KODAK
DATA BOOK

5th Edition

50¢

KODACHROME FILMS

FOR MINIATURE AND MOVIE CAMERAS

FIFTH EDITION

KODACHROME FILMS
FOR MINIATURE AND MOVIE CAMERAS

FIRST 1953 PRINTING

This printing of KODACHROME FILMS FOR MINIATURE AND MOVIE CAMERAS is a slight revision of the First 1952 Printing. Minor changes have been made in the text to include the latest products. Kodachrome Film in the 335 size has been made available for stereo camera users. The Brownie Movie Projector has been introduced as a companion to the Brownie Movie Camera and two new Kodaslide Projectors have also been announced. The basic information on picture taking with Kodachrome Film, however, is unchanged.

This printing of KODACHROME FILMS FOR MINIATURE AND MOVIE CAMERAS provides owners of the *Kodak Reference Handbook* with a replacement unit for any Color Films section bearing an earlier copyright date than the Fifth Edition, 1950.

Kodachrome Films for Miniature and Movie Cameras is one of a whole series of Kodak Data Books. Most of them are sold as units; some are also components of the various Kodak Handbooks, such as the *Kodak Reference Handbook* or the *Kodak Color Handbook*. Each is a complete unit in itself.

The *Reference Handbook* contains detailed information on the characteristics and uses of Kodak films, papers, filters, lenses, formulas, and related products. It also treats comprehensively such topics as picture taking, flash and flood lighting, processing, and other photographic techniques.

The *Color Handbook* contains four Color Data Books: Color As Seen and Photographed, Color Photography Outdoors, Color Photography in the Studio, and Kodak Color Films. Extra separators are included in the *Color Handbook* for indexing other color publications.

Additional Data Books and other punched publications describing materials, techniques, and processes for better photography are available for the *Kodak Photographic Notebook*. See your Kodak dealer for complete information.

KODACHROME FILMS

FOR MINIATURE AND MOVIE CAMERAS

FIFTH EDITION, 1950
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Enjoyment of color transparencies is doubled with Kodachrome Prints and Enlargements, supplied in sizes up to 8 x 10 inches. Shown are the 2X and 3X sizes. See your Kodak dealer.

Kodak Color Films and Prints

• The use of Kodachrome Film has become widespread among owners of miniature and movie cameras. The great appeal of good color pictures and the relative ease and simplicity with which they can be taken accounts, in a large part, for the increasing popularity of these types of equipment. Kodachrome movies can be made with almost any 8mm or 16mm camera. After the film has been returned from processing, it can be shown to your family and friends with a projector like one of the 8mm or 16mm Kodascope Projectors. Owners of most miniature still cameras can make color slides on Kodachrome Film to be shown with a projector, a table viewer, or a hand viewer. Color prints and enlargements can also be ordered from Kodak dealers. The Kodak Dye Transfer Process provides the advanced amateur with the opportunity of making beautiful color prints in his own darkroom.

Kodachrome Film is easy to use; no special lenses or attachments are needed for the camera. Simple exposure information is packed with each roll of film. If the instructions are followed, even the casual picture-taker can make outstandingly beautiful movies and slides.

There are two types of Kodachrome Film—Daylight Type for making pictures in daylight and Type A for pictures with clear flash and photographic flood lamps. Both types of film are available in three still-camera sizes: K135 and K135A in 20- and 36-exposure rolls, K828 and K828A in 8-exposure rolls, and K335 and K335A for 20 pairs of 23 by 24-mm stereo frames in stereo cameras with standard spacing. The movie film is available in 8mm and 16mm rolls and magazines.

After the color pictures have been taken and the camera unloaded, the film should be sent to one of the Kodak processing laboratories listed in the instruction sheet packed with the film. There the film is processed and, in the case of miniature-camera films, the pictures are cut apart, placed in individual mounts unless otherwise specified, and sent back ready for showing. Movie films are returned on reels for projecting with Kodascope or other projectors. The purchase price of the film includes the cost of processing, mounting, and return transportation.

If Kodachrome Film has been used in a camera which has picture dimensions other than 24 by 36-mm or 28 by 40-mm or in a stereo camera with other than the 23 by 24-mm frame dimensions and stand-

ard spacing between frames, this film is returned uncut so that the photographer can place the pictures in suitable mounts. Although the K135 size film can be used in many stereo cameras, the K335 size is specifically designed for stereo use. Stereo pairs, with standard separation, made on this size film are returned in cardboard stereo mounts for use in hand viewers. K135 film exposed in stereo cameras will be mounted in stereo mounts *only if the remittance to cover the mounting charge is enclosed with the film when it is sent in for processing.*

Kodacolor Film, Daylight Type and Type A (for artificial light) is used much like black-and-white film in roll-film cameras. It provides the user with paper prints in color. It is available in six popular film sizes: C127, C828, C120, C620, C116, and C616.

Exposed Kodacolor Film is sent for development to negatives through Kodak dealers. The purchase price of the film includes this processing, but does *not* include the making of Kodacolor Prints. Prints can be ordered, however, either when the film is sent in for processing or after the negatives have been returned.

Kodak Ektachrome Film, Daylight Type and Type B (for artificial light), is available in standard sheet-film sizes and in E120 and E620 rolls for exposure in roll-film cameras having *f*/6.3 or faster lenses. Although the Eastman Kodak Company does not maintain a processing service for this film, commercial processing laboratories are located in many of the cities across the country. The Kodak Ektachrome Processing Kit provides the user who wishes to process his own films with a complete set of prepared chemicals.

Kodak Ektacolor Film, Type B, is a sheet film balanced for exposure with 3200 K lamps and is supplied in the most popular sheet-film sizes. This film is designed for processing by the user to color negatives. A complete set of processing solutions can be prepared from the Kodak Ektacolor Processing Kit. These negatives can then be printed by the Kodak Dye Transfer Process without making color-separation negatives. The Data Book *Kodak Dye Transfer Process* on sale at Kodak dealers, describes the printing process in detail.

Kodak Ektacolor Print Film is a sheet film on which positive color transparencies are made, either by contact or by enlargement, from Kodak Ektacolor negatives. This film is regularly available in several sheet-film sizes ranging from 2¼ by 3¼ inches to 11 by 14 inches, and in larger sizes and in rolls on special order from which large, brilliant display transparencies can be made. The film is processed by the user in solutions made up from the chemicals in the Kodak Ektacolor Processing Kit.

Kodachrome Prints and Enlargements are full-color pictures on white cellulose acetate base. They are made from positive color transparencies on orders placed through Kodak dealers. Kodachrome Prints 2X (2¼ by 3¼ inches) are supplied from originals 28 by 40mm or smaller; Kodachrome Prints 3X (3 by 4⅜ inches) and Kodachrome Enlargements 5 x 7 and 8 x 10, from originals 4 by 5 inches or smaller.

Black-and-white prints can also be made from Kodachrome or Kodak Ektachrome transparencies, and from individual frames of Kodachrome movies. It is first necessary to make (or have a photofinisher make) black-and-white negatives from the originals.

Kodacolor Prints and Enlargements from Kodacolor negatives and Kodachrome transparencies can be ordered from Kodak dealers. These color prints on a paper base are approximately 3½ inches wide, including margins; the length is dependent on the proportions of the negative. A 2¼ by 3¼-inch Kodacolor negative is made from the Kodachrome transparency and is returned to the customer along with the print. Kodacolor Enlargements are made in several sizes from Kodacolor negatives and from negatives of Kodacolor transparencies.

The Kodak Flexichrome Process provides the photographer with a method for making high-quality color prints. Black-and-white negatives or color transparencies can be printed by making a gelatin relief image which is then hand-colored. Coloring is simplified because the print accepts only the right amount of the applied color.

Kodachrome Duplicates (24 by 36-mm) of 24 by 36-mm and 28 by 40-mm color transparencies are supplied on order through Kodak dealers. Kodachrome Duplicates of 16mm Kodachrome Films are also supplied, but Kodachrome Duplicates of 8mm Kodachrome Films are not available. Through the use of duplicate transparencies and motion-picture films, valuable original films can be preserved. The use of duplicates avoids the necessity of excessively frequent projection of original films by lecturers, or of projection for extended periods of time as in displays, both of which tend to accelerate normal wear and shorten the usable life of Kodachrome Film.

Notice: If color films are damaged or lost by us or any associate company, they will be replaced with unexposed film. Except for such replacements, films will be accepted for processing, printing, enlarging, duplicating, or any other service without warranty, guarantee, or other liability of any kind. Like other dyes, the dyes used in Kodak color films, prints, and enlargements may change in time. These products, therefore, will not be replaced or otherwise warranted against any change in color.

Equipment Required

• This section discusses Kodak products for use in Kodachrome photography—types of film available, cameras and adapters for making transparencies or movies, and filters and Pola-Screens.

TYPES OF FILM

Kodachrome Film, Daylight Type, is color balanced for exposure in average sunlight on a clear day, that is, in illumination which is the equivalent of noon sunlight plus skylight. Kodachrome Film, Type A, is color balanced for use with photographic flood 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

There are several Kodak cameras in which 20- and 36-exposure rolls of Kodachrome Film K135 can be used. The Kodak Retina IIa Camera heads the list with its exceedingly fast *f*/2.0 coated lens and coupled rangefinder. The Kodak Signet Camera has an *f*/3.5 Kodak Ektar Lens and a Kodak Synchro 300 Shutter. Both the Retina IIa and the Signet Cameras have the rangefinder and viewfinder windows combined for ease of focusing and framing. Both types of flash lamps can be synchronized with the flash shutters on these cameras. The economically priced Kodak Pony 135 Camera is trimly styled and very compact. For those who prefer the 8-exposure No. 828 roll, the Kodak Flash Bantam and the Kodak Pony 828 Cameras are both available with *f*/4.5 lenses and flash shutters.

