$ and $f/8$ is recommended; for cameras operated at 24 frames per second, an opening of $f/5.6$.

ARTIFICIALLY LIGHTED SUBJECTS

ARTIFICIALLY lighted pictures are of two types: (1) those lighted by such illuminants as floodlights, stage lights, or street lamps, and (2) those lighted by Photoflood or Photoflash Lamps.

Existing Lighting

Exposure suggestions for the following night shots made without special lighting are for use with Kodachrome Film, Type A. For exposures longer than 1/25 second, a camera support should be used. The Kodak Eye-Level Tripod, Kodak Turn-Tilt Tripod Head, Kodak Table Top Tripod, and Kodak Tilt-A-Pod are useful accessories for such picture-taking activities.

Floodlighted buildings require still-camera exposures of 1/10, 1/5, or 1/2 second at $f/2$. Motion-picture cameras operated at normal or half speed should be set at the largest lens aperture.

Animated electric signs are especially interesting color subjects for motion pictures on Kodachrome Film, Type A. An $f/1.9$ or $f/1.6$ lens is usually necessary, and it should be set at the largest opening. For still pictures, an exposure of 1/25 second at $f/2$ is suggested.

Store windows, if brightly lighted, require about the same exposures as those recommended for photographing floodlighted buildings.

Fireworks displays can be photographed in color with both still and motion-picture cameras. For still cameras, the diaphragm should be set at $f/5.6$ or $f/8$ and the shutter opened and left open until the desired number of displays have been recorded. Several displays pictured

on one transparency often make an interesting pattern. A tripod or other firm support for the camera should be used. Kodachrome movies can be made at $f/1.9$, normal speed, of practically all displays. For pictures of white fire such as is used in a "Niagara Falls" type of fireworks display, the lens can be stopped down to $f/2.8$.

Brightly lighted streets photograph best when wet, the reflection of lights from electric signs, theater marquees, and store windows adding to the effectiveness and over-all illumination of the scene. Effective still-camera pictures of such subjects can be made at exposures of $1/10$ to $1/2$ second at $f/2$. For motion pictures in color of well-lighted streets, an aperture of $f/1.9$ should be used at normal camera speed. Kodachrome Film, Type A, is recommended.

Sports events such as hockey games, wrestling bouts, and skating shows in arenas that are floodlighted are within the range of color photographers having cameras with large-aperture lenses. Kodachrome Film, Type A, should be used. Exposures of $1/10$ to $1/2$ second at $f/2$ are recommended for still cameras; normal speed at $f/1.9$ or $f/1.6$ for motion-picture cameras.

Scenes on the stage, if well-lighted, can be made with both still and motion-picture cameras. The most suitable seats in the theater are those at such a distance from the stage that the lens to be used includes the full width of the stage, or less, in its angle of view. Still-camera exposures for a brilliantly lighted stage are $1/25$ to $1/10$ second at $f/2$ on Kodachrome Film, Type A. A quiet moment in the action must be chosen. Motion pictures should be made at $f/1.6$ or $f/1.9$, normal speed. Permission from the theater management should be obtained before making pictures of stage performers.

Photoflood and Photoflash Lighting

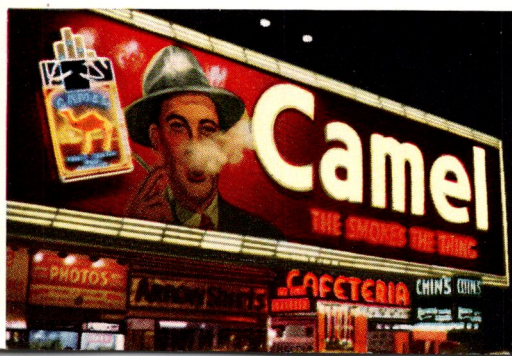
Photoflood and Photoflash Lamps are especially suitable for color photography with Kodachrome Film, Type A. Exposure data for their use are given in the Data Sheets, and with the lighting illustrations on pages 24, 25, and 26. Ordinary home lighting lamps are not recommended for use with Kodachrome Film because of the low illumination level and yellowish light they produce.

The Kodaflector and the Kodaflector Senior, each with two conical reflectors on a stand, are recommended for use with Photoflood Lamps. The Kodak Flashholder for use with any Kodak camera with a Kodak flash shutter and the Kodak Junior Synchronizer for use with non-synchronized shutters are suitable for making Kodachrome pictures with Photoflash Lamps.

Photoflood Lamps No. 1 and 2 and Reflector Photoflood Lamps No. RFL2 permit the exposure of Kodachrome Film, Type A, without filters. Reflector Photoflood Lamps are especially convenient to use because they require no additional reflectors. These and the regular No. 2 Lamps give twice the light given by the No. 1 Lamps and have an average life twice as long.

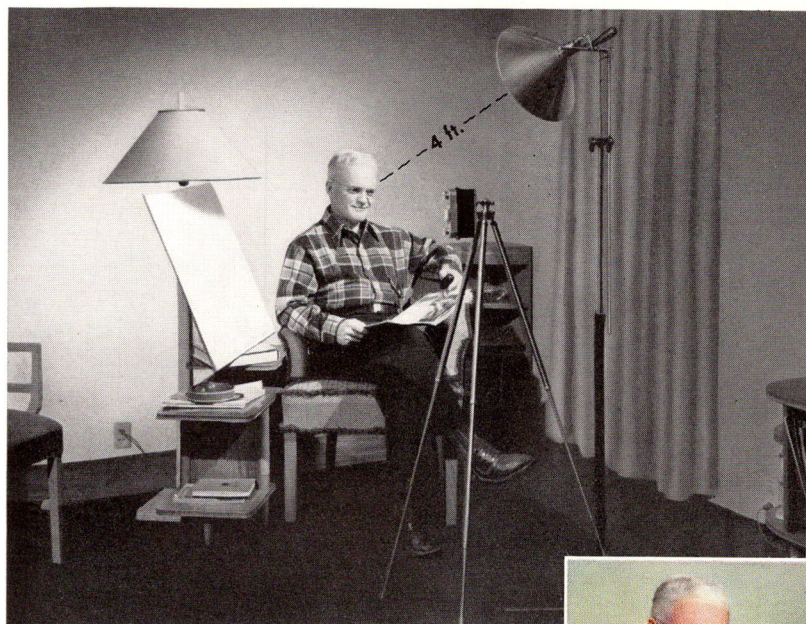
Also available are Reflector Photo-spot Lamps No. RSP2, which give a narrow, powerful beam of light. These lamps are sometimes useful for special purposes, such as backlighting or lighting dark hair in portraits, but require care and skill in handling because of the strength of the concentrated beam.

Suggested lighting arrangements for making pictures indoors with the regular Photoflood and Reflector Photoflood Lamps are shown on the following three pages. The one on page 25 is particularly recommended. NOTE: No more than Six No. 1 or three No. 2 or RFL2 Photoflood Lamps should be used on a single fused circuit, because any load in excess of this number will probably blow fuses or damage wiring. If there are two 15-ampere circuits in a room, however, two or three No. 2 Lamps can be used on each.



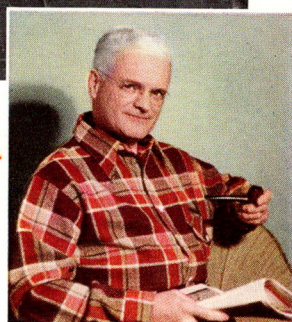
Wrestlers, circus, roller skating show, animated sign—all are marvelous material for pictures on Kodachrome Film, Type A. The quantity and quality of the illumination vary, but an $f/1.9$ lens is usually necessary for movies, $f/2$ for stills.

A SINGLE LAMP AND REFLECTOR . . .



FOR THIS PICTURE

Data for Type A film: 1/10 second at f/4 or f/4.5, with one No. 2 Photoflood in Kodaflector (matte side) at 4 feet.



A Reflector Photoflood can be used instead of a No. 2 Photoflood in Kodaflector. A reflector, such as a matte white card, is also required. Place the lamp slightly above and to one side of the camera. This position provides nearly full front lighting with slight shadowing for roundness in portraits and casts the subject shadow out of important picture areas. Place the reflector just outside the picture area and at the angle which reflects the maximum amount of light into the shadowed areas of the face. Direct the lamp at the reflector rather than at the subject. Place the subject close to a light-colored background, because dark backgrounds are usually unattractive in informal color portraits. The floor lamp shown in the black-and-white illustration was used, not as a light source, but to support the reflector in taking this Kodachrome picture.

FOR BETTER CLOSE-UPS . . .



CAMERA LIGHT
AND SIDE LIGHT

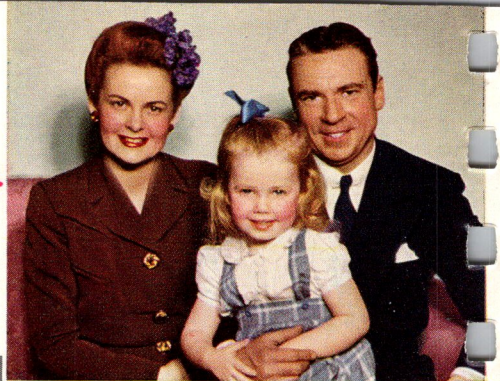


Data for Type A film: 1/10 second, between f/4.5 and f/5.6, with one Reflector Photo flood as camera light at 5 feet and another as side light at 4 feet. Two No. 1 Photo floods in clamp-on reflectors to light background.

The black-and-white illustration shows an effective basic lighting arrangement for most indoor portraits. Place the camera light near lens level to provide general illumination, and arrange the side light above lens level to cast a triangular pattern of light on the opposite cheek of the subject. The subject should be close to a light-colored background, or better, 4 to 6 feet in front of a background which is illuminated separately. Be sure that the background is illuminated evenly and that no direct rays from any lamp strike the camera lens. Do not use too many lamps on any one circuit; see note, page 23. See also "Lighting Contrast," page 27.

FOR GROUP PICTURES...

THIS 2-LAMP
ARRANGEMENT



Exposure Data for Type A film: 1/5 second, between $f/4$ and $f/5.6$, with two No. 2 Photofloods in Kodaflectors (matte side) at 7 feet. For open flash, one No. 22 Photoflash Lamp in reflector at 9 feet, $f/16$ with CC15 filter.

Informal groups can be photographed effectively with two Photoflood Lamps. For such shots, place both lamps near, but above, the camera axis and pointed down slightly. This lighting provides even illumination for a large area, but gives little modeling. If clothing and background colors are predominantly light (for example, a group of people dressed in white clothing near a light-colored wall), give one-half stop less than normal exposure. When dark clothing and dark background are predominant, give one-half stop more exposure than normal. Additional information on the use of Photoflood and Photoflash Lamps appears in the Data Sheets.

Photoflash Lamps provide plenty of light for the short exposures required in making pictures of children, other active subjects, and large groups. Open-flash exposures can be made by using the SM or No. 5 Lamps in a Kodak Photo Flasher or by using the No. 22 or 50 Lamps in reflectors and firing them on regular house current. The SM and No. 5 Lamps can also be used in the Kodak Flashholder or Kodak Junior Synchronizer for synchronized flash pictures. The No. 6 and 31 Lamps are designed for synchronization with focal-plane shutters.

Filter recommendations and exposure information for the clear-glass Photoflash Lamps mentioned above are given in the Data Sheet for Kodachrome Film, Type A. Exposure information for the Daylight (blue) Photoflash Lamps No. 5B and 22B is given in the Data Sheet for Kodachrome Film, Daylight Type.