The Brownie Movie Camera with its Lumenized *f*/2.7 lens provides 8mm economy with simplicity of operation. The ease and convenience of magazine loading are available in both movie-film sizes with either the Cine-Kodak Magazine 8 or the Cine-Kodak Royal Magazine Cameras. The Cine-Kodak Reliant Camera is attractively styled and has much of the convenience of magazine loading by virtue of its sprocketless construction. Interchangeable lenses are available for all these cameras with the exception of the Brownie Movie Camera. The regular line of high-quality Cine Ektanon Lenses is supplemented by a complete line of top-quality Cine Ektar Lenses in a variety of focal lengths and with apertures, in one case, as large as *f*/1.4. One of the

On the left is the Kodak Signet 35 Camera with f/3.5 Kodak Ektar Lens, Synchro 300 Shutter, and coupled rangefinder combined with the viewfinder. The Brownie Movie Camera, on the right, is simple to operate and gives excellent results.

several easily threaded Kodascope projectors with their fast Projection Ektanon lenses, efficient cooling systems, and high-wattage lamps makes an ideal companion to a Cine-Kodak camera.

Miniature Adapters

By means of various adapters, Kodachrome Film in the miniature sizes can be exposed in cameras which ordinarily take larger film sizes. For example, the owner of a Kodak Reflex II Camera can make Kodachrome slides by inserting a Kodak 828 Adapter in his camera. Because the focal length of the lens is longer than that normally used with miniature-film sizes, images of all objects are larger when these adapters are used. Birds and animals or other subjects which ordinarily cannot be closely approached can be more easily photographed. Portraits tend to be free from the distortion so frequently encountered in close-ups made with lenses of normal focal length.

Adapter	To be used with
Kodak 35mm Film Adapter A	Kodak Flurolite Enlarger A Kodak Precision Enlarger A Assembly and 2¼ by 3¼-inch Hand and Stand Cameras such as the Kodak Recomar 18*
Bantam Kodachrome Adapter B	Kodak Precision Enlarger B Assembly and 3¼ by 4¼-inch Hand and Stand Cameras such as the Kodak Recomar 33*
Kodak 828 Adapter	Kodak Reflex Cameras
Kodak Tourist Adapter Kit	Kodak Tourist Cameras with f/4.5 lenses

*Although these cameras are no longer manufactured, many of them are still in use.

KODAK FILTERS AND POLA-SCREENS

The colored filters commonly used in black-and-white photography cannot be used with Kodachrome Film, or the picture will show an over-all cast of the same color as the filter. The filters described below have been specially designed for use in color photography.

Kodak Skylight Filter (Wratten No. 1A). This pink-colored filter is intended for use with Kodachrome Film, Daylight Type, out-of-doors when the lighting conditions are such that pictures made without a filter would be too bluish. Pictures made of subjects illuminated only by skylight on a bright day tend to be excessively blue unless the Skylight Filter is used over the camera lens. This filter has been designed to absorb ultraviolet and blue as well as green light because light from the sky is both bluer and greener than the normal mixture of sunlight and skylight for which the film is color balanced. The Skylight Filter is also useful for warming-up the color balance of pictures taken on days when the sky is completely over-cast and for distant landscapes in which the undesirable bluish haze can be shifted toward a more neutral color by the use of this filter. No increase in exposure is required when the Skylight Filter is used.

Special-Purpose Filters

These filters find specialized use in color photography. The two types of filters described here can be used singly or in any combination to provide almost any desired color correction.

Kodak Light Balancing Filters are available in a yellowish and a bluish series. By their use the photographer is able to secure bluer (cooler) or yellower (warmer) color rendering.

Yellowish *Kodak Light Balancing Filters* No. 81, 81A to 81EF
Bluish *Kodak Light Balancing Filters* No. 82, 82A to 82C

The Kodak Color Compensating (CC Filters) are available in a series of six different colors. The final letter in each designation identifies the color of the filter. The number following the hyphen indicates the density (the decimal point is omitted) of the filter to the light it absorbs. For example, the density of a yellow filter is given for blue light. Specific applications of filters of both types, particularly in connection with the use of Kodachrome Film under artificial illumination, are given in the Data Sheets.

Yellow	CC-05Y to CC-50Y	*Red*	CC-05R to CC-50R
Magenta	CC-05M to CC-50M	*Green*	CC-05G to CC-50G
Cyan	CC-05C to CC-50C	*Blue*	CC-05B to CC-50B

Kodak Daylight Filter for Kodak Type A Color Films (Wratten No. 85). This orange filter must be used if Kodachrome Film, Type A, is to be exposed in daylight. While this film-and-filter combination may yield satisfactory pictures in sunlight, it is not recommended for general daylight use because with some subjects, and especially under overcast conditions, it does not produce as good color rendering as Kodachrome Film, Daylight Type, with no filter. The filters currently being supplied have improved stability. If the filter now being used is several years old, its replacement is recommended.

Kodak Photoflood Filter for Kodak Daylight Type Color Films (Wratten No. 80A). This bluish filter must be used for exposing Kodachrome Film, Daylight Type, by photographic flood lamps. For emergency use only, this combination requires six times the exposure for Kodachrome Film, Type A, with these lamps, and its color rendition is not so good.

Kodak Pola-Screens

These 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, and landscapes. The indicator handle of the Pola-Screen must point at the sun for greatest effect. An exposure increase is necessary because of the absorption of the polarized light by the Pola-Screen and because the subjects are side-lighted. The exposure for Kodachrome Film should be 1/25 second at approximately *f*/4.5 with still cameras and *f*/3.5 with motion-picture cameras. Used in photographing distant scenes lighted by clear sun from the side or overhead, the Pola-Screen reduces light bluish haze as can be seen in the two pictures on page 38. The Pola-Screen can also be used to subdue or eliminate oblique reflections from non-metallic surfaces, such as water, glass, wood, leaves, and rocks. The removal of surface reflections increases color saturation.

Pola-Screens are supplied in all the different series sizes of Kodak Combination Lens Attachments. Thus a Pola-Screen can be used on almost any still or movie camera lens.

The Kodak Pola-Screen Viewer, which fits over the indicator handle of the Pola-Screen, is an added convenience because it is possible to see the effect which the Pola-Screen will have on the picture. The viewer fits all series sizes of Pola-Screens.

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

Kodachrome Photography Outdoors

• The following general suggestions and illustrations apply to the use of Kodachrome Film in making pictures outdoors under various daylight conditions. Recommendations on taking pictures in artificial light are given in a separate section.

COLOR OF SUBJECTS

In general, Kodak color films provide a pleasing reproduction of the colors of light reflected from the subject. 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, whereas shadows on a sunny day simply look dark to most people, they actually are blue, and appear so in the picture, because the light that reaches them comes largely from the blue sky. A person in the early morning or late afternoon sunlight appears normal in color, but this early or late sunlight is orange, and as a result the picture will be too orange. Sometimes colored casts or shadows appear in the picture as a result of light reflected from bright-colored surroundings. The effect is less objectionable if the source of the reflected color also appears 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 by exposing his film in the most favorable lighting and surroundings.

TYPES OF PICTURE SUBJECTS

Kodak exposure guides divide outdoor picture subjects into the following classifications:

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

Top lighting—presents shadow problems

Front lighting—simple and effective

Back lighting without exposure increase

Back lighting combined with reflector

Open shade—balance too bluish

Open shade with Kodak Skylight Filter

Light—Beach and snow scenes, light-colored flowers and buildings, people in white clothing, 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.

OUTDOOR LIGHTING

Only slightly more care is needed in selecting the lighting conditions for effective color pictures outdoors than 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 on page 11 show the effects of some of the lighting conditions described in more detail 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 shadows under the eyes, the nose, and the chin.

Up to two hours after sunrise and during the two hours before 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 more exposure than that recommended for average lighting conditions.

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. The term "open shade" does not, however, describe

*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.

the lighting conditions existing under porch roofs or under canopies or trees. 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 Kodak Skylight Filter should be used to prevent excessive bluishness.

Front lighting of a subject to be photographed in sunlight 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 then taking the picture from a position chosen so that the sun is behind and slightly to one side of the camera.

Side and back lighting of a subject require more care in exposure than front lighting and should be supplemented by the use of a reflector or flash lamp, especially in close-ups, to produce satisfactory rendering in both highlight and shadow areas. Properly handled, either side or back lighting frequently gives more attractive results than front lighting for portraits, because the modeling on the face is more pleasing and the tendency to squint is greatly reduced.

If supplementary lighting cannot be used, additional exposure must be given to subjects which are receiving the sunlight from the back or the side in order to retain sufficient detail in the shadows. Approximately one-half stop more than the normal exposure for subjects illuminated by front lighting should be given to side-lighted subjects when pictures are made in direct sun on bright, clear days.

When the sun is almost directly behind the subject, then the exposure increase depends upon the distance between the camera and the subject. For back-lighted close-ups, a full stop more exposure than that for front lighting should be given; for near and distant shots, one-half stop more exposure is sufficient. If the subject is a portrait, for example, and a close-up is being made in which the full length of the figure occupies the entire vertical dimension of the frame, the exposure increase should be one stop. If the camera-to-subject distance is greater so that the subject occupies less height than the vertical dimension of the picture frame, then the same exposure should be given as for side lighting, or one-half stop more than normal. The reason that two different exposure recommendations are made for back-lighted subjects is that the shadow areas in close-ups are large and occupy important space. At distances beyond 6 to 8 feet, the shadow areas become smaller and a proper over-all rendering becomes increasingly important. One caution should be observed when back-lighted pictures are made: since the sun is shining almost directly into the lens, shade the lens to prevent the direct sunlight from

Use of Supplementary Lighting—Above, shadows are heavy. Below, a blue flash lamp has lightened them and given a more natural picture. Both exposures 1/50 second between f/5.6 and f/8.

falling on the lens. The coating used on Kodak Lumenized lenses helps to minimize loss in color saturation and contrast when pictures are made under these conditions.

Supplementary Lighting

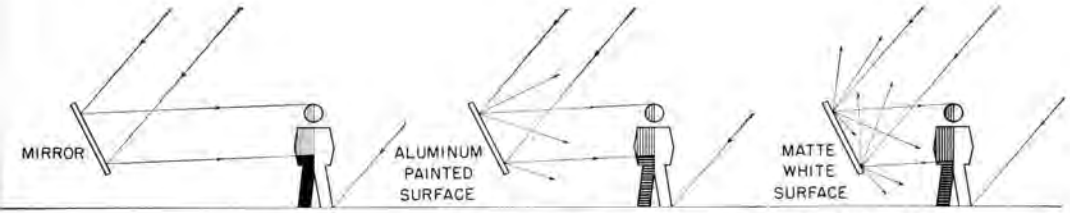
Supplementary lighting includes the use of reflecting surfaces and synchronized flash lamps for illuminating shadow areas in sunlit scenes, thus reducing lighting contrast to a more desirable level. It is often valuable in making close-ups of people, flowers, or other small objects, especially when the subject is side- or back-lighted. When supplementary lighting is used for such subjects, the normal exposure setting for front-lighted subjects is recommended.

Supplementary Flash. To provide additional light of the proper quality to illuminate the shadow areas not directly reached by sunlight, blue flash lamps, such as the No. 5B, 25B, 11B, 40B, 22B, and 2B, can be used with any camera with a flash shutter or one to which a synchronizer can be attached. The use of flash lamps avoids the necessity of having an assistant or standards to hold a reflector at a fixed angle. Flash equipment can be somewhat more portable and convenient to transport than reflectors. The effect of a reflector, however, is immediately evident, whereas the effect of a flash lamp is visible only after the film has been processed.

When supplementary flash is used, no change in the daylight exposure is necessary from that required for a front-lighted subject in direct, bright sunlight. The lighting contrast should be reduced to a ratio of approximately 3 to 1 by the additional light furnished to the shadow regions. The amount of light is controlled by the size of the bulb selected, by the distance from the bulb to the subject, and by the presence of any diffusing material, such as a clean white handkerchief, over the reflector. The exposure recommendations given in the Data Sheets for supplementary flash outdoors (pages 42-43) are based upon the standard bright sunlight exposure, and provide a 3 to 1 lighting ratio.

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 difficult to handle because of the harsh, secondary shadows created by it. Such a reflector can be used, however, to bring out detail in dark portions of the picture or to highlight a center of interest if desired. 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 to the reflecting surface. The mirror should be removed just before the picture is taken.

A very diffuse type of reflector can be made from white paper, white cardboard, white sheeting, or composition board painted with a flat white paint. Such surfaces reflect light in all directions and thus give uniform lighting, but they are effective at a distance no greater than the width of the reflector. Beaded screens are not recommended, because they reflect most of the light back toward the source.

JUDGING EXPOSURE

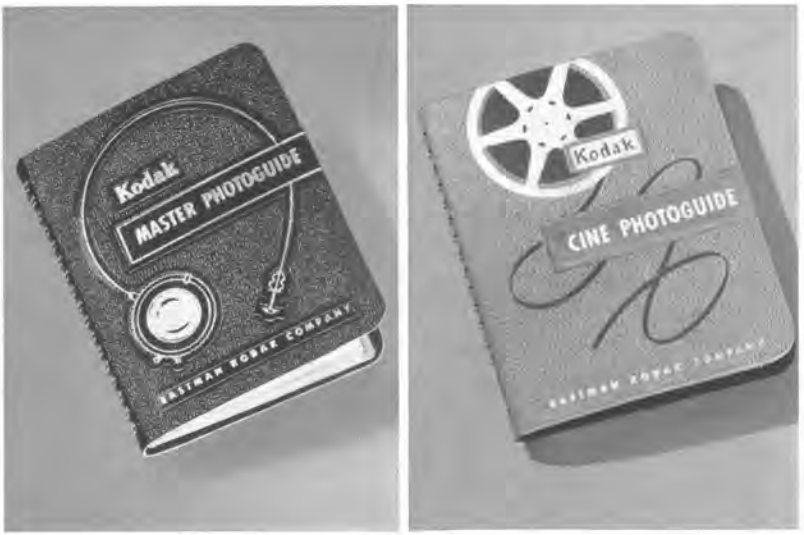
In making color pictures in daylight or artificial light with Kodachrome Film, camera settings must be determined much more carefully than in black-and-white work. You can learn much from studying your transparencies when they are projected properly or viewed on a suitable illuminator.

Correctly exposed Kodachrome transparencies should have detail in both light and dark areas, with 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.



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

DETERMINING EXPOSURE SETTING

For most lighting conditions and subjects, reliable information is provided in the Data Sheets, film instruction sheets, and the following Kodak exposure guides.

Kodaguide Snapshot Dial. This convenient guide provides a quick method of determining the still-camera settings for Kodachrome, Kodacolor, and Kodak black-and-white films. One dial is for outdoor pictures and the second dial is for flash pictures.

Kodak Master Photoguide. Complete, concise, picture-taking information for still pictures with black-and-white and color films. Convenient dial computers, tables, and brief text present practical data on exposure, filters, depth of field, and other essentials of general and special application.

Kodaguide Movie Dial. Provides a simple method of determining lens openings for the exposure of 8mm and 16mm Cine-Kodak black-and-white films and Kodachrome Film outdoors in daylight or indoors by photographic flood lamps.

The Kodak Cine Photoguide provides the movie maker with information on exposure under various lighting conditions; lenses, films, and filters; close-up work; and movie continuity. The convenient index and the dial-type computers make the Photoguide easy to carry and to use in the field.

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 the manufacturer's instructions should be followed carefully to insure satisfactory results.

The best possible method of calibrating an exposure meter is to make a photographic test under actual conditions of use. Make pictures of several typical subjects, giving the exposure indicated by the meter, a half stop more, and a half stop less. The meter setting which gives best results can then be selected for future work. Such a check takes into account the lens, shutter, and individual working technique, as well as the meter itself.

Exposure-index values, recommended as settings for meters marked as requiring American Standard Exposure Indexes, will be found in the Data Sheets (pages 42-45). Any of these settings should be regarded by the critical worker merely as a basis for making a practical test with his own equipment.

In daylight, the meter settings given in the Data Sheets apply for both reflected-light and incident-light meters when they are used as recommended. A reflected-light meter should be pointed downward to minimize the effect of the sky if the manufacturer recommends this practice. Avoid the inclusion of large areas that are unusually bright, such as overcast sky regions, or unusually dark, such as foliage and trees, which can unduly influence a reflected-light reading. The manufacturers' instructions should always be followed carefully.

Any meter reading taken in daylight should be questioned if it indicates a lens opening smaller than f/11 for an amateur motion-picture camera operating at 16 frames per second, or an exposure of less than 1/50 second between f/8 and f/11 for a still camera, because underexposure is likely to result.

In artificial light, the meter settings in the Data Sheets apply to:

1. Incident-light meters used at the subject position.
2. Reflected-light meters used to take a reading from a gray card of 18 percent reflectance, held in front of the subject and facing halfway between the camera and main light.
3. Reflected-light meters used at the camera position, provided the subject and background have about the same brightness and all the background included in the angle of view of the meter is fully lighted.

For method 2, the gray side of the Kodak Neutral Test Card is recommended. In dim light, a more satisfactory reading can be obtained from the white side of the test card (reflectance, 90 percent). In this

case, divide the exposure index by 5 and round it to the nearest calculator setting. Set the calculator arrow as for a normal subject.

The use of a gray or white card is basically equivalent to the use of an incident-light meter. With either of these techniques, increase the indicated exposure by half a stop if the subject is unusually dark, or decrease it by half a stop if the subject is unusually light.

If the reading is taken from the palm of the hand or the subject's face, divide the exposure index by 2. When the palm of the hand is used with a subject which does not contain skin tones, make a half-stop exposure allowance if the subject is unusually dark or light.

SPECIAL DAYLIGHT SUBJECTS

There are many subjects which require special exposure information; data on a number of them 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 photographic flood lamp.

Flowers are treated as any normal outdoor subject in sunlight, and an exposure between *f*/8 and *f*/11 at 1/25 second with the camera on a tripod 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 reflected from the foliage. A gray or colored cardboard background, large enough to fill the background of the picture area, can be used to isolate single flowers. For extreme close-ups, Kodak Portra Lenses are available for both still and motion-picture cameras.

Architectural Interiors. Natural lighting coming through the windows usually has such uneven distribution in the room that artificial light is used, either instead of, or to supplement the daylight. Where there is little daylight entering the room and there are no windows included in the picture, Type A film and flood or flash lamps can be used. Draperies and curtains over the windows will reduce the amount of

daylight in the room. When more than 25 percent of the general illumination is coming from outside, or when the scene through the window is photographed, blue-coated flash lamps and Daylight Type film are recommended. Base the exposure on the outdoor scene, and place the blue flash lamps at the distances determined from the guide numbers in the table for flash lamps used as a sole source on page 43 of the Data Sheets. If more than one lamp is used to cover the same area, multiply the guide number by 1.4 for each lamp in excess of one.