CAUTION: Since lamps may shatter when flashed, the use of a transparent protective screen over the reflector is recommended. *Do not flash the lamps in an explosive atmosphere.*

Lighting Contrast

Since the range of subject brightnesses which can be accommodated by Kodachrome Film is somewhat limited, lighting contrast for color pictures made in artificial light should be softer than that used in black-and-white photography. However, brilliant results can usually be obtained without contrasty lighting, because color contrast accomplishes much of the effect of lighting contrast in black-and-white work.

If one light is placed close to the camera, and another light of equal strength is placed at the same distance from the subject but at an angle of about 45° to the camera-subject axis, the areas illuminated by both lamps will receive two units of illumination, while the areas illuminated only by the camera light will receive one unit. Thus the lighting ratio will be 2 to 1. In general, the lighting ratio for Kodachrome Film should not exceed 2 to 1, or, with subjects which do not contain a wide range of reflectances, 3 to 1.

With lighting arrangements involving several lamps, the lighting ratio can be checked by using an exposure meter to read the light reflected from a gray or white card held close in front of the subject. One reading should be made with the card turned to the position which gives the maximum reading on the meter light scale. All lights should be on except those so far to the side or back of the subject that they might influence the meter directly. The other reading should be made with the card turned toward the camera lens. In this case, only the light or lights at the camera position should be on.

Lighting distribution is also important. Normal color rendering in all areas of an indoor subject will be obtained only when the whole scene is adequately illuminated. Otherwise there may be areas that will be reproduced so dark that color and detail are lost. Such areas are often difficult to recognize in viewing the original scene because visual adaptation effects tend to make them appear adequately lighted.

Lighting distribution can be checked by using an exposure meter to read the light reflected from a gray or white card held, facing the camera, in various positions over the set. The readings should be made with all lights on, although it is well to turn off any lights positioned where they might influence the meter directly.

Color Schemes

The color of the background, clothing, and other properties used in indoor color pictures is usually within the control of the photographer. Care in the selection of these items will pay dividends in more pleasing results. The following suggestions may be helpful.

In portrait photography, the center of interest in the picture should be the subject's face. Since conspicuous patterns or contrasting brilliant colors in either clothing or background tend to distract attention from the face, they should be avoided. An excess of brilliant colors is not pleasing in any color photograph.

Clothing colors should harmonize with the complexion and hair color of the subject. Light, soft colors are usually more effective than dark colors or black, and do not require so much care in lighting.

Unlike black-and-white pictures, color pictures do not require the use of a background lighter or darker than the subject, because contrast is created by color differences. In general, the background color should be a tint or shade of a color which harmonizes with the dominant color of the clothing, that is, which lies near it on a color wheel. Touches of color complementary to the clothing color, that is, opposite it on the color wheel, are suitable for small areas or accessories. A background complementary to the clothing can sometimes be used for a more dramatic effect, provided harsh, brilliant colors are avoided. In case of doubt, buff or gray is almost always satisfactory.

Backgrounds should be large enough to cover the field of view easily. When they are several feet behind the subject, they require separate illumination for the most pleasing results. For normal color rendering of the background, this illumination should be in balance with that falling on the subject. Matte surfaces are best, because they reflect light evenly and diffusely.

SHOWING AND CARE OF KODACHROME PICTURES

MINIATURE transparencies can be viewed as they are or in small diffuse-light hand viewers, but only on projection are their true beauty, realism, and illusion of depth revealed. When colored slides are shown to friends, community groups, etc., they should be arranged for continuity and dramatic effect. The operator of the projector should be thoroughly familiar with its operation, and he can avoid later delay and confusion by setting up the projector and arranging for room light control before starting the show.

Motion pictures, to be most effective, should be properly edited and titled. As in the projection of slides, the operator should have a thorough knowledge of the operation of the projector and have all equipment set up and tested before the show is to begin. Easy control of room lights should be arranged beforehand. Background music from records, appropriate to the mood of the scenes being shown, adds a professional touch to both slide and motion-picture shows.

It is very important in projecting both slides and motion pictures that the screen image be small enough to retain its full brilliance, especially when there is stray light in the room. The audience should be seated between the projector and screen, near the projection axis.

PROJECTORS RECOMMENDED

FOR projecting Kodaslide transparencies and 2 by 2-inch glass-bound slides, three models of Kodaslide projectors are available. The Kodaslide Projector, Model 1A, is equipped with a 150-watt lamp and a 4-inch $f/3.5$ lens. The Model 2A is also equipped with a 150-watt lamp and offers a choice of two lenses, 5- and $7\frac{1}{2}$ -inch. The Kodaslide Projector, Master Model, is equipped with a 1000-watt lamp and a choice of five lenses designed for a variety of projection conditions, including the showing of slides in lecture halls and theaters. All three projectors have Lumenized lenses and condensing systems.

Accessories for use with the Models 1A and 2A include the Kodaslide Changer, which simplifies loading and changing slides, and the Koda-

Kodak still projection equipment ranges from the Kodaslide Projector, Model 1A, for home use, to the Master Model, right, for pictures on screens up to 20 feet square.

COLOR FILMS 29



slide Dissolve Control Outfit, which permits continuous projection from two like projectors, uninterrupted by slide carrier movement.

For the projection of Kodachrome motion pictures, there are several Kodascope projectors, including both 8mm and 16mm models. All feature brilliant projection quality and proven reliability.

In projection, heat and light from the projection lamp tend to accelerate fading. With well-designed slide projectors, fading of slides is imperceptible for ordinary projection times of 30 seconds to 2 minutes. Longer times should be avoided. The heat-absorbing glasses in Kodaslide Projectors should never be removed, and projection lamps of higher than recommended wattages should not be used.

KODAK SLIDE MOUNTING MATERIALS

KODACHROME transparencies which are to be handled considerably should be mounted in glass. The Kodak Slide Kit, available through Kodak dealers, contains binding materials for fifty glass slides. Items in the kit can also be purchased separately. Kodak Ready-Mounts, cardboard mounts used by the Eastman Kodak Company in making up Kodaslides, are also available through Kodak dealers.

CLEANING TRANSPARENCIES

IN many cases light fingerprints or oily smudges can be removed by breathing on the transparency, then wiping it gently with a soft cloth. If this is not successful, Kodak Film Cleaner* can be used sparingly on a plush pad or a wad of cotton. Moistened only slightly so that no pools or droplets of liquid will be formed on the film, the pad or cotton should be used with light, even strokes.

The use of too much cleaning fluid may cause streaks or spots by removing some of the protective lacquer with which the emulsion side of the film is coated. If this occurs, the lacquer should be removed completely, and Kodak Film Lacquer applied as described on the next page.

CLEANING AND WAXING MOTION-PICTURE FILM

By slowly drawing motion-picture film through a cotton pad moistened with a nearly saturated solution of carnauba wax in Kodak Film Cleaner,* cleaning and waxing can be performed in one operation. Such a solution can be prepared by placing a marble-size lump of carnauba wax in one pint of Kodak Film Cleaner and allowing the lump to dissolve. The operation should be carried out slowly as the film is rewound, to permit the film to dry before it reaches the reel.

*Warning: Volatile solvent. Use with adequate ventilation. Avoid prolonged breathing of the vapor.

REMOVING LACQUER FROM TRANSPARENCIES

THE protective lacquer can be removed from miniature Kodachrome transparencies by one of two methods, depending on the particular type of lacquer that has been used. The lacquers used on Kodachrome Film, K135 and K828, have been of two types, one soluble in Kodak Film Cleaner, the other soluble in an alkaline solution (such as 5 per cent sodium carbonate or an alkaline developer). It is seldom possible to identify the type of lacquer at hand except by actual trial. The following steps are suggested:

1. Removal should first be attempted with a plush pad or a wad of cotton well moistened with Kodak Film Cleaner. If after a few strokes of the pad the lacquer starts to come off, this method should be continued until all lacquer is removed.
2. If the lacquer is not affected by Kodak Film Cleaner, it can be removed in 5 per cent sodium carbonate or an alkaline developer. Treatment in either of these solutions should be followed by washing.

IMPORTANT: If the lacquer is soluble in Kodak Film Cleaner, do not put the transparency into either water or an alkaline solution; this will cause the lacquer to wrinkle and mark the emulsion surface.

At one time an alkali-soluble lacquer was used over the picture area of the transparency only, not over the perforations. If the lacquer can be identified in this manner, 5 per cent sodium carbonate or an alkaline developer should be used. Kodak Film Cleaner should be tried first when the lacquer extends over the perforations.

After the lacquer has been removed, the transparency should be coated with Kodak Film Lacquer according to the directions below.

APPLYING KODAK FILM LACQUER

TRANSPARENCIES should be held flat for lacquering. Their edges can be fastened to a flat surface with adhesive tape, with the emulsion side up and the perforations completely covered with tape. A small quantity of Kodak Film Lacquer should be poured into a small, clean receptacle, then applied with a camel's-hair brush and allowed to dry in a dust-free location for 10 minutes. Unused lacquer in the receptacle should be discarded. Brushes can be cleaned with a 5 per cent sodium carbonate solution, after which they should be washed in clear water.

Kodak Film Lacquer can be removed from transparencies by soaking the transparencies in a 2 to 5 per cent solution of sodium carbonate. Within 2 minutes following visual disappearance of the lacquer, the transparencies should be removed from the carbonate solution, washed for 5 minutes in clear water, and dried thoroughly.

KODACHROME PRINTS AND DUPLICATES

KODACHROME Prints and Kodachrome Duplicates are made only from *original* transparencies or 16mm film lengths, and all orders must be placed through Kodak dealers. Neither Kodachrome Prints nor Kodachrome Duplicates are available from 8mm Kodachrome Film.

KODACHROME PRINT SIZES

KODACHROME Prints are offered in standard sizes and in special sizes. Prints can be ordered separately or when Kodachrome Films are sent in for processing. Prints are made on a white pigmented cellulose acetate base which gives maximum brilliance and durability.

Standard-Size Prints are made only from transparencies mounted in regular 2 by 2-inch slides (glass or standard cardboard slides) having openings approximately 28 by 40 mm or 24 by 36 mm. Kodachrome Prints are available in the following standard sizes:

2X—About $2\frac{1}{4}$ by $3\frac{1}{4}$ inches, unmounted, round corners

3X—About 3 by $4\frac{3}{8}$ inches, unmounted, round corners

5X—About 5 by $7\frac{1}{2}$ inches, in large double mounts

8X—About 8 by 11 inches, in large double mounts

Kodachrome Prints 2X and 3X show a slightly smaller picture area than that visible through the aperture of the transparency mount.

Special-Size Prints can be obtained in any size up to 11 by 14 inches from standard-size originals and from nonstandard originals such as 18 by 24 mm, 24 by 24 mm, and 20 by 28 mm, or from 16mm Kodachrome Film frames. The enlargements can be made from any designated portion of the miniature Kodachrome originals. If cropping is desired, it should be indicated by attaching a mask to the slide.

Kodachrome transparencies which are to be greatly enlarged must be exceedingly sharp and of good color, but low in contrast. Originals with high contrast or large dark areas will not enlarge satisfactorily. Because the definition in color enlargements from small areas is often unsatisfactory, Kodachrome Prints from small areas or from 16mm frames are not recommended.

SELECTING TRANSPARENCIES FOR KODACHROME PRINTS

KODACHROME transparencies that produce the most attractive and best quality color prints are naturally those which have been well exposed and properly lighted. Kodak dealers will be glad to assist customers in the selection of suitable transparencies.