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 1/50 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 the use of a Kodak Skylight Filter may be desirable to prevent excessive bluishness.

Reflectors are recommended because if they are positioned carefully, the principal shadows of the subject will be lightened. 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 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. An exposure setting for normal subjects is recommended unless the scene consists almost wholly of snow.

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 should be classified as *dark* subjects.

Beach scenes and people in such bright surroundings should be treated as light subjects. The exposure recommendation for such subjects in bright sun is 1/50 second at *f*/8.

Tropical scenes. It is often supposed that the sun is brighter in the tropics than elsewhere. Measurements made all over the world have shown, however, that under the same atmospheric conditions, and with the sun at the same altitude in the sky, the illumination is practically constant, regardless of geographical location or time of year.

In some tropical areas, however, light-colored scenes occur rather frequently. Some of these scenes, such as those including large expanses of white sand or houses finished in white or very light stucco, reflect much more light than the usual light-colored scene and can be given one full stop less exposure than an average subject.

The sun is often directly overhead in the tropics. On a clear day, the top lighting causes deep shadows in important areas. Pictures made under these conditions, especially of heavy tropical foliage or close-ups of dark-skinned natives, may require as much as a full stop more exposure than normal unless supplementary lighting is used.

The generally higher temperatures in the tropics demand more care in storage of film (see page 37), but they should not be allowed to influence the photographer's judgment of exposure.

Before starting on any extended trip, use all your equipment and *see the results*, especially if you have a new camera or meter. It is also wise to return a film for processing from time to time. Have this film sent, after processing, to a photographically critical friend at home. He can check its quality and cable you if anything goes wrong. If your pictures are extremely important—for example, if they are to be used for lecture or publication purposes—take more than one camera with you to avoid any problems arising from failure of the equipment.

Aerial views and distant mountain scenes should be taken under as clear weather conditions as possible. Atmospheric haze lends a bluish cast to the scene and tends to obscure detail. Use cross lighting to emphasize detail; avoid shooting against the light. Either Daylight Type or Type A film can be used. The results on both types of film tend to be quite similar, particularly when the Kodak Skylight Filter is used with the Daylight Type film.

For aerial views at altitudes below 1000 feet, the recommended exposure is 1/100 second at *f*/4.5. A third stop smaller aperture should be used between 1000 and 2000 feet, a half stop smaller between 2000 and 4000 feet, and one full stop smaller at altitudes above 4000 feet. The lens setting for motion-picture cameras operating at 16 frames per second and used at altitudes below 1000 feet should be *f*/8. Smoother pictures are obtained when the camera is operated at speeds higher than 16 frames with corresponding larger apertures.

Artificial Lighting

• Artificially lighted pictures are of two types: (1) those taken by whatever illumination is already available, and (2) those for which the photographer must use flash or photographic flood 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, use the Kodak Eye-Level Tripod.

Floodlighted buildings require still-camera exposures of 1/2 to 3 seconds at *f*/4.5. Motion-picture cameras operated at normal or half speed should be set at the largest lens aperture.

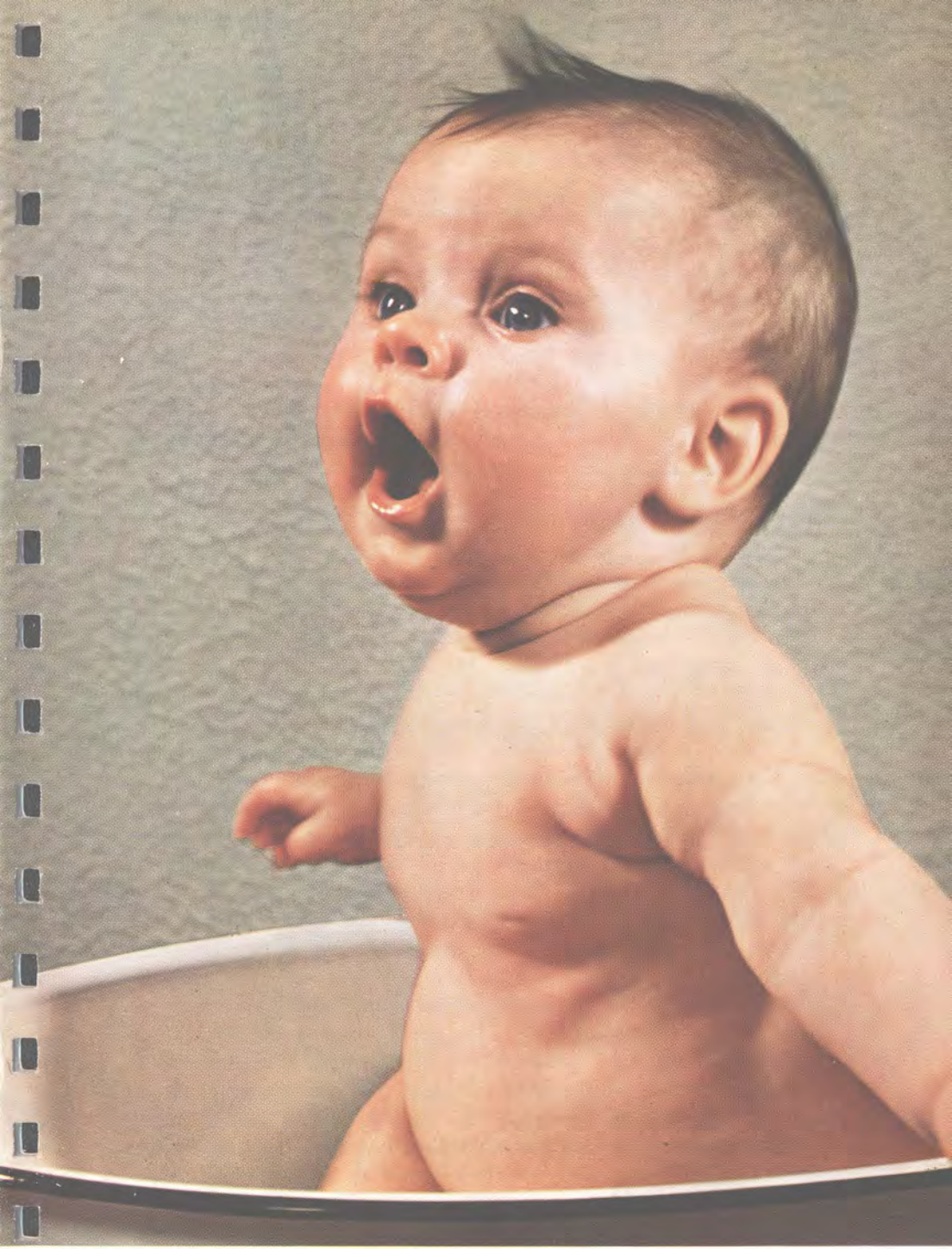
Animated electric signs are especially interesting color subjects for motion pictures on Kodachrome Film, Type A. An *f*/1.9 or *f*/1.6 lens is usually necessary, and it should be set at the largest opening. For still pictures, an exposure of 1/25 second at *f*/2 is suggested.

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. 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.

Brightly lighted streets photograph best when wet because the reflections of lights from signs and windows add to the effectiveness of the scene. Still-camera pictures can be made at exposures of 1/2 to 3 seconds at *f*/4.5. 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.

Fluorescent signs, illuminated by an ultraviolet source, photographed with Kodachrome Film, Type A, will have the blues emphasized, whereas the yellows and reds will be more brilliant when the Daylight Type film is used. A Kodak Wratten Filter No. 2B should be placed over the lens to prevent any reflected ultraviolet from recording as blue light on the film. The strength of the fluorescence varies so widely with different signs that a series of test exposures ranging from 1/2 to 32 minutes at *f*/4.5 is recommended.



Two flash lamps were used to capture the bubbling vitality of this young subject. One lamp was well to the left, facing the subject; the other to the right, relatively near the camera and quite high. This setup produced the soft shadows so desirable in baby pictures; it could readily be duplicated with two flood lamps for a movie shot.

Sports events, such as hockey games, wrestling bouts, and skating shows, in arenas that are floodlighted can be photographed on Kodachrome Film, Type A. Exposures of 1/10 to 1/25 second at *f*/2 are recommended for stills; normal speed at *f*/1.9 or *f*/1.4 for movies.

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*/1.4 or *f*/1.9, normal speed. Permission from the theater management should be obtained before making pictures of stage performers.

PHOTOGRAPHIC FLOOD AND FLASH LIGHTING

Flood and flash lamps are especially suitable for indoor photography with Kodachrome Film, Type A. Ordinary lamps for home lighting are not recommended because of the yellowish light they produce.

A Kodak Vari-Beam Standlight or Clamplight, having a bowl-shaped reflector, is recommended for use with flood lamps. Vari-Beam lights offer great flexibility both in positioning the beam and controlling its width. Exposure data for their use are given in the Data Sheets and in the exposure guides. The Kodak Flasholder is designed to be used with cameras equipped with Kodak flash shutters.

Flood Lamps are available in several sizes. No. 1 and No. 2 lamps are intended for home use. Reflector-type flood lamps are particularly convenient to use because they do not require additional reflectors. Also available are spot lamps, such as the Reflector Photospot Lamps No. RSP2, which give a narrow, powerful beam of light. These lamps can be used for special purposes, such as back lighting or highlighting dark hair in portraits. Medium-beam, 375-watt, reflector-type flood lamps are designed for movie use on a hand-held frame like the Kodak Photo-Light Bar. At least two of these lamps should be used, one on either side of the camera, to insure uniformity of illumination.

Suggested lighting arrangements for making pictures indoors with photographic flood lamps are shown on page 27.

NOTE: No more than six No. 1 or three No. 2 flood lamps or three reflector-type flood 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.

Flash lamps are particularly useful for pictures of active subjects like children or of large groups. Kodak miniature cameras have flash shutters with built-in contacts which can be used with a Kodak Standard Flasholder. Usually the flash lamp is located at the camera, although a more pleasing type of lighting is obtained with one light at the camera and one in a second flasholder like the Kodak Flasholder Extension Unit, Model B, at 45° to the camera axis. Greatest versatility is provided by the Kodak Ektalux Flasholder and its many accessories, some of which enable it to be used with nonflash shutters. Flash-exposure information is given for the various lamps in the Data Sheets and in the Kodaguide Snapshot Dial. *Caution:* Since lamps may shatter when flashed, the use of a transparent, protective screen, such as the Kodak 2-Way Flashguard, over the reflector is recommended. *Do not flash the lamps in an explosive atmosphere.*

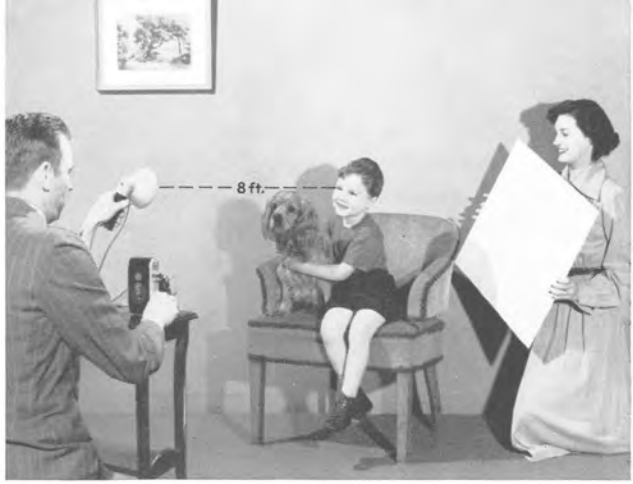
Red Eye Rendering. Sometimes when flash pictures are made of persons looking directly into the lens with the flash lamp close to the camera, reflections from the back of the eye may fill the pupil with red light. The likelihood of this effect occurring can be minimized by placing the Flasholder at the end of the bracket or holding it off the camera. Have the subject look at a brightly lighted area the same distance away as the camera.

Pictures Indoors

On the following two pages are examples of pictures which can readily be made at home using only simple lighting setups. The type of picture at the top of the next page can be made with any camera which takes Kodachrome Film in either one of the miniature sizes. The Kodak Tourist II Camera is shown with the Kodak Flasholder, Model B, and the Tourist Adapter Kit which accepts No. 828 film. The flash lamp can be mounted on the camera but, if it is held slightly to one side and above the lens (use the 3-foot extension cord for the Flasholder), more roundness and modeling are produced in the face. Use a clean white cardboard or blotter to reflect light into the shadows.

Flood lamps with their own built-in reflectors can be screwed into a convenient pair of bridge lamps as shown in the center picture on page 27. The Reflector Photospot Lamp RSP2 gives an added sheen and sparkle when used to back light the hair, but be careful not to move it in too close because the beam is exceedingly concentrated. For movies, the Kodak Photo-Light Bar with the recommended reflector-type flood lamps permit the photographer to follow the action with the lights as the subjects move about the room.

Pictures Made On KODACHROME FILM, TYPE A



Photoflash Lamp No. 5 in Kodak Standard Flash-older. Kodak Tourist II Camera with Adapter Kit. 1/100 sec at *f*/6.3.

Two 375-watt, medium-beam lamps. Cine-Kodak Reliant Camera. Lens setting: *f*/5.6.

No. 2 lamps in Kodak Vari-Beam Lights set at *STILL* position. 1/10 sec between *f*/4.0 and *f*/5.6.

Portraits of a professional nature can be made in the home by taking a little care in placing the lights. Locate the subject a few feet away from the background so that lights can be placed behind the subject and directed onto the background to eliminate the shadows. A light-colored matte background of adequate size to fill the field of view easily should be selected. The reproduction of the background in the photograph can be varied by changing the amount of light falling on it. Approximately the same amount of light should be used on it as is falling on the face of the subject. In the portrait at the bottom of page 26, No. 2 flood lamps were used in the Kodak Vari-Beam Standlight and Clamplights. One lamp, the main or key light, was placed high and to the side of the camera in order to cast a light shadow of the nose onto the opposite corner of the mouth. The fill-in or supplementary light was used close to the camera to reduce the lighting contrast by throwing light into the shadows.

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. 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 area illuminated by both lights, as seen from the camera, will receive two units whereas the shadow side of the face illuminated solely 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 greatly exceed 3 to 1 for subjects having average reflectances. This is particularly important when prints or enlargements are to be made from the transparencies. With subjects which do not contain a wide range of reflectances or when the transparencies, like movie films, are to be projected only, a higher ratio can be used.

With lighting arrangements involving several lamps, the lighting ratio can be checked by using an exposure meter. An incident-light meter can be used directly, or the light reflected from a gray or white card held close in front of the subject can be read with a reflected-light meter. The Kodak Neutral Test Card is recommended, and can also be used for exposure determination. 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 incident-light meter or 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 to the eye they may appear adequately lighted.

Lighting distribution can be checked by using an incident-light meter, or a reflected-light meter and a gray or white card held facing the camera from 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 is almost always satisfactory.

Prints and Duplicates

• All orders for Kodachrome and Kodacolor Prints and Enlargements must be placed through Kodak dealers.

COLOR PRINTS AND ENLARGEMENTS

Various sizes of color prints are available from postive transparencies:

From:	You Can Order:
Kodak Ektachrome or other sheet-film transparencies, up to and including 4 x 5 inches Kodak Ektachrome or other transparencies from 620 or 120 roll films	Kodachrome Prints 3X Kodachrome Enlargements 5 x 7 and 8 x 10 Kodachrome Enlargements, Special Sizes, up to and including 8 x 10 inches Kodachrome Contact Prints (special order)
24 x 36-mm Kodachrome or other transparencies 28 x 40-mm Kodachrome transparencies	Kodachrome Prints 2X and 3X Kodachrome Enlargements 5 x 7 and 8 x 10* Kodachrome Enlargements, Special Sizes, up to and including 8 x 10 inches Kodacolor Prints Kodacolor Enlargements, up to and including 5 x 7
Stereo, 18 x 24-mm and 24 x 24-mm	Kodachrome Prints 2X and 3X Kodachrome Enlargements, Special Sizes, up to and including 8 x 10 inches
8mm or 16mm Kodachrome frames	Kodachrome Enlargements, Special Sizes, up to 2¼ x 3¼ inches or 4 x 6 inches, respectively (not recommended; original must be extremely sharp)

*To make a full 8 x 10-inch Kodachrome Enlargement from a 24 x 36- or 28 x 40-mm transparency, it is necessary to crop a little from the long dimension of the picture. The customer may, if he wishes, indicate the end from which this cropping should be done. If the long dimension cannot be cropped, a Kodachrome Enlargement, Special Size, should be ordered.

NOTE: All 28 x 40-mm or smaller transparencies which are sent in for printing or enlarging should be mounted in 2 x 2-inch glass or cardboard slides with centered apertures. Unmounted transparencies are returned in cardboard mounts, and a service charge is made.

Care of Prints. Kodachrome and Kodacolor Prints and Enlargements contain dyes which are as stable as possible, consistent with other requirements. However, prolonged exposure to bright daylight and direct sunlight should be avoided. They should not be displayed for long periods of time in or near windows. For maximum stability, they should be protected from light except when they are being viewed.

SELECTING TRANSPARENCIES FOR PRINTING

For best results, Kodachrome and Kodacolor Prints and Enlargements should be made from original transparencies—not duplicates. Select

transparencies of low lighting contrast, sharp focus, good exposure, and subjects which fill the frame.

The eye readily adapts itself to over-all bluish, reddish, or other tints in projected images, since there are no lighted surroundings of known color for comparison. A print, however, is viewed in lighted, familiar surroundings to which the eye is already adapted; its color rendering is thus judged more critically. Check transparencies 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. Group the Kodachrome originals on an illuminator to see if differences in color rendering might make the prints unsatisfactory for mounting together on an album page.

Definition. Sharp prints can be made only from transparencies which are free from evidence of camera or subject motion and are in sharp focus. To be certain, examine the transparency with a magnifier.

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.

COMPARING 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 be great differences in color rendering and brightness.

A simple and effective method of comparison is to hold the print under a desk lamp and view the transparency by light reflected from a sheet of white paper on the table underneath the same lamp. Either tungsten light or daylight is a satisfactory illuminant for displaying and for viewing these color prints.

Mounting. Kodachrome and Kodacolor Prints and Enlargements can be mounted with Kodak Rapid Mounting Cement. The printed instructions packed with the cement should be carefully followed. Other adhesives, particularly those containing water or penetrating solvents, should not be used. To obtain good adhesion with the Kodachrome Prints and Enlargements, roughen the back of the print slightly with sandpaper. Kodachrome and Kodacolor Prints and Kodachrome Enlargements can be dry mounted with Kodak Thermount Tissue and an iron like the Kodak Thermount Iron operating between 175 and 210 F. Higher temperatures may adversely affect the dyes. Do not mount Kodacolor Enlargements by any process using heat.