It is assumed that the maker likes the Kodachrome picture as it is, and the attempt is made to reproduce it as closely as possible.

In projecting Kodachrome transparencies from which color prints might be ordered, remember that the eye readily adapts itself to general bluish, reddish, or other tints in projected images, since there are no lighted surroundings of known color for comparison. A print, however, is viewed amid lighted, familiar surroundings to which the eye is already adapted; its color rendering is thus judged more critically than that of the transparency.

To assure satisfactory Kodachrome Prints, transparencies should be checked carefully for the following specific points:

Color Rendering. Compare the transparencies with others that have produced good prints. Note especially the color rendering in faces. If Kodachrome Prints are to be grouped together on an album page, the Kodachrome originals should be viewed together on an illuminator. In this way, it is easy to see differences in color rendering which might make the prints unsatisfactory for simultaneous viewing.

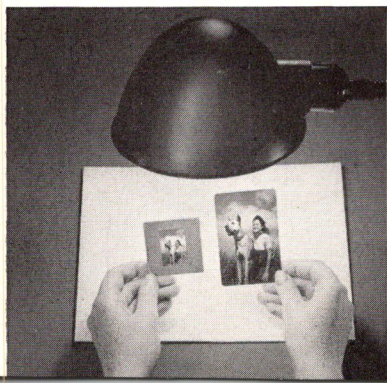
Definition. The Kodachrome picture must be sharp if the enlarged color print is to be sharp. Examine the projected image closely, or check the transparency itself through a magnifying glass.

Exposure. If a correctly exposed Kodachrome transparency is held against white paper under a bright light, it appears quite dark. If it looks like a fairly good print when so viewed, it is overexposed and will not produce a good color print. On the other hand, transparencies slightly darker than normal will frequently print well if plenty of detail and good color are present in all important shadow areas.

Contrast. Scenes which are evenly lighted produce excellent prints. Scenes which are side-lighted, back-lighted, or partly in shade are likely to have important details obscured by heavy shadows, and therefore they may not print satisfactorily. Dark shadows in a transparency will be dark in a color print.

COMPARING KODACHROME PRINTS WITH TRANSPARENCIES

In checking print quality, it is important to view the transparency and print simultaneously by light of the same color quality and at balanced levels of illumination. If the transparency is viewed by strong daylight from a window and the print by weak tungsten light, there will naturally be great differences in color rendering and brightness.



The illustration shows a simple and effective method of comparing print and original. The print is held under a desk lamp and the transparency is viewed by light re-

flected from a sheet of white paper on the table underneath the same lamp. Either tungsten light or daylight, but not fluorescent light, is a satisfactory illuminant for Kodachrome Prints.

CARE OF KODACHROME PRINTS

KODACHROME Prints contain dyes which are as stable as possible, consistent with their other requirements, but since the dyes, like other dyes, may change in time, the prints are not warranted against change in color. Prolonged exposure to bright daylight, and particularly to direct sunlight, should be avoided. The prints should therefore not be displayed for long periods of time in or near windows, or in other locations subject to direct sunlight. For the greatest degree of stability, Kodachrome Prints should be kept in an album or folder.

KODACHROME DUPLICATES

WITH the increasing use of still and motion-picture Kodachrome Films, there has been a demand for duplicate color transparencies from Kodachrome originals and duplicates in color of 16mm Kodachrome Film.

Duplicate Kodachrome Transparencies																														
From Kodachrome, Kodachrome Professional, or Kodak Ektachrome Film Originals																														
FROM: Any original transparency of the following size:	TO: Any duplicate Kodachrome transparency of the following size:																													
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 50%; padding-right: 10px;">*24 x 36 mm (35mm)</td><td rowspan="15" style="font-size: 4em; vertical-align: middle;">}</td></tr> <tr><td>†*28 x 40 mm (Bantam)</td></tr> <tr><td>2¼ x 3¼ in.</td></tr> <tr><td>2½ x 3½ in.</td></tr> <tr><td>3¼ x 4¼ in.</td></tr> <tr><td>4 x 5 in.</td></tr> <tr><td>5 x 7 in.</td></tr> <tr><td>‡8 x 10 in.</td></tr> <tr><td>4.5 x 6 cm</td></tr> <tr><td>6.5 x 9 cm</td></tr> <tr><td>9 x 12 cm</td></tr> <tr><td>11 x 14 in.</td></tr> <tr><td>45 x 107 mm</td></tr> <tr><td>6 x 13 cm</td></tr> </table>	*24 x 36 mm (35mm)	}	†*28 x 40 mm (Bantam)	2¼ x 3¼ in.	2½ x 3½ in.	3¼ x 4¼ in.	4 x 5 in.	5 x 7 in.	‡8 x 10 in.	4.5 x 6 cm	6.5 x 9 cm	9 x 12 cm	11 x 14 in.	45 x 107 mm	6 x 13 cm	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 50%; padding-right: 10px;">§24 x 36 mm (35mm)</td><td rowspan="10" style="font-size: 4em; vertical-align: middle;">}</td></tr> <tr><td>2¼ x 3¼ in.</td></tr> <tr><td>2½ x 3½ in.</td></tr> <tr><td>3¼ x 4¼ in.</td></tr> <tr><td>4 x 5 in.</td></tr> <tr><td>5 x 7 in.</td></tr> <tr><td>8 x 10 in.</td></tr> <tr><td>°11 x 14 in.</td></tr> <tr><td>4.5 x 6 cm</td></tr> <tr><td>6.5 x 9 cm</td></tr> <tr><td>9 x 12 cm</td></tr> <tr><td colspan="2" style="padding-top: 10px;">} No duplicates of any size can be made from originals of these sizes.</td></tr> </table>	§24 x 36 mm (35mm)	}	2¼ x 3¼ in.	2½ x 3½ in.	3¼ x 4¼ in.	4 x 5 in.	5 x 7 in.	8 x 10 in.	°11 x 14 in.	4.5 x 6 cm	6.5 x 9 cm	9 x 12 cm	} No duplicates of any size can be made from originals of these sizes.	
*24 x 36 mm (35mm)	}																													
†*28 x 40 mm (Bantam)																														
2¼ x 3¼ in.																														
2½ x 3½ in.																														
3¼ x 4¼ in.																														
4 x 5 in.																														
5 x 7 in.																														
‡8 x 10 in.																														
4.5 x 6 cm																														
6.5 x 9 cm																														
9 x 12 cm																														
11 x 14 in.																														
45 x 107 mm																														
6 x 13 cm																														
§24 x 36 mm (35mm)		}																												
2¼ x 3¼ in.																														
2½ x 3½ in.																														
3¼ x 4¼ in.																														
4 x 5 in.																														
5 x 7 in.																														
8 x 10 in.																														
°11 x 14 in.																														
4.5 x 6 cm																														
6.5 x 9 cm																														
9 x 12 cm																														
} No duplicates of any size can be made from originals of these sizes.																														
<p>*Originals may be mounted or unmounted. Duplicates are supplied in all listed sizes up to and including 5 x 7 inches.</p> <p>†Same-size duplicates cannot be made from originals of this size. Duplicates of Bantam originals in the 24 x 36-mm size are slightly reduced so that the entire picture area inside the Bantam mask will be included in the 24 x 36-mm duplicate.</p> <p>‡Enlarged duplicates of 8 x 10-inch transparencies are not available.</p> <p>§Duplicates in the 35mm size will be returned in Kodak Ready-Mounts unless otherwise specified. They are not available in strip form. The minimum area that can be reduced to this size from sheet-film transparencies is 2¼ x 3¼ inches.</p> <p>°Original transparencies of this size cannot be duplicated, but 11 x 14-inch enlarged duplicates can be made from smaller sizes.</p> <p>NOTE: Kodachrome Professional and Kodak Ektachrome Film transparencies should not be sent for duplication bound between glass. A six-diameter enlargement is the maximum that will be supplied from any transparency.</p>																														



Both enlarged Kodachrome Prints and enlarged Kodachrome transparencies can be made from original miniature Kodachrome transparencies.

In commercial fields, duplicate sets of transparencies and movie films are needed for illustrated lectures, for salesmen's sample kits, and for dealer displays. Frequently the duplicate transparencies are wanted in larger or smaller sizes than the original transparencies.

16mm Kodachrome duplicates are available from either 16mm silent or sound Kodachrome Films. Orders for silent duplicates require no special preparation by the customer. In the case of 16mm Kodachrome sound duplicates, the sound record submitted for printing must be either a 35mm or 16mm matched positive print of high quality. When a sound track is sent in for duplicating, the proper starting point on both the sound-track film and the 16mm Kodachrome original should be indicated clearly and accurately, to assure synchronization.



BLACK-AND-WHITE PRINTS

ENLARGED black-and-white prints of 16mm Kodachrome Film frames and of 24 by 36-mm or 28 by 40-mm Kodachrome transparencies are frequently desired for albums, Christmas cards, or gifts.

To make such prints, it is necessary first to obtain negatives on film from the transparencies or film frames. These, as well as the desired prints, can be ordered from photofinishers or made with a minimum of darkroom equipment as described below. All such work can be done without damage to the film original. Black-and-white negatives made from 16mm Kodachrome Film frames or from 24 by 36-mm or 28 by 40-mm transparencies should be enlarged onto panchromatic film measuring at least $2\frac{1}{4} \times 3\frac{1}{4}$ inches.

Although properly exposed Kodachrome originals will, of course, produce the best results, improperly exposed transparencies often yield negatives satisfactory for printing.

The original Kodachrome transparencies from which negatives are to be made must be both sharp and clean. Dust and lint can be removed from the surface of transparencies with a camel's-hair or other soft brush. For removing fingerprints or oily smudges, see "Cleaning Transparencies," page 30.

In some instances, the use of filters will aid in obtaining better negatives for printing. The same rules apply for their use as apply when original color subjects are photographed through filters on black-and-white film, with one exception: a yellow, orange, or red filter used to penetrate atmospheric haze in original scenic subjects will not eliminate haze recorded in color transparencies. With panchromatic negative materials, the Kodak Wratten Filter X2 (No. 13) is suggested for improved rendering of flesh tones.

BLACK-AND-WHITE NEGATIVES

ENLARGED black-and-white film negatives of color film frames or transparencies can be made with a conventional enlarger such as the Kodak Precision Enlarger as follows:

Surround the selected frame or transparency with an opaque mask and place it, emulsion side up, in the negative carrier of the enlarger. Cover the enlarger lamp house with a black hood to eliminate all stray light. Frame and focus the image on the enlarger easel. Place a sheet of Kodak Panatomic-X Sheet Film on the easel and make a test exposure. A three-diameter enlargement from a miniature transparency will require about 6 seconds at $f/16$. Develop the film in Kodak Developer D-76 for 5 minutes in a tray or 7 minutes in a tank at 68°F.

HOW THE KODACHROME PROCESS WORKS

THERE are two general methods which can be used in color photography. One is described as the "additive," the other as the "subtractive" process.

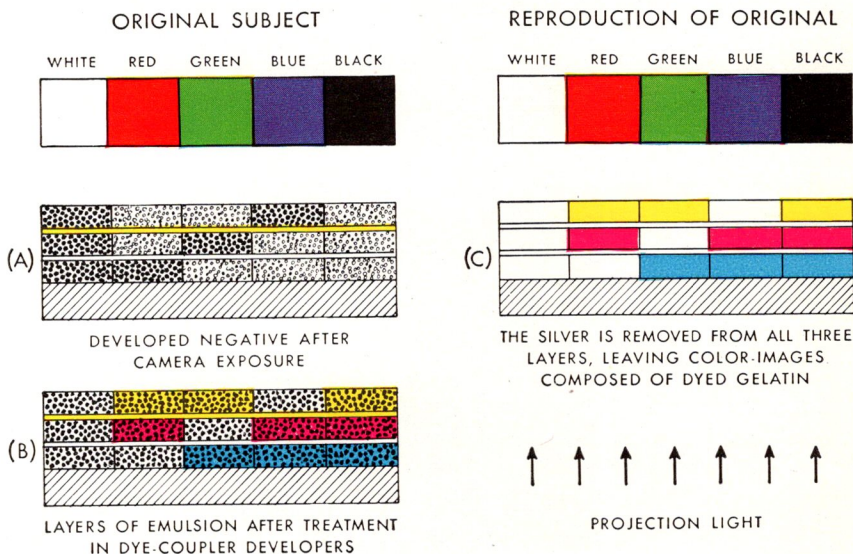
The "additive" process depends upon the addition of red, green, and blue light. An example of this method is the use of microscopic dots of red, green, and blue over the entire picture area, these dots being added together by the eye without the perception of the individual dots as such.

The "subtractive" process employs superimposed layers of cyan, magenta, and yellow which exert independent control of the primary colors—red, green, and blue.

Kodachrome Film, which exemplifies a "subtractive" process, has three emulsion layers, separated by gelatin layers, coated on the film support. The layers, so thin that their total thickness scarcely exceeds that of the emulsion layer of a black-and-white film, are on safety film base which has an antihalation backing.

EXPOSURE OF THE THREE KODACHROME LAYERS

THE picture on the top emulsion is taken by blue light, on the middle emulsion by green, and on the bottom emulsion by red light. This is not accomplished by blue, green, and red filters, but in the following



way: The top emulsion is sensitive to *blue* light only. The *green* and the *red* light pass through it without affecting it, so that the *blue* light alone makes the exposure. A yellow filter layer above the middle emulsion prevents any *blue* light from reaching the two lower emulsions. The middle emulsion is sensitive to *green* but not to *red*. It is sensitive to *blue* as all emulsions are, but the *blue* light cannot reach it, and the *red* light passes through without affecting it. Therefore, the exposure is made by *green* light. The bottom emulsion is sensitive to *red* but not to *green*. It is also sensitive to *blue*, but the *blue* light cannot reach it, and the *green* light does not affect it. Hence, the picture is taken by *red* light alone.

REPRODUCTION OF COLORS IN PROJECTION

DIAGRAM A on the opposite page shows how the film looks in cross-section after camera exposure and first development of the emulsion layers to negative images. Diagram B shows the appearance of the film after coupler development has been completed. In Diagram C, the silver has been removed and white light from a projection lamp is transmitted through the film to a screen, giving an image in the colors of the original subject. A complete understanding of the manner in which screen images in color are secured with Kodachrome Film can best be achieved by tracing the passage of light through the dye layers. It is suggested that the reader follow closely the right-hand side of the diagram while reading the following paragraph.

White light (on the screen) is secured by the unobstructed passage of light from the projector lamp to the screen. *Red* light results when a ray of white light is filtered by successive layers of magenta and yellow dye. The magenta layer absorbs green, leaving only blue and red. The yellow layer in turn absorbs blue, leaving only red. To secure *green* light, the cyan (blue-green) layer absorbs red, leaving green and blue. The yellow layer then absorbs blue, and green light proceeds to the screen. For *blue* light, the cyan layer again subtracts red, leaving blue and green. The magenta layer then takes out the green, leaving only blue. Intermediate colors and mixtures are secured by partial absorptions at each layer. Heavy dye deposits in all three layers subtract light of all colors, resulting in a black screen image.

It should be pointed out that there is no available process of color photography which can be said to give entirely accurate and repeatable reproduction of color. Kodachrome Films, properly used, give satisfactory color rendering, but they are not intended for making precise color records, or for matching or measuring colors.

KODACHROME FILM, DAYLIGHT TYPE

A color film designed for use in miniature still cameras or amateur motion-picture cameras and balanced for exposure in sunlight. Processed by the Eastman Kodak Company, it yields full-color transparencies for projection. Miniature Kodachrome transparencies can be used to obtain Kodachrome Prints or black-and-white prints, and can also be reproduced by photomechanical methods, the Kodak Dye Transfer Process, or other processes of color printing. Kodachrome Duplicates are available from originals of all sizes except 8mm.

Exposure Index: Daylight—10 Tungsten—4*

These values are recommended as settings for meters using American Standard Exposure Indexes. For older meters calibrated for Weston ratings and for older General Electric meters, the following settings are suggested:

Weston Daylight—8 Tungsten—3*
 General Electric Daylight—12 Tungsten—5*

*For emergency use with Kodachrome Filter for Photoflood.

These settings apply to average subjects and to meter readings taken from the camera position. In daylight, the meter should be pointed downward to minimize the effect from the sky if the manufacturer recommends this practice.

Daylight Exposure Table—Still Cameras: Lens openings at 1/50 second.

LIGHTING	OPENING FOR AVERAGE SUBJECTS	LIGHT-COLORED SUBJECTS	DARK-COLORED SUBJECTS	SIDE-LIGHTED SUBJECTS	BACK-LIGHTED SUBJECTS
Bright, Direct Sunlight	Between f/5.6 and f/8	f/8	f/5.6	Between f/5.6 and f/8*	f/4.5*
Weak, Hazy Sun—No Distinct Shadows Cast	f/4.5	f/5.6	f/4	*Assuming shadow areas are unimportant. With close-ups having important shadow areas, use one full lens opening larger.	
Sky Overcast—Cloudy, but Bright	f/3.5	f/4	f/2.8		
Open Shade on Bright Day	Between f/2 and f/2.8	f/2.8	f/2		

Light Sources: Best color rendering is obtained in bright or hazy sunlight. The light sources listed in the following table can also be used, but in general they do not give as good results even with the recommended filters.

LIGHT SOURCE	FILTER	REMARKS
Photoflood Lamps	Kodachrome Filter for Photoflood	For best results and shorter exposures with Photoflood Lamps, Kodachrome Film, Type A, without a filter is recommended.
Bluish daylight conditions*	Kodachrome Haze Filter	This filter reduces bluishness in distant scenes and pictures taken on an overcast day or in shade under a clear blue sky.
Daylight fluorescent lamps	Kodak CC33	For warmer results than are obtained with no filter.
White flame carbon arc lamps	Kodak CC23	For warmer results than are obtained with no filter.
*Color rendering becomes warmer with the Kodak CC14 Filter (1/4 to 1/2 stop exposure increase), still warmer with the Kodak CC15 Filter (1/2 to 3/4 stop exposure increase).		

Supplementary Flash to Illuminate Shadows in Outdoor Subjects: In bright sunlight, lighting contrast is frequently excessive, particularly with near-by side- or back-lighted subjects. The blue Photoflash Lamps No. 5B and 22B provide a handy means of illuminating shadow areas with light approximating daylight

in color quality. The lamp must be accurately synchronized by means of a flash shutter or a correctly adjusted synchronizer.

With bright sunlight and a clear blue sky, a desirable lighting ratio of about three to one is obtained by using the No. 22B Lamp at 12 feet or the No. 5B Lamp at 8½ feet. At shorter distances, a clean white handkerchief can be draped over the flash reflector to maintain this ratio. The following table is based on an exposure of 1/50 second at a lens opening between *f/5.6* and *f/8*.

LAMP-TO-SUBJECT DISTANCE	USE OF HANDKERCHIEF WITH 5B LAMP	USE OF HANDKERCHIEF WITH 22B LAMP
4 ft	2 thicknesses	—
6 ft	1 thickness	2 thicknesses
8½ ft	no handkerchief	1 thickness
12 ft	—	no handkerchief

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

Photoflash Exposure Guide Numbers: For the use of No. 5B and 22B Photoflash Lamps indoors, independently of daylight, in average flash reflectors. Divide the proper guide number by the distance in feet from lamp to subject. The answer is the recommended lens opening for average subjects in average rooms with light-colored walls and ceilings.

No. 22B Lamp*: Open flash—50; 1/100 sec—40; 1/200 sec—25

No. 5B Lamp : Open flash—45; 1/100 sec—35; 1/200 sec—25

*The No. 22 Lamp (clear glass) can be used with a Kodak Wratten Filter No. 78A. One-half stop more exposure is required.

Daylight Exposure Table—Amateur Motion-Picture Cameras: For 8mm and 16mm Kodachrome Film, at 16 frames per second (1/35 second shutter time).

LIGHTING	OPENING FOR AVERAGE SUBJECTS	LIGHT-COLORED SUBJECTS	DARK-COLORED SUBJECTS	SIDE-LIGHTED SUBJECTS	BACK-LIGHTED SUBJECTS
Bright, Direct Sunlight	<i>f/8</i>	Between <i>f/8</i> and <i>f/11</i>	Between <i>f/5.6</i> and <i>f/8</i>	<i>f/8*</i>	<i>f/5.6*</i>
Weak, Hazy Sun—No Distinct Shadows Cast	<i>f/5.6</i>	Between <i>f/5.6</i> and <i>f/8</i>	Between <i>f/4</i> and <i>f/5.6</i>	*Assuming shadow areas are unimportant. With close-ups having important shadow areas, use one full lens opening larger.	
Sky Overcast—Cloudy, but Bright	<i>f/4</i>	Between <i>f/4</i> and <i>f/5.6</i>	Between <i>f/2.8</i> and <i>f/4</i>		
Open Shade on Bright Day	<i>f/2.8</i>	Between <i>f/2.8</i> and <i>f/4</i>	Between <i>f/1.9</i> and <i>f/2.8</i>		

Photoflood Exposure Tables—Still Cameras and Amateur Motion-Picture Cameras: See leaflet packed with Kodachrome Filter for Photoflood.

Rolls Available for Miniature Cameras:

K135 20- and 36-exposure rolls (standard frame size—24 x 36 mm) for Kodak Ektra, Kodak 35, Kodak Retina, Leica, Contax, and other 35mm cameras.
K828 8-exposure rolls (standard frame size—28 x 40 mm) for Kodak Bantam Special, Bantam *f/4.5*, and Bantam *f/5.6* cameras.

Rolls and Magazines Available in 8mm and 16mm Film:

50- and 100-ft rolls for Cine-Kodak and other 16mm cameras.
200-ft roll for 200-ft film chamber of Cine-Kodak Special.
50-ft magazine for Cine-Kodak Magazine 16 and Filmo 141 cameras.
50-ft Packette for Simplex Pockette and Filmo 121 cameras.
100-, 200-, and 400-ft rolls perforated one edge for 16mm sound recording.
25-ft roll for Cine-Kodak and other 8mm cameras taking film 16mm wide.
25-ft magazine for Cine-Kodak Magazine 8 cameras.

KODACHROME FILM, TYPE A for Artificial Light

A color film designed for use in miniature still cameras or amateur motion-picture cameras and balanced for exposure with Photoflood Lamps. Processed by the Eastman Kodak Company, it yields full-color transparencies for projection. Miniature Kodachrome transparencies can be used to obtain Kodachrome Prints or black-and-white prints, and can also be reproduced by photomechanical methods, the Kodak Dye Transfer Process, or other processes of color printing. Kodachrome Duplicates are available from originals of all sizes except 8mm.