KODACHROME DUPLICATES

To avoid damaging valuable originals, duplicates should be ordered, and the originals safely stored. Duplicates are useful for illustrated lectures, salesmen's sample kits, and dealer displays. Friends and relatives frequently want copies of slides or movies of family groups or pictures taken on vacation trips.

Same-size duplicates are supplied from original color transparencies 24 by 36mm or smaller which are mounted in standard 2 by 2-inch mounts with central mask openings. Same-size duplicates are also supplied from either or both sides of mounted stereo pairs 24 by 36mm or smaller. Originals 28 by 40mm are reduced slightly so that the entire picture area is reproduced in the 24 by 36-mm duplicate. Reduced duplicates 24 by 36mm are supplied from sheet-film originals 2¼ by 3¼ inches to 8 by 10 inches in size (except 6 by 13 cm). Sheet-film originals should not be sent for duplication mounted in glass; at extra charge, they are masked to improve the quality of the duplicates.

Duplicates are not available in strip form. They are supplied in 2 by 2-inch Kodak Ready-Mounts, except when they are ordered unmounted or when the original is smaller than 24 by 36mm.

Kodachrome duplicates of movie film 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 photographic 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. Only black-and-white copies are made from 8mm Kodachrome Films.

Projecting Kodachrome Pictures

• Miniature transparencies should be projected in order that their beauty of color, realism, and illusion of depth may be revealed. Movies and colored slides should be shown in a room with as little stray light as possible reaching the screen. The audience should be seated in front of the projector and close to an imaginary line drawn from the projector to the screen. For continuity and dramatic effects, the slides and movies should be edited and titled. Before the audience is invited to sit down, the equipment should be set up and tested, and easy control of the room lights from the projector position arranged. Appropriate background music from records played softly adds greatly to the performance.

Unless the projector is placed at the proper distance from the screen and the lamp is of the correct wattage, the pictures may appear over- or under-exposed. The following table is helpful in locating the projector so that films which have been properly exposed will be shown to their best advantage. For lenses differing in focal length from those shown in the table, the correct projection lamp should still be determined by the picture width as given in the table. For specific projec-

SUGGESTED LAMP SIZES

Projector	Lens*	Screen Distance (in feet)	Picture Size (in inches)	Lamp Size (in watts)	
				Matte Screen	Beaded Screen
8mm Movie	1-inch, f/1.6	11	16 x 22	300	300
		14	22 x 30	500	300
		19	30 x 40	1000	500
16mm Movie	2-inch, f/1.6	13	22 x 30	300	—
		18	30 x 40	300	300
		26	45 x 60	750	300
		42	72 x 96	—	1000
2 x 2-inch slide, 24 x 36-mm (With 28 x 40-mm slides, the picture size will be approximately 12 percent greater.)	5-inch, f/3.5	10	22 x 30	100	100
		13	30 x 40	100	100
		15	37 x 50	150	100
		22	52 x 70	300	100
		33	84 x 108	500	300
		44	108 x 144	750	500

*With slower or uncoated lenses, use a lamp of the next higher wattage; with faster lenses, use the next lower wattage. NOTE: If the room cannot be completely darkened, a higher-wattage lamp will improve picture quality.

tion distances with these other lenses, refer to the instruction manuals accompanying the projectors. The lamp sizes suggested for matte and beaded screens are for average transparencies under average projection conditions encountered in homes or small auditoriums. Avoid using lamps of over 500 watts for short, home projection distances.

PROJECTION EQUIPMENT

The Kodaslide Merit Projector, with a 150-watt lamp and a 5-inch *f*/3.5 Kodak Projection Ektanon Lens, is designed primarily for home use. For showing slides on larger screens in classrooms or conference rooms, the additional light provided by the Kodaslide Highlux II Projector, with its 200-watt lamp, or the blower-equipped Kodaslide Highlux III Projector, with its 300-watt lamp insures satisfactory screen brightness. The Highlux Projectors are also equipped with the 5-inch *f*/3.5 Kodak Projection Ektanon Lens. For long projection distances, such as those encountered in auditoriums, the Kodaslide Projector, Master Model, is unexcelled. Lamps up to 1000 watts and a set of four interchangeable lenses give optimum results under various conditions. In addition to the slide projectors, two Kodaslide Table Viewers, the 4X and the Model A, with their built-in screens, can be used to show slides in a normally lighted room.

The economically priced Brownie Movie Projector, for users of 8mm film, has a 300-watt lamp and permits forward, still, and reverse projection. The Kodascope Eight-71A with its fast *f*/1.6 Lumenized lens will accomodate lamps up to 1000 watts. The Kodascope Pageant Sound Projector is a single-unit projector for showing both sound and silent 16mm films in either homes or large auditoriums. The effectiveness of silent films can be enhanced greatly by playing background music interspersed with live commentary through the sound system of the Pageant. Three accessory speakers can be quickly coupled to the projector and positioned along both sides and in the front of the auditorium to provide uniform sound coverage.

The Kodaslide Merit Projector is convenient to use and gives bright, clear screen images. The Kodaslide Projector, Master Model (right) can be adapted to fit almost any need.

The Kodaslide Table Viewer, Model A, provides a convenient way to show your transparencies to a small group in a lighted room. The slide changer accommodates about 95 Kodaslide transparencies or 30 glass-mounted slides. The slides are loaded in the channel on one side, projected in sequence by moving the changer handle in and out, and stored after viewing on the other side.

Pictures like these are possible under existing illumination with Kodachrome Film, Type A, and cameras with f/2.0 lenses. Support the camera on a solid object and snap the picture during a natural pause in the action. Shutter speeds will range from $^1/_2$ to $^1/_{25}$ second.

Fading of Slides

Kodachrome slides can be projected many hundreds of times with no appreciable change taking place. In projection, the life of a color slide depends upon the amount of light and heat on the slide and the total projection time, both continuous and intermittent. A shorter life must be expected when a slide is projected frequently and for a relatively long time with a high-wattage lamp.

CLEANING TRANSPARENCIES

Light fingerprints or oily smudges can often be removed by breathing on the transparency, and then wiping it gently with a soft cloth. If this is not successful, use Kodak Film Cleaner sparingly on a plush pad or a wad of cotton. Wipe the film with light, even strokes.

REMOVING LACQUER FROM TRANSPARENCIES

If the protective lacquer with which most miniature Kodachrome transparencies have been coated has become scratched or fingerprinted, it should be removed before the transparency is relacquered. Transparencies processed during the last 10 years are coated with a lacquer which is removable in an alkaline solution, such as a 1 percent solution of sodium carbonate or bicarbonate, or developer solution. After the transparency has been soaked for about 1 minute in the solution, it should be washed for 5 minutes in running water, wiped with a viscose sponge, and dried thoroughly. Kodak Film Lacquer should then be applied as described below.

For instructions on removing lacquer from transparencies processed prior to 1943, write to the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.

APPLYING KODAK FILM LACQUER

Transparencies should be held flat for lacquering. Their edges can be fastened with adhesive tape to a flat surface, 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, and 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 1 percent solution of sodium carbonate or sodium bicarbonate, after which they should be washed in clear water before being dried. Kodak Film Lacquer can be removed by soaking the transparency in an alkaline solution as described above.

Care and Storage of Kodachrome Film

• High temperature and high relative humidity can affect the color and speed of Kodachrome Film so that the quality of the processed film is unsatisfactory. Special precautions are therefore necessary in the storage of color films both before and after exposure, particularly in tropical areas and even in some parts of the United States.

PACKAGE PROTECTION OF UNEXPOSED FILMS

The regular packing for all Kodachrome Films, with only two exceptions, is moisture-tight. No special or tropical packing is needed. Kodachrome Films in 25-foot 8mm rolls and 50-foot 16mm rolls are regularly sold in packing which is only moisture-resistant. This packing provides adequate protection from the humidities normally encountered in temperate zones and for periods of not over a week in tropical regions through the expiration dates stamped on the film cartons. Tropical packing, which is available for these two sizes on special order, is needed when these films are taken for longer than one week into regions having sustained high relative humidity. Because the protection originally provided is no longer effective, *film should not be removed from the package until shortly before use.*

Films should not be left near sources of heat like steam pipes, on top floors of uninsulated buildings, or in automobile compartments.

STORAGE OF UNEXPOSED FILMS

The ideal storage relative humidity is between 40 and 60 percent, preferably near 40 percent. Films in packing which is only moisture-resistant should not be stored without additional protection in damp basements or iceboxes where the relative humidity is high. Additional protection can be provided by sealing them in a friction-top can or in a fruit jar. The packing of 8 and 16mm 50-foot rolls can be made more moisturetight by winding an additional layer or two of a good grade, waterproof, surgical tape over the existing tape seal.

During summer heat (over 75 F) in temperate or tropical zones, film sealed in moisturetight packing should be stored in an icebox or a mechanical refrigerator. Where possible, the following maximum storage temperatures should not be exceeded.

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

Grand Canyon—Early morning sunlight. Upper picture—no filter, f/16, 2 seconds. Lower picture with Kodak Pola-Screen. Note darker sky and slight penetration of distant haze, f/16, 8 seconds.

Keeping effects can be arrested almost completely for long periods of time by storing the film at 0 to—10 F in freezing unit of the type now commercially available. To avoid condensation on the cold film, packages kept in cold storage should be allowed to reach approximate room temperature before they are opened for use.

Films not in moisturetight packing must be kept away from formaldehyde, industrial gases, motor exhausts, and vapors of solvents. All films must be protected from x-rays and radioactive materials.