Exposure Index: *Tungsten*—16 *Daylight*—10*

These values are recommended as settings for meters using American Standard Exposure Indexes. For older meters calibrated for Weston ratings and for older General Electric meters, the following settings are suggested:

Weston	<i>Tungsten</i> —12	<i>Daylight</i> — 8*
General Electric	<i>Tungsten</i> —20	<i>Daylight</i> —12*

*With Kodachrome Type A Filter for Daylight. (In daylight, the meter should be pointed downward to minimize the effect from the sky if the manufacturer recommends this practice.)

These values apply when a reading of the scene is taken from the camera position and the subject and background have about the same brightness. If the reading is taken from the palm of the hand or the subject's face, divide it by 2; if the reading is taken from a white card held close to the subject and facing the camera, divide it by 5. Set the meter calculator as for a normal subject. For convenience, the Exposure Index (or meter setting) instead of the light reading can be divided by the same number and then rounded to the nearest calculator setting. When using a card or the palm of the hand, allow for unusually light or dark subjects. Other methods of meter use may require other correction factors.

Copying and Close-Up Work: In copying, the use of a white 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. An Effective Aperture Kodaguide furnishes an easy means of determining the effective lens opening.

Photoflood Exposure Table—Still Cameras: For Kodachrome Film, Type A, with No. 2 Photoflood Lamps in Kodaflectors (matte side), or with Reflector Photoflood Lamps.

SHUTTER TIME	NUMBER OF LAMPS	LAMP-TO-SUBJECT DISTANCE WITH NO. 2 OR REFLECTOR PHOTOFLOOD LAMPS						
		<i>f</i> /2	<i>f</i> /2.8	<i>f</i> /3.5	<i>f</i> /4	<i>f</i> /4.5	<i>f</i> /5.6	
1/25 or 1/20	1 2 3	5 ft 7½ ft 9 ft	3¾ ft 5½ ft 6½ ft	3 ft 4¼ ft 5 ft		3½ ft 4½ ft	3¼ ft 4 ft	3¼ ft
1/5 or 1/4	1 2 3	12 ft 17 ft 21 ft	8½ ft 12 ft 15 ft	6½ ft 9½ ft 12 ft	6 ft 8½ ft 10 ft	5½ ft 7½ ft 9½ ft	4 ft 6 ft 7½ ft	4 ft 6 ft 7½ ft

Note: Do not use more than three No. 2 or Reflector Photofloods on a single fused circuit.

Light Sources: In general, best color rendering is obtained with Photoflood Lamps. Satisfactory color rendering can be obtained with the light source and filter combinations listed on the following page.

LIGHT SOURCE	FILTER
Daylight Photoflash Lamps No. 5, 6, 11, 22, 31, and 50 SM Photoflash Lamp	Kodachrome Type A Filter for Daylight Kodak CC15
3200°K Lamps White fluorescent lamps	Kodak CC23, for warmer results than are obtained with no filter Kodak CC4 Kodak CC34

Photoflood Exposure Table—Amateur Motion-Picture Cameras: For 8mm and 16mm Kodachrome Film, Type A, at 16 frames per second (1/35 second shutter time) with No. 1 Photoflood Lamps in Kodaflectors.

Number of No. 1 Photoflood Lamps and Distance from Lamps to Subject	2 at 9 ft or 3 at 11 ft or 4 at 13 ft	2 at 6½ ft or 3 at 7½ ft or 4 at 9 ft	2 at 4½ ft or 3 at 5½ ft or 4 at 6½ ft	2 at 3 ft or 3 at 3¾ ft or 4 at 4½ ft
Lens Opening and Camera Speed	f/1.9 Normal Speed or f/2.8 Half Speed	f/2.7 or f/2.8 Normal Speed or f/4 Half Speed	f/4 Normal Speed or f/5.6 Half Speed	f/5.6 Normal Speed or f/8 Half Speed

Photoflash Exposures: These exposures are for K135A and K828A films with the Kodak CC15 Filter and apply to average subjects in average rooms with light-colored walls and ceilings. With dark-colored subjects in dark surroundings, use one full lens opening larger.

No. 22 lamp in Kodaflector (matte side)	7 ft	10 ft	14 ft	20 ft	28 ft
Lens opening for open-flash exposures:	f/22	f/16	f/11	f/8	f/5.6

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

Photoflash Exposure Guide Numbers: For use with Photoflash Lamps in average flash reflectors. Divide the proper guide number by the lamp-to-subject distance in feet. The answer is the recommended lens opening for average subjects in average rooms with light-colored walls and ceilings.

BETWEEN-THE-LENS SHUTTERS					FOCAL-PLANE SHUTTERS		
SHUTTER TIME	SM†	No. 5*	No. 11*	No. 22*	SHUTTER TIME	No. 6*	No. 31*
Open, 1/25, 1/50	50	90	100	145	1/50	65	70
1/100	50	75	80	115	1/100	45	50
1/200	35	60	65	90	1/250	30	35

†No filter or Kodak CC23 for slightly warmer results. *With the Kodak CC15 Filter.

Daylight Exposure Table—Still Cameras: Use the “Daylight Exposure Table—Still Cameras” in Data Sheet for Kodachrome Film, Daylight Type. A Kodachrome Type A Filter for Daylight must be used on the camera lens.

Daylight Exposure Table—Amateur Motion-Picture Cameras: Use the “Daylight Exposure Table—Amateur Motion-Picture Cameras” in the Data Sheet for Kodachrome Film, Daylight Type. A Kodachrome Type A Filter for Daylight must be used on the camera lens.

Rolls and Magazines Available: Same as for Kodachrome Film, Daylight Type. The letter A following the number designates Type A film (K135A, K828A).

KODACHROME PROFESSIONAL FILM DAYLIGHT TYPE

Code Notch

A color sheet film balanced for exposure in sunlight. Processed by the Eastman Kodak Company, it yields positive color transparencies which can be viewed by transmitted light or projection. The transparencies are well suited to reproduction by photomechanical methods, the Kodak Dye Transfer Process, or other processes of color printing. They can also be used to obtain Kodachrome Duplicates or Kodachrome Professional Prints. Black-and-white prints can be made by means of intermediate negatives.

Exposure Index: *Daylight—8*

This value is recommended as a setting for meters using American Standard Exposure Indexes. A setting of 6 is suggested for older meters calibrated for Weston ratings; 10 for older General Electric meters. These settings apply to average subjects and to meter readings taken from the camera position. In daylight, the meter should be pointed downward to minimize the effect from the sky if the manufacturer recommends this practice.

Daylight Exposure Table: Kodachrome Professional Film, Daylight Type. Lens openings at 1/50 second.

LIGHTING	OPENING FOR AVERAGE SUBJECTS	LIGHT-COLORED SUBJECTS	DARK-COLORED SUBJECTS	SIDE-LIGHTED SUBJECTS	BACK-LIGHTED SUBJECTS
Bright, Direct Sunlight	f/6.3	f/8	f/5.6	f/6.3*	f/4.5*
Weak, Hazy Sun—No Distinct Shadows Cast	f/4.5	f/5.6	f/4	*Assuming shadow areas are unimportant. With close-ups having important shadow areas, use one full lens opening larger.	
Sky Overcast—Cloudy, but Bright	f/3.5	f/4	f/2.8		
Open Shade on Bright Day		f/2.8			

Light Sources: In general, best color rendering is obtained in bright or hazy sunlight. The bluish cast which is otherwise evident in (a) pictures taken on an overcast day, (b) pictures taken in shade under a clear blue sky, and (c) distant scenes, mountain views, etc., can be avoided by the use of the Kodak CC14 or CC15 Filter. Color rendering becomes warmer with the CC14 Filter, which requires $\frac{1}{4}$ to $\frac{1}{2}$ stop more exposure than that otherwise necessary, and still warmer with the CC15 Filter, which requires $\frac{1}{2}$ to $\frac{3}{4}$ stop more exposure than that otherwise necessary. Satisfactory color rendering can also be obtained with certain other light source and filter combinations, listed in the following table. Mercury vapor lamps cannot be used.

LIGHT SOURCE	FILTER	REMARKS
Daylight (blue) Photoflash Lamps White flame carbon arc lamps	None Kodak CC23	In some cases satisfactory color rendering can be obtained with no filter.
Kodatron Flashtube FT-402 Daylight fluorescent lamps	Kodak CC15 Kodak CC33	
Daylight (blue) Photoflood Lamps	None	Useful only for supplementing daylight illumination of indoor subjects such as room interiors and show windows.

Photoflash Exposure Guide Numbers: For the use of No. 5B and 22B Photoflash Lamps indoors, independently of daylight, in average flash reflectors. Divide the proper guide number by the distance in feet from lamp to subject. The answer is the recommended lens opening for average subjects in average rooms with light-colored walls and ceilings.

No. 22B Lamp*: Open flash—55; 1/100 sec—45; 1/200 sec—28

No. 5B Lamp : Open flash—50; 1/100 sec—40; 1/200 sec—25

*The No. 22 Lamp (clear glass) can be used with a Kodak Wratten Filter No. 78A. One-half stop more exposure is required.

Supplementary Flash to Illuminate Shadows in Outdoor Subjects: In bright sunlight, lighting contrast is frequently excessive, particularly with near-by side- or back-lighted subjects. The blue-bulb Photoflash Lamps No. 5B and 22B provide a handy means of illuminating shadow areas with light approximating daylight in color quality. The lamp must be accurately synchronized by means of a flash shutter or a correctly adjusted synchronizer.

With bright sunlight and a clear blue sky, a desirable lighting ratio of about three to one is obtained by using the No. 22B Lamp at 12 feet or the No. 5B Lamp at 8½ feet. At shorter distances, a clean white handkerchief can be draped over the flash reflector to maintain this ratio. The following table is based on the use of Kodachrome Professional Film, Daylight Type, with an exposure of 1/50 second at *f*/6.3.

LAMP-TO-SUBJECT DISTANCE	USE OF HANDKERCHIEF WITH 5B LAMP	USE OF HANDKERCHIEF WITH 22B LAMP
4 ft	2 thicknesses	—
6 ft	1 thickness	2 thicknesses
8½ ft	no handkerchief	1 thickness
12 ft	—	no handkerchief

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

Daylight Fluorescent Lamps: Note filter recommendation on preceding page. With two banks of eight 40-watt, 48-inch tubes in polished aluminum reflectors, the exposure is about 1 second between *f*/5.6 and *f*/8 when the key light is 4 feet from the subject and the fill-in light is 6 feet from the subject.

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.

KODACHROME PROFESSIONAL FILM

TYPE B for Artificial Light

Code Notch

A color sheet film balanced for exposure with 3200°K Lamps. Processed by the Eastman Kodak Company, it yields positive color transparencies which can be viewed by transmitted light or projection. The transparencies are well suited to reproduction by photomechanical methods, the Kodak Dye Transfer Process, or other processes of color printing. They can also be used to obtain Kodachrome Duplicates or Kodachrome Professional Prints. Black-and-white prints can be made by means of intermediate negatives.

Exposure Index: *Tungsten—10* *Daylight—6**

These values are recommended as settings for meters using American Standard Exposure Indexes. For older meters calibrated for Weston ratings and for older General Electric meters, the following settings are suggested:

Weston	<i>Tungsten—8</i>	<i>Daylight—5*</i>
General Electric	<i>Tungsten—12</i>	<i>Daylight—8*</i>

*With Kodak Wratten Filter No. 85B. (In daylight, the meter should be pointed downward to minimize the effect from the sky if the manufacturer recommends this practice.)

These values apply when a reading of the scene is taken from the camera position and the subject and background have about the same brightness. If the reading is taken from the palm of the hand or the subject's face, divide it by 2; if the reading is taken from a white card held close to the subject and facing the camera, divide it by 5. Set the meter calculator as for a normal subject. For convenience, the Exposure Index (or meter setting) instead of the light reading can be divided by the same number and then rounded to the nearest calculator setting. When using a card or the palm of the hand, allow for unusually light or dark subjects. Other methods of meter use may require other correction factors.

Copying and Close-Up Work: In copying, the use of a white 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. An Effective Aperture Kodaguide furnishes an easy means of determining the effective lens opening.

3200°K Lamp Exposure Table: Based on the use of two 500-w PS-25 3200°K Lamps in bowl-type studio reflectors within 45° of the camera-subject axis.

DISTANCE, LAMPS TO SUBJECT	5 ft	7 ft	10 ft	14 ft	20 ft
CAMERA SETTINGS*	<i>f/16, 1 sec</i>	<i>f/11, 1 sec</i>	<i>f/8, 1 sec</i>	<i>f/5.6, 1 sec</i>	<i>f/5.6, 2 sec</i>

*These values are intended only as guides. They will vary somewhat, according to the shape and surface of the reflectors, the position of the bulbs in the reflectors, and the age of the lamps.

A satisfactory portrait lighting is obtained by placing one lamp near the camera at lens level, the other considerably higher and at an angle of approximately 45° to the camera-subject axis.

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.

Unless a special effect is desired, light sources having different color qualities must not be mixed. In particular, avoid mixing tungsten light and daylight. Mercury vapor lamps cannot be used. Satisfactory color rendering can be obtained with the following light source and filter combinations:

LIGHT SOURCE	FILTER
Photoflood Lamps and "CP" (3350°K) Lamps Photoflash Lamps No. 5, 6, 11, 22, 31, and 50 White fluorescent lamps	Kodak CC15 Kodak Wratten No. 2A Kodak CC34 plus CC95

Flashlamps in Synchronizers: The following Exposure Guide Numbers are for Photoflash Lamps in efficient synchronizer reflectors. Divide the guide number by the lamp-to-subject distance in feet. The answer is the recommended lens opening for average-size rooms with light-colored walls and ceilings.

BETWEEN-LENS SHUTTERS	No. 5*	No. 11*	No. 22*	FOCAL-PLANE SHUTTERS		
				No. 6*	No. 31*	
Open, 1/25, 1/50	75	80	105	1/50	55	60
1/100	65	65	85	1/100	35	40
1/200	40	40	60	1/250	20	25

*With Kodak Wratten Filter No. 2A.

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

Flashlamps in Studio Reflectors: The following Exposure Guide Numbers are for open-flash use with Photoflash Lamps in large studio reflectors. Note filter recommendation above. Divide the guide number as described above for lamps used with synchronizers. If the number of lamps lighting the same area is doubled, use one lens opening smaller.

Photoflash Lamp No. 22—**105**

Photoflash Lamp No. 50—**150**

White Fluorescent Lamps: Note filter recommendation above. With two banks of eight 40-watt, 48-inch tubes in polished aluminum reflectors, arranged with the key light 4 feet from the subject and the fill-in light 6 feet from the subject, the required exposure is about 1 second at *f*/8.

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.

SPECIAL KODAK MOTION-PICTURE SERVICES

IN addition to Kodak services previously described, the Eastman Kodak Company offers both copying and titling services for amateur motion-picture photographers. Orders must be placed through Kodak dealers.

COPYING SERVICE

PICTURES, drawings, maps, and printed or hand-lettered cards from $1\frac{5}{8}$ by $2\frac{1}{2}$ to 11 by 14 inches can be copied and supplied on either 8mm or 16mm Kodachrome Film. The minimum length of film for each subject is 4 feet on 16mm film, 2 feet on 8mm film.

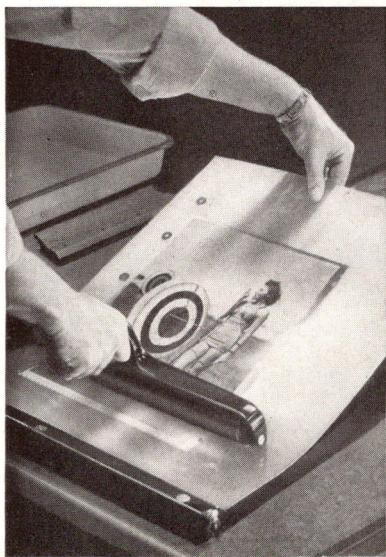
KODACHROME TITLES

KODACHROME titles are supplied *only* on 16mm film. Both card and scroll titles have black lettering on a red background. Orders should specify whether the titles are for use with original films or duplicates.

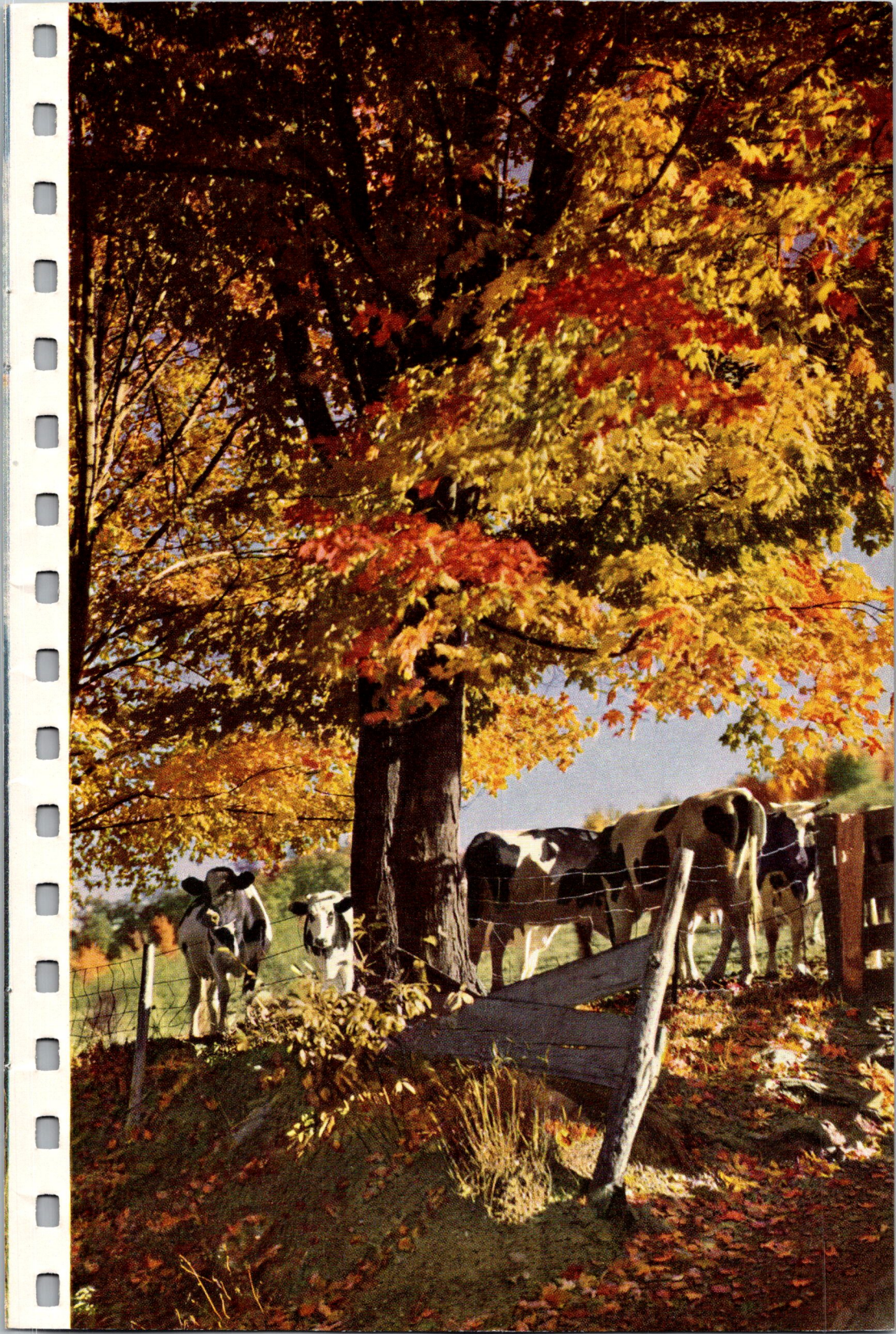
KODAK DYE TRANSFER PROCESS

FROM Kodachrome transparencies, full-color photographic prints of excellent quality can be made in sizes up to 16 by 20 inches by the Kodak Dye Transfer Process. Color-separation negatives are first made from the transparency through red, green, and blue filters. Each negative is printed on a separate sheet of Kodak Matrix Film, which is then specially processed to produce a positive relief image in gelatin which will absorb dye in proportion to its thickness. The three matrices are dyed cyan, magenta, and yellow, respectively. When the images are transferred, in register, to a sheet of premordanted Kodak Dye Transfer Paper, a color print is produced.

All the necessary chemicals are supplied in prepared form. Complete instructions are packed with the Kodak Matrix Dye Set, which contains chemicals for preparing 1 gallon of each dye solution. While most of the equipment required is standard, a few special items are needed for registering the images and for control purposes. Further information can be obtained from Kodak dealers or by writing to the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.



Transferring an image by rolling the dyed matrix (on a Kodak Dye Transfer Blanket) into contact with Kodak Dye Transfer Paper.





247010

247010

KODACOLOR PHOTOGRAPHY

KODACOLOR Film makes it possible for the owner of an ordinary roll-film camera to make color negatives at relatively low cost and almost as easily as black-and-white negatives. This film is intended primarily for exposure in sunlight and can be used with the simplest types of folding and box cameras. Blue flashlamps approximate daylight in color quality and can be used to supplement daylight or as the sole light source when daylight is not available.

After exposure, the film is returned to a Kodak dealer, who sends it to the Eastman Kodak Company for development to negatives. The original price of the film includes development to negatives, but does *not* include the making of Kodacolor Prints.

The Kodacolor Process reproduces colors with sufficient fidelity to afford attractive color prints. It is not intended for the making of color records, or for matching or measuring colors.

CAMERAS

CAMERAS for use in exposing Kodacolor Film range from the simple box models to the Kodak Medalist with its many refinements. Outstanding among folding cameras are the Kodak Vigilant and Monitor. Under ideal lighting conditions, Jiffy Kodak and Brownie cameras are also suitable for taking Kodacolor pictures. In fact, Kodacolor Film is accepted by any camera which takes Kodak Film designated by one of the following numbers: 127, 620, 120, 616, and 116.

Loading Procedure. In the great majority of cameras, Kodacolor Film is loaded, advanced, and unloaded in the same manner as black-and-white roll films, except that there are six standard exposures per roll instead of the eight exposures customary with rolls of black-and-white films. Certain cameras that make 10, 12, 15, or 16 pictures on regular eight-exposure rolls of black-and-white film make 8, 9, 11, or 12 pictures, respectively, on six-exposure rolls of Kodacolor Film.

With automatic film-positioning cameras, it is necessary to trip the shutter or to release the stop device as many times as required to permit winding until the end of the backing paper has passed the film window on the back of the camera.