Film kept past the expiration date may require ½ to 1 stop more than normal exposure, and the color quality may suffer.

PROTECTION OF FILMS AFTER PACKAGE IS OPENED

Films should be exposed and processed as soon as possible after the package has been opened, particularly under humid conditions. Do not leave a loaded camera in the sun in a closed automobile or in a carrying case. If the exposed films must remain in a climate having temperatures above 75 F or relative humidities above 60 percent for several days or weeks before processing, keep them as cool and dry as possible. Do not seal them in their original package or any other moistureproof container unless they are first dried. In warm weather, exposed films, whether dried or not, should be stored inside a refrigerator (if available) and as far from the cooling coils as possible.

Drying of films is seldom necessary in temperate climates except under exceptionally humid conditions. If resealing of the film is necessary, drying can be accomplished by storing the films in a sealed can or jar with activated silica gel. This can be obtained in bulk from chemical supply houses or in perforated metal containers from some photographic dealers. Silica Gel Air Driers are manufactured by the Davison Chemical Corporation, Baltimore 3, Maryland, and contain a color indicator which turns from blue to pink when the silica gel requires reactivation. Heating at 300 F to 400 F in a vented oven or over a fire for about 30 minutes is sufficient for reactivating small quantities; 2 or 3 hours, for large quantities. Cool the silica gel inside a closed metal container and keep it sealed until needed.

If bulk silica gel is used, it should be separated from the film by a porous partition, such as filter paper or fine muslin, to prevent dust from reaching the film. Approximately 1 ounce or one Davison dryer will dry 20 rolls of K135 or K828 film from equilibrium at approximately 80 percent to 40 percent relative humidity; and 5 ounces or three dryers will dry ten 100-foot rolls of 16mm motion-picture film. Rice dried by browning in an oven or dried tea leaves can also be

used. Approximately eight times as much dried rice or tea leaves are required as activated silica gel. Calcium chloride is not recommended because it dusts when dry, liquefies when moist, and is corrosive. Films to be shipped to a processing laboratory should not be delayed unnecessarily for drying, but should be shipped together with the Silica Gel Air Dryers inside a sealed can. Desiccants in bulk form should not be shipped with the film because of the danger of dust.

STORAGE OF PROCESSED FILMS

Store the film where it is dark, cool, and dry. Avoid storage in warm attics or damp basements. Mold growth and changes in the color of the dyes can take place under adverse storage conditions. Make sure slides which are used in humid climates are lacquered. Exceedingly dry conditions, that is, under 25 percent relative humidity, make movie film brittle and curly, but this degree of dryness is seldom encountered. Do not deliberately humidify your movies unless laboratory control is possible. Overhumidification can produce damage.

The best possible storage conditions are at 40 F and 25 percent relative humidity. From a more practical aspect, temperatures up to 80 F do not bring about marked changes in the dyes if the relative humidity is kept between 25 percent and 60 percent. If necessary, the film can be placed in a sealed container with activated silica gel or Davison Dryers. The same quantities of desiccant are required as are used for unprocessed film. Glass-mounted slides which are used in projectors with high-wattage lamps should be stored at a relative humidity of 35 percent or less to avoid condensation on the glass.

Convenient grouping of slides by subject matter is easy with a Kodaslide Compartment File, a Kodaslide Flexo File, or a Kodaslide File Box. Assemble short lengths of motion-picture film on Kodascope Reels and store them in Kodascope Cans ready for projection.

CLEANING AND WAXING MOTION-PICTURE FILM

By drawing motion-picture film slowly 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 (available in some drug stores, particularly in the larger cities) in a 4-ounce bottle of Kodak Film Cleaner and allowing it to stand for 24 hours. The film is rewound slowly to permit it to dry before it reaches the reel. Change the pad frequently to avoid scratching the film with accumulated dirt particles.

KODAK DYE TRANSFER PROCESS

• From positive color transparencies on Kodachrome and Kodak Ektachrome Films and from color negatives on Kodak Ektacolor Film, photographic color prints can be made in sizes up to 16 by 20 inches by the Kodak Dye Transfer Process. Briefly, relief images are made on matrix films, either from three separation negatives made from a positive color transparency, or directly from an original color negative. The relief images or matrices, as they are called, are then dyed cyan, magenta, and yellow and transferred in register to a sheet of premordanted paper. The picture below shows the operation of removing the third matrix from the paper revealing the completed print.

Color prints of the highest quality can be made from good originals by the Kodak Dye Transfer Process. All the chemicals are available in prepared form. In the Kodak Data Book *Color Separation and Masking*, complete instructions are given for making balanced separation negatives from positive color transparencies. The making of the print itself from separation negatives or from a color negative is described in the Data Book *Kodak Dye Transfer Process*. Each of these well-illustrated publications is on sale at Kodak dealers.

KODAK SONOTRACK COATING

• With the introduction of magnetic sound projectors and magnetic striping on film, it is now possible for the photographer to add a sound track to his own processed 16mm movies. Kodak Sonotrack Coating can be applied to either the more widely used silent-perforated film with the rows of perforations along both edges or the sound-perforated type with a row of perforations along only one edge. It is possible to obtain perfectly satisfactory sound quality on the narrower track with which the silent-perforated film is coated. For the critical user, however, best quality is obtained with the wider track on sound-perforated film and by initially exposing the film and, of course, subsequently projecting it at sound speed.

Kodak Sonotrack Coating is available through Kodak dealers. It is important for the film to be in good condition and all splices sound. Sections with wrinkles or torn perforations should be cut out and the ends carefully spliced together. After the film has been returned from having the coating applied, the magnetic track, consisting of background music and narration, can be recorded with a suitable magnetic sound projector. The track can then be played back at once on the same projector if desired. For further information, consult your Kodak dealer.

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 pictures for projection. Miniature Kodachrome transparencies can be used to obtain Kodachrome or Kodacolor Prints and Enlargements, 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*—2.5*

*For emergency use with Kodak Photoflood Filter for Kodak Daylight Type Color Films (No. 80A)

These settings are recommended for meters marked for American Standard Exposure Indexes. (For other meters, refer to the manufacturer's instructions.) They apply to reflected- or incident-light readings, properly made, of average subjects. Certain reflected-light meters should be pointed downward to minimize the effect of the sky. Still-camera lens settings of less than 1/50 second between *f*/8 and *f*/11 should be questioned, because underexposure is likely.

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

Subject Type	Clear Sun Falling On:		Hazy Sun	Cloudy-Bright	Open Shade (5)
	Front of Subject	Side or Back (4)			
Light (1)	*f*/8	*f*/5.6 ▲ 8	*f*/5.6	*f*/4	*f*/2.8
Average (2)	*f*/5.6 ▲ 8	*f*/5.6	*f*/4 ▲ 5.6	*f*/2.8 ▲ 4	*f*/2 ▲ 2.8
Dark (3)	*f*/5.6	*f*/4 ▲ 5.6	*f*/4	*f*/2.8	*f*/2

(1) Distant scenes; near-by people in beach or snow scenes. Light objects predominating.
(2) Near-by people, gardens, houses, scenes not in shade. Light and dark objects in about equal proportions. Use this classification if in doubt.
(3) People in dark clothing; dark foliage, animals, buildings.
(4) With back-lighted close-ups containing important shadow detail, give ½ to 1 stop more exposure than listed. If possible, use supplementary flash with side or back lighting (see below).
(5) Subject shaded from the sun but lighted by a large area of clear, unobstructed sky. Use larger lens opening with smaller sky area; a slightly smaller lens opening with reflecting clouds.
▲ indicates setting halfway between designated lens openings.

Light Sources: Best color rendering is obtained in clear 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	Kodak Filter	Remarks
Bluish daylight	Skylight (Wratten No. 1A)	This filter is recommended primarily for use in shade under a clear blue sky.
Photoflood lamps	Photoflood (Wratten No. 80A)	For best results and shorter exposures, use of Type A film is recommended.
Blue flash lamps	None	
Daylight fluorescent lamps	CC-20B	

Supplementary Flash Outdoors: In bright sunlight, lighting contrast is frequently excessive, particularly with near-by side- or back-lighted subjects. More pleasing results are obtained by using blue flash lamps to illuminate the shadows. In the following table, note the choice in lamp-to-subject distance range offered by the choice of shutter time and lens opening. However, Kodak Flash 200 and other shutters designed primarily for Class F lamps must be set at 1/25 second. With flash fill-in, use the same settings for front, side, or back lighting.

Lamp-to-Subject Distances for Supplementary Flash			
Shutter Time and Lens Opening	1/25 between *f*/8 and *f*/11	1/50 between *f*/5.6 and *f*/8	1/100 between *f*/4 and *f*/5.6
5B or 25B lamp	5† to 10 feet	7 to 14 feet	10 to 20 feet
11B or 40B lamp	7† to 13 feet	9 to 18 feet	13 to 27 feet
22B or 2B lamp	8† to 15 feet	10 to 20 feet	15 to 30 feet

†At shorter distances, drape a white handkerchief over the flash reflector.