In the case of a few reflex cameras, the film advance is controlled by turns of the take-up spool and is therefore affected by the film thickness. These cameras include the Korelle Reflex; also the "old standard" Rolleiflex model, which does not have automatic shutter setting, and with which only the first exposure is positioned in the film

window. To obtain the maximum number of exposures with these cameras, the following special winding procedure is recommended:

When using film designated by the number C120, wind the film to the star following the arrow and set the exposure counter at Number 1. Advance the film until Number 3 appears on the counter and make the first exposure. Make the second exposure at Number 4, etc., until the ninth and last exposure is made with the counter at Number 11. Wind off the remainder of the roll.

KODAK FILTERS AND POLA-SCREENS

KODAK color filters or other filters should not be used in Kodacolor photography. If a color filter is used, the picture will assume the color of the filter. Kodak Pola-Screens can be used with Kodacolor Film, as with Kodachrome Film, Daylight Type, to darken blue skies for greater contrast with side-lighted buildings, blossoms, etc. Cameras with Pola-Screens must be used at right angles to the sun for the greatest effect. An exposure increase of one and one-half stops for the Pola-Screen must be added to the normal half or full stop increase required because of side lighting (see page 9).

EXPOSURE IN DAYLIGHT

THE one all-important rule to follow for best Kodacolor results in daylight is to *photograph subjects in bright or hazy sunlight, giving exposures recommended in the instruction sheet packed with the film, in the Data Sheet in this book, or as indicated on the Snapshot Kodaguide.* Further information on taking pictures outdoors is given on pages 7 to 10.

Compared to black-and-white negative materials, Kodacolor Film has limited camera exposure latitude.* For this reason, lens settings for Kodacolor pictures should always be determined carefully. Underexposure results in loss of shadow detail and in poor photographic quality, just as in black-and-white photography. Too much exposure causes highlights in the prints to become blocked up, with the result that faces lose modeling. *Both errors tend to falsify colors.*

Compared to Kodachrome Films, however, Kodacolor has somewhat greater exposure latitude. This is due largely to the fact that Kodacolor Film is a negative material, while Kodachrome is a reversal material, designed to yield positive images. With miniature Kodachrome Films, camera exposure latitude is about one stop. With Kodacolor Film, satisfactory Kodacolor Prints can be made from Kodacolor negatives which received as much as two full stops more than the correct exposure.

*The term "camera exposure latitude" refers to the interval between the greatest and least amounts of exposure that will produce satisfactory results.

ARTIFICIALLY LIGHTED SUBJECTS

ONLY blue flashlamps such as Photoflash Lamps No. 5B and 22B should be used for making Kodacolor pictures without daylight or for lighting shadow areas of daylighted subjects; synchronizing equipment is required. Neither clear Photoflash Lamps nor regular or daylight-type Photoflood Lamps should be used, because the resulting pictures will tend to be orange in color.

A common fault of Kodacolor pictures taken with Photoflash Lamps is a rather flat and washed-out appearance in the face of the subject, caused by overexposure of flesh tones. It can be avoided by the use of lamp and reflector combinations which produce even, diffuse illumination, such as the No. 22B Lamp and a Kodaflector (matte side). If the light is not evenly distributed and well diffused, the reflector should not be pointed directly at the face of the subject.

Better lighting effects are obtainable if a second lamp in an extension flash holder is used as a side light. With one lamp at the camera and a second lamp higher and at an angle of about 45° to the camera axis, the exposure required is about half that for a single lamp.

For best results in making Photoflash pictures with Kodacolor Film, the instructions in the Data Sheet should be followed carefully.

RETURN OF FILM FOR DEVELOPMENT—KODACOLOR PRINTS

DETAILED instructions for returning exposed Kodacolor Film for development and printing appear in the instruction sheet packed with each roll.

There are two types of orders. The first is an order to "*Develop and Print*," which the customer can enter with a Kodak dealer when he returns the film to him for development. In this case, the customer will not see the Kodacolor negatives before they are printed. Kodacolor Prints will be made only from those negatives which, in the opinion of the operator, are of suitable quality. No discretion can be exercised over subject matter except where the negatives are out of focus, very badly framed, or were obviously exposed by accident.

The second type of order is for "*Prints Only*," after the customer has seen the negatives. In this case, Kodacolor Prints will be made from all negatives submitted, except in unusual cases where the quality of resulting prints will be so unsatisfactory as to be unacceptable. All prints are made to a standard width of about $2\frac{7}{8}$ inches, plus margins. The lengths depend on the proportions of the original negatives.

Selection of Negatives for Printing. A Kodacolor negative looks much like a black-and-white negative, but contains colors complementary to

those of the original subject. Although Kodacolor negatives are intended primarily for the making of Kodacolor Prints, they can also be used to make black-and-white prints or enlargements on regular photographic papers. The work can be done by a photofinisher or by the photographer himself. In some cases, satisfactory black-and-white prints can be obtained even from negatives which are unsatisfactory for Kodacolor Prints.

In addition to the negative color image, Kodacolor negatives contain a low-contrast positive "mask" which results in a gray tone extending to the edges of the film. This mask improves the quality of the prints. The mask makes Kodacolor negatives appear dense regardless of whether or not the film has been correctly exposed. A correctly exposed negative shows detail in both highlight and shadow areas. When the negative has been underexposed, however, detail is lacking in the light areas, which correspond to shadow areas in the original scene.

Kodacolor negatives for printing should be sharp and correctly exposed, with good shadow detail, but no "blocking up" of highlights. A negative showing a wide range of colors will produce a colorful print. The color balance of a Kodacolor negative is not especially significant, however, because differences in color balance between rolls are corrected in the making of Kodacolor Prints. For this reason, it is not possible to judge the negatives according to a "master" Kodacolor negative of a typical subject.

Prints from selected areas of negatives can also be made on special order. Because of the extra work involved, an extra charge is made for the first print from each cropped negative.

Cropped areas must conform to one of the smaller standard negative sizes appearing in the table in the Data Sheet. The cropped area should be indicated by attaching tape or a black paper mask to the back of the negative. The narrower dimension of the cropped area will be enlarged to the standard width of approximately $2\frac{1}{8}$ inches.

It is essential that a Kodacolor negative should not be trimmed in any way to indicate cropping. Otherwise, the perforations which are punched along one edge of the negative may be lost. This key is needed as a guide to color balance when Kodacolor Prints are made.

Matched prints from a given negative can be made only if they are ordered at one time.

Mounting of Kodacolor Prints can be done satisfactorily with Kodak Rapid Mounting Cement. Rubber cement should not be used because the solvent may affect the dyes. Pastes containing water or other penetrating solvents are also unsuitable.

Kodak Thermount Tissue is also recommended for mounting color prints; this material can be used at a lower temperature than regular mounting tissue. Regular dry mounting tissue is not recommended, because excessive heat in the mounting process may affect the dyes.

TO HELP JUDGE KODACOLOR PRINTS...

FAULT	CAUSE	REMEDY
Lack of shadow detail: Shadows dark, good detail in light areas.	Underexposure of shaded areas due to side or back lighting.	With side or back lighting, use a reflector or blue flashlamp to direct light into shaded areas.
Lack of highlight detail: Faces and other light-colored areas lack color and texture.	Overexposure.	Follow the exposure tables in the instruction sheet supplied with the film.
Image too yellow: Good shadow and high-light detail, but no blue tones and an excess of yellow tones.	Yellow filter used over the lens. Film was exposed with Photoflood illumination.	No color filter should be used with this film. Use only blue flashlamps for artificial lighting.
Light patches or streaks:	Careless film handling. Light leaks in camera, resulting in fog. Direct sunlight on camera lens.	Load and unload the camera in subdued light. Keep the film wound tightly. Have the camera checked for light leaks. Use a lens hood or some other means of shading the lens.
Halation around light-colored areas:	Camera lens dirty.	Clean the lens with Kodak Lens Cleaning Paper or a soft, lintless cloth.
Picture blurred: Entire picture blurred. Moving object in picture blurred.	Camera was moved. Object was moving too fast to be stopped at shutter speed used.	Be sure the camera is steady at time of exposure. Use a shutter speed fast enough to stop the motion of the object to be photographed.
Fuzzy pictures:	Camera not focused for camera-to-subject distance at which picture was made. Camera lens dirty.	Measure the camera-to-subject distance carefully. Don't guess. Clean the camera lens.
Side edges red-orange:	Film allowed to unwind, permitting light to strike film edges.	Keep the film wound tightly. Load and unload the camera in subdued light.
Image too orange:	Kodacolor Film was exposed to early morning or late evening sunlight.	Do not make Kodacolor pictures of people during the first two hours after sunrise, or during the two hours before sunset, because at these times sunlight is too orange.
Poor photographic quality: Little or no separation between colors.	Outdated film used, or partially exposed roll left in camera too long.	Expose film before expiration date on carton. Have exposed film developed as quickly as possible.

KODACOLOR ROLL FILM

A color film which permits the taking of color snapshots in nearly all types of roll-film cameras. The exposure and development of the film result in color negatives, called Kodacolor negatives. These negatives resemble ordinary black-and-white negatives, but contain colors complementary to those of the original subjects. They are intended for the making of Kodacolor Prints, which are obtainable on orders placed with Kodak dealers. Black-and-white contact prints and enlargements can be made from Kodacolor negatives in the same manner as from black-and-white negatives.

Exposure Index: *Daylight—25*

This value is recommended as a setting for meters using American Standard Exposure Indexes. A setting of 20 is suggested for older meters calibrated for Weston ratings; 32 for older General Electric meters. In daylight, the meter should be pointed downward to minimize the effect from the sky if the manufacturer recommends this practice.

Daylight Exposure Table: Lens openings at **1/50 second** shutter time. For winter scenes without snow, use one lens opening larger in all cases.

LIGHTING CONDITIONS*	LENS OPENINGS FOR AVERAGE SUBJECTS	LIGHT-COLORED SUBJECTS	DARK-COLORED SUBJECTS
Bright, Direct Sunlight	<i>f/11</i>	Between <i>f/11</i> and <i>f/16</i>	Between <i>f/8</i> and <i>f/11</i>
Hazy Sun, Soft Shadows	<i>f/8</i>	Between <i>f/8</i> and <i>f/11</i>	<i>f/6.3</i>

*Since Kodacolor Film is color balanced for bright or hazy sunlight, best results can be expected under these lighting conditions only. Kodacolor pictures made on cloudy days or in shade require about 1/50 second at *f/4.5*, but tend to be flat and somewhat bluish.

With Kodak Vigilant Junior, Jiffy Kodak, and Brownie cameras, and cameras with similar lens openings, snapshots should be made only with front lighting in bright, direct sunlight, and with the largest lens opening.

Supplementary Flash to Illuminate Shadows in Outdoor Subjects: In bright sunlight, lighting contrast is frequently excessive, particularly with nearby side- or back-lighted subjects. The blue Photoflash Lamps No. 5B and 22B provide a handy means of illuminating shadow areas with light approximating daylight in color quality. The lamp must be accurately synchronized by means of a flash shutter or a correctly adjusted synchronizer.

With bright sunlight and a clear blue sky, a desirable lighting ratio of about three to one is obtained by using the No. 22B Lamp at 12 feet or the No. 5B Lamp at 8½ feet. At shorter distances, a clean white handkerchief can be draped over the flash reflector to maintain this ratio. The following table is based on an exposure of 1/50 second at *f/11*.