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

Lamp No. and Reflector	Open, 1/25	1/50	1/100	1/200
5B or 25B in Kodak Flasholder	45	40	35	25
22B or 2B in 6- to 7-inch polished	75	65	55	45

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

Caution: Since lamps may shatter when flashed, use of a Kodak 2-Way Flashguard or other shield over the reflector is recommended. With the diffuse side of the Flashguard, increase the lens opening ½ stop. *Do not flash lamps in an explosive atmosphere.*

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

Subject Type	Clear Sun Falling On: Front of Subject	Clear Sun Falling On: Side or Back (4)	Hazy Sun	Cloudy-Bright	Open Shade (5)
Light (1)	*f*/8 ▲ 11	*f*/8	*f*/5.6 ▲ 8	*f*/4 ▲ 5.6	*f*/2.8 ▲ 4
Average (2)	*f*/8	*f*/5.6 ▲ 8	*f*/5.6	*f*/4	*f*/2.8
Dark (3)	*f*/5.6 ▲ 8	*f*/5.6	*f*/4 ▲ 5.6	*f*/2.8 ▲ 4	*f*/1.9 ▲ 2.8

(1-5) The notes to the exposure table on page 42 apply, except for the supplementary flash recommendation. Use of a reflector often improves close-ups of side- and back-lighted subjects.

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

Rolls and Magazines Available for Miniature Cameras:

K135 20- and 36-exposure magazines (normal picture size—24 x 36mm) for Kodak Pony 135, Retina, Signet, and all other cameras taking Kodak 135 films.

K335 magazines for 20 standard 23 x 24mm stereo pairs.

K828 8-exposure rolls (normal picture size—28 x 40mm) for Kodak Bantam, Pony 828, and all other cameras taking Kodak 828 films (not recommended for use in cameras with lenses slower than *f*/5.6).

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

50- and 100-ft rolls for Cine-Kodak and other 16mm spool cameras.

200-ft roll for 200-ft film chamber of Cine-Kodak Special cameras.

50-ft magazine for Cine-Kodak Royal and other 16mm magazine cameras.

50-ft Packette for Simplex Pockette and Filmo 121 cameras.

100- and 200-ft rolls perforated one edge for 16mm sound recording cameras.

25-ft roll for Cine-Kodak and other 8mm cameras taking double 8mm film.

100-ft roll for 8mm Bolex Camera.

25-ft magazine for Cine-Kodak Magazine 8 and other 8mm magazine 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 pictures for projection. Miniature Kodachrome transparencies can be used to obtain Kodachrome or Kodacolor Prints and Enlargements, 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*

*With Kodak Daylight Filter for Kodak Type A Color Films (No. 85). Certain reflected-light meters should be pointed downward to minimize the effect of the sky.

These settings are recommended for meters marked for American Standard Exposure Indexes. (For other meters, refer to the manufacturer's instructions.) They apply to incident-light meter readings taken from the subject position, and to reflected-light readings taken from a gray card of 18% reflectance† held close to the subject, facing halfway between the camera and the main light. They also apply when a reflected-light reading of the scene is taken from the camera position, provided both subject and background have approximately the same brightness. The Exposure Index should be divided by 2 if the reading is taken from the palm of the hand or the subject's face, or divided by 5 if the reading is taken from a white card of 90% reflectance.† Set the meter calculator arrow as for a normal subject.

When using a card or the palm of the hand, allow ½ stop more exposure for unusually dark subjects, ½ stop less for unusually light subjects.

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

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

Photoflood Exposure Table—Still Cameras: For Kodachrome Film, Type A, with two No. 2 photoflood lamps in Kodak Vari-Beam Lights at STILL position. Give ½ stop more exposure for two reflector-type photoflood lamps.

Shutter Time	Lamp-to-Subject Distance				Both lamps at same distance from subject: fill-in light at camera; main light at 45° angle to camera-subject axis and 2 to 4 feet higher than fill-in light.
	3½ ft	5 ft	7 ft	10 ft	
1/25 1/2	*f*/4.5 *f*/16	*f*/3.5 *f*/11 ▲ *f*/16	*f*/2.8 *f*/8 ▲ *f*/11	*f*/2 *f*/5.6 ▲ *f*/8	

▲ indicates setting halfway between designated lens openings.

Note: This table is for new lamps, beams superimposed. After 1 hour burning, use ½ lens opening wider; after 2 hours, next larger opening.

Light Sources: Best color rendering is obtained with photoflood lamps. 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	Kodak Filter
Daylight	Daylight (Wratten No. 85)
Flash lamps:	
No. 5, 6, 11, 22, 31, and 50	Wratten No. 81C
No. 0, 2, 2A, 3, 25, 26, and 40	Wratten No. 81D
SM	None
SF	Wratten No. 81A
3200 K Lamps	Wratten No. 82A
Standard Warm White Fluorescent Lamps	CC-10Y plus CC-20M
Standard Cool White Fluorescent Lamps	CC-40Y plus CC-30M

Photoflood Exposure Table—Amateur Motion-Picture Cameras: Either two No. 2 photoflood lamps in Kodak Vari-Beam Lights at MOVIE position or two 375-watt (PH-375) lights at either side of camera in Kodak Photo Lite Bar.

Two No. 2 photoflood lamps. Main light at 45° angle to camera-subject axis and 2 to 4 feet higher than lens. Fill-in light at camera.		Lens Opening*	Two 375-watt medium beam reflector-type photoflood lamps (PH-375)
Main Light	Fill-in Light		
3½ ft	5 ft	*f*/5.6	4½ ft
5 ft	7 ft	*f*/4	6 ft
7 ft	10 ft	*f*/2.8	9 ft
11 ft	16 ft	*f*/1.9	13 ft

*For new lamps, beams superimposed. After 1 hour burning, use ½ lens opening larger; after 2 hours, next larger opening.

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

Between-Lens Shutters	SM* or SF*	No. 5* or 25*	No. 11† or 40†	No. 2† or 22†	Focal-Plane Shutters	No. 6‡ or 26‡
Open, 1/25	45	70	95	110		
1/50	45	60	85	100	1/100	45
1/100	40	55	70	90	1/200	30
1/200	35	40	55	65	1/400	22

*In Kodak Flasholder or similar 4- to 5-inch satin-finished reflector.
†In 6- to 7-inch polished reflector.
‡In 4- to 5-inch polished reflector.

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

Caution: Since lamps may shatter when flashed, use of a Kodak 2-Way Flashguard or other shield over the reflector is recommended. With the diffuse side of the Flashguard, increase the lens opening ½ stop. *Do not flash lamps in an explosive atmosphere.*

Daylight Exposure Tables—Still and Amateur Motion-Picture Cameras: Use the appropriate table in the Data Sheet for Kodachrome Film, Daylight Type. A Kodak Daylight Filter for Kodak Type A Color Films (No. 85) should 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).

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 black-and-white negatives 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 2¼ x 3¼ 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 34.

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 Flurolite Enlarger A or the Kodak Hobbyist 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 Film on the easel and make a test exposure. A three-diameter enlargement from a miniature transparency will require about 25 seconds at *f*/8. 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.

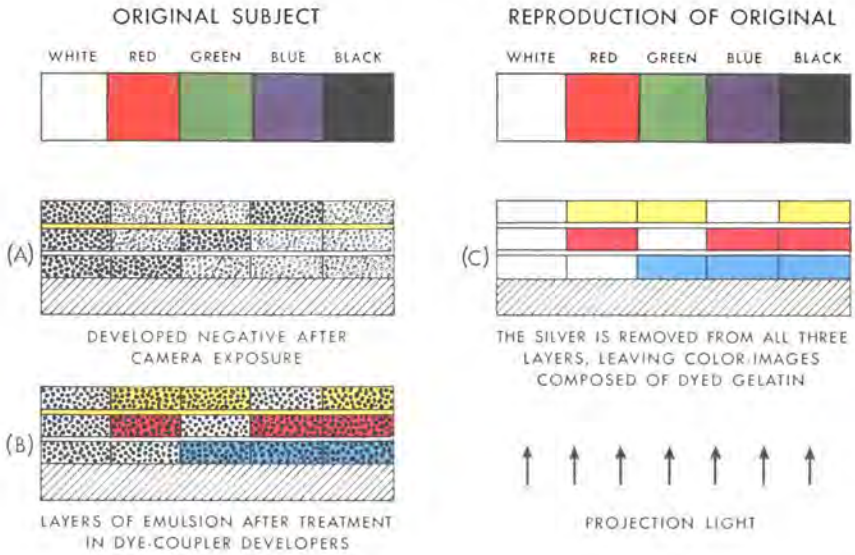
The "additive" process depends upon the addition of red, green, and blue light. An example of this method is the use of microscopic dots of red, green, and blue over the entire picture area, these dots being added together by the eye without the perception of the individual dots as such.

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 page 47 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.

For the advanced worker—a series of publications containing complete information on color photography with Kodak materials.

*COLOR AS SEEN AND PHOTOGRAPHED. A readable explanation of the fundamentals of color and color photography. Describes how the Kodak color processes work and how results are influenced by visual effects. Profusely illustrated.

*COLOR PHOTOGRAPHY OUTDOORS. Professional tips on making high-quality color pictures under a variety of illumination conditions. Includes sections on supplementary flash and scenic, illustrative, and architectural photography.

*COLOR PHOTOGRAPHY IN THE STUDIO. Discusses light sources, equipment, and lighting and camera techniques for successful color photography indoors. Includes sections on portrait and commercial lighting, special problems, make-up and flash technique.

*KODAK COLOR FILMS. Contains full information on handling, processing, color balance and speed, use of filters, and related subjects. Includes a detailed Data Sheet for each of the Kodak materials used in still color photography.

KODAK FLEXICHROME PROCESS. Gives complete, step-by-step instructions for making Flexichrome prints and coloring them. Explains the details of practical technique in a way that solves processing and coloring problems before they arise.

COLOR SEPARATION AND MASKING. Describes procedures for making separation negatives which are balanced in contrast and density range. Includes full information on the technique of masking for best quality in the color prints.

KODAK DYE TRANSFER PROCESS. Covers both the printing of separation negatives with Kodak Matrix Film and the printing of Kodak