LAMP-TO-SUBJECT DISTANCE	USE OF HANDKERCHIEF WITH 5B LAMP	USE OF HANDKERCHIEF WITH 22B LAMP
4 ft	2 thicknesses	—
6 ft	1 thickness	2 thicknesses
8½ ft	no handkerchief	1 thickness
12 ft	—	no handkerchief

Photoflash Exposures Indoors: One No. 22B Photoflash Lamp in Kodaflector (matte side)—Open Flash (set shutter for time or “bulb”).

LAMP DISTANCE	5 ft*	7 ft	10 ft	14 ft
1 No. 22B (no filter)	f/11	f/8	f/5.6	f/4

*At this distance, use largest lens opening with Kodak Vigilant Junior, Jiffy Kodak, and Brownie cameras, and cameras with similar lens openings.

Photoflash Exposure Guide Numbers: For use with Photoflash Lamps in average flash reflectors. Divide the proper guide number by the lamp-to-subject distance in feet. The answer is the recommended lens opening for average subjects in average rooms with light-colored walls and ceilings.

PHOTOFLASH LAMP	OPEN FLASH, 1/25 or 1/50 SECOND, BULB OR TIME	1/100 SECOND	1/200 SECOND
No. 5B	50	40	25
No. 22B	55	45	28

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

Sizes of Kodacolor Negatives and Prints, and Exposures Per Roll:

As indicated in the following table, the negative size determines both the print size and the maximum number of exposures per roll.

KODACOLOR ROLL NUMBER	NEGATIVE SIZE IN INCHES	MAXIMUM NUMBER OF EXPOSURES	APPROX. PRINT SIZE* IN INCHES	KODACOLOR ROLL NUMBER	NEGATIVE SIZE IN INCHES	MAXIMUM NUMBER OF EXPOSURES	APPROX. PRINT SIZE* IN INCHES
C127	$1\frac{5}{8} \times 2\frac{1}{2}$	6	$2\frac{7}{8} \times 4\frac{1}{2}$	C120 or C620	$2\frac{1}{4} \times 3\frac{1}{4}$	6	$2\frac{7}{8} \times 4\frac{3}{16}$
	$1\frac{5}{8} \times 1\frac{5}{8}$	9	$2\frac{7}{8} \times 2\frac{7}{8}$		$2\frac{1}{4} \times 2\frac{1}{4}$	9	$2\frac{7}{8} \times 2\frac{7}{8}$
	$1\frac{3}{16} \times 1\frac{9}{16}$	12	$2\frac{7}{8} \times 2\frac{1}{8}$		$1\frac{5}{8} \times 2\frac{1}{4}$	12	$2\frac{7}{8} \times 4$
C120	$1\frac{3}{16} \times 1\frac{9}{16}$	12	$2\frac{7}{8} \times 3\frac{1}{16}$	C116 or C616	$2\frac{1}{2} \times 4\frac{1}{4}$	6	$2\frac{7}{8} \times 5$
	$2\frac{1}{4} \times 2\frac{1}{2}$	8	$2\frac{7}{8} \times 3\frac{3}{16}$		C616	$2\frac{1}{8} \times 2\frac{1}{2}$	11 or 12

*All Kodacolor Prints are made to the same width of about $2\frac{7}{8}$ inches, plus margins; the length is dependent upon the proportions of the negative. The above lengths are approximate, because of slight variations in the negative dimensions obtained with different cameras.

CARE OF FILM, PRINTS, AND NEGATIVES: Kodacolor Film should not be left in cameras for long periods of time. The film, prints, and negatives should be kept in a cool, dry place. The prints and negatives must be protected from prolonged exposure to bright daylight, especially direct sunlight. A picture album is recommended for the prints. Kodacolor Prints and negatives will not keep well in the tropics.

Notice: Kodacolor Prints and negatives contain dyes which are as stable as possible, consistent with their other requirements. Like other dyes, they may change in time. Neither Kodacolor Film nor Kodacolor Prints will be replaced or otherwise warranted against any change in color.

HOW THE KODACOLOR PROCESS WORKS

A METHOD of producing dye images in color photography is supplied by the chemical reaction known as "coupler development." In this reaction, when the developer reacts with silver bromide and forms silver, its oxidation product, as it is formed, reacts with another chemical substance known as a "coupler" and forms a color compound, that is, a dye.

In the Kodacolor Process, the couplers are carried in very small globules of organic materials which are dispersed throughout the emulsion layers. The arrangement is illustrated by the micrographic diagrams on page 60; the particles are so small that they can be seen only under a high-power microscope. These globules protect the couplers from the gelatin and at the same time protect the silver bromide from any interaction with the couplers. This process might be known technically as the "protected coupler process." When a suitable developer is used, the oxidation product of the developing agent dissolves in the organic materials and there reacts with the coupler, so that dyes are formed in the small globules dispersed through the layers. The color of the dye depends upon the nature of the coupler.

REPRODUCTION OF COLORS

Kodacolor Film has three light-sensitive emulsions as well as a yellow filter layer and an emulsion layer for producing a mask image. The quality of the final print is improved as a result of this mask image. The bottom emulsion responds to red light, the middle emulsion to green light, and that at the surface to blue light. The yellow filter layer below the top emulsion prevents blue light from reaching the other two emulsions. The layers, so thin that their total thickness scarcely exceeds that of the emulsion layer of a black-and-white film, are coated on a safety film base having an antihalation backing.

Like the Kodachrome Process, the Kodacolor Process reproduces colors by the "subtractive" method. After exposure, Kodacolor Film is developed in a single color



Kodacolor negatives used for making Kodacolor Prints also yield excellent black-and-white prints and moderate enlargements by following ordinary printing and enlarging techniques.

KODACOLOR PRINT

KODACOLOR NEGATIVE

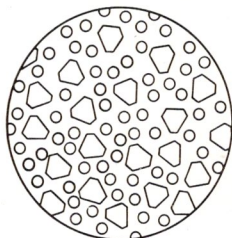
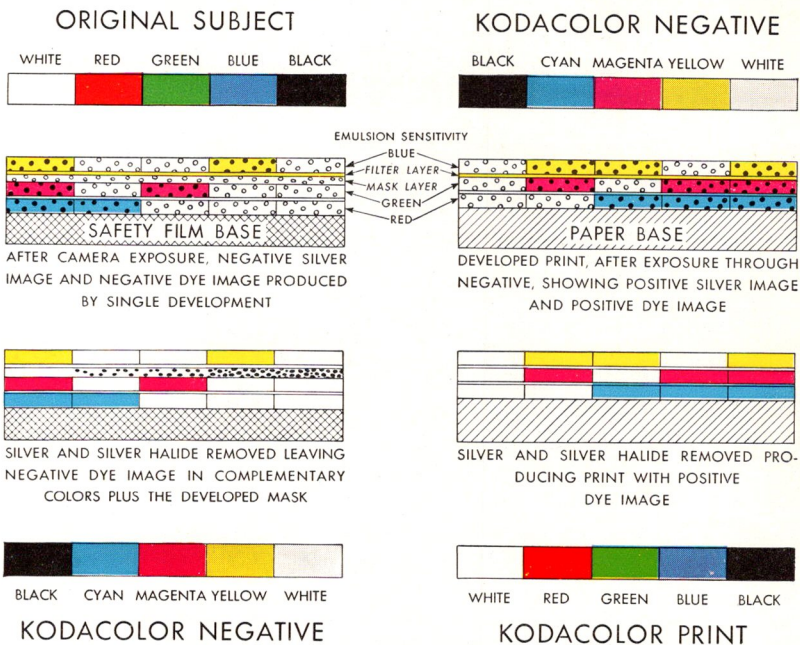


Processed Kodacolor Films are "color negatives," not color transparencies. Light areas of the subject appear dark in the negative, and dark areas appear light. Colors of the negative are complementary to those of the subject, as illustrated by the blue-green appearance of the red jacket in the negative shown above. Kodacolor Prints are full-color positive prints on paper made from Kodacolor negatives on orders placed through Kodak dealers.

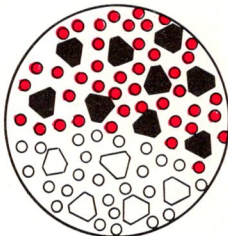
developer, the oxidation product of which reacts simultaneously with all three couplers, each in its own layer, and thus produces a dye image along with a silver image in each layer. A cyan image is formed in the bottom layer, a magenta image in the middle layer, and a yellow image in the top layer. In subsequent processing steps the silver is removed from the color layers, and a negative silver image of the dyes in the two lower layers is formed in the mask layer. The final dye image is not only negative as regards light and shade but also contains colors which are complementary to those of the original sub-

ject. When such a negative is printed upon a paper having a set of similar emulsions (excepting the mask) and requiring similar processing, a color print is obtained in which the colors of the original subject are reproduced. The reproduction of colored subjects by the Kodacolor Process is shown diagrammatically below.

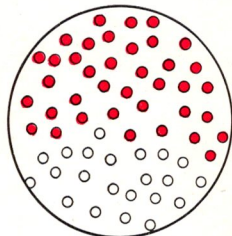
As previously noted, the Kodacolor Process reproduces colors with sufficient fidelity to afford attractive color prints, but is not intended for the making of color records or for matching or measuring colors.



Kodacolor Emulsion: Crystals of Silver Bromide and Globules of Coupler Dispersed in Gelatin.



Kodacolor Emulsion (Magenta Layer) after Development Showing Dye Image and Silver Image.



Kodacolor Emulsion (Magenta Layer) after Removal of Silver and Silver Bromide.



SELECTED KODAK PUBLICATIONS

On Sale at Kodak Dealers

Kodak Reference Handbook. A convenient binder containing separators and seven Kodak Data Book sections (Data Books without covers). It can be kept up to date by replacing out-dated sections with new editions of the following seven Data Books:

Kodak Lenses, Range Finders, and Shutters. A Data Book on these vital camera parts and their use. Includes specifications, depth-of-field and field-size tables, and useful optical formulas.

Kodak Films. A Data Book treating the physical and photographic properties of black-and-white films, and including Data Sheets for Kodak roll films, film packs, and sheet films.

Filters and Pola-Screens. A Data Book which discusses the theory and use of filters and Kodak Pola-Screens. Includes Data Sheets for the more popular Wratten Filters. Illustrated in color.

Kodachrome and Kodacolor Films. A Data Book on still photography and home movies in color. Discusses lighting, exposure, and many special subjects. Illustrated in color. Includes Data Sheets.

Kodak Papers. A Data Book on the characteristics of contact and enlarging papers, and methods of selection and use of papers for prints of high quality. Includes Data Sheets.

Processing and Formulas. A Data Book presenting a comprehensive group of Kodak formulas. It discusses principles and procedures for processing films, plates, and papers.

Copying. A Data Book dealing with the copying of all types of originals. Includes Data Sheets for the most suitable Kodak films.

Kodak Photographic Notebook. A loose-leaf, metal-ring binder containing five separators, a quantity of notebook paper, and a list of special photographic articles which are available without charge. Designed to serve as a supplement to the *Kodak Reference Handbook*.

Kodak Data Books not included in the *Kodak Reference Handbook* but punched for insertion in the *Kodak Photographic Notebook* are:

Ektachrome and Kodachrome Professional Films. A Data Book on the Kodak sheet films for color photography, including extensive information on their use. Illustrated in color.

Slides. A Data Book on the making and showing of slides and transparencies in black-and-white and in color.

Infrared and Ultraviolet Photography. A Data Book describing both the principles and practice in these two specialized fields.

EASTMAN KODAK COMPANY • ROCHESTER 4, N. Y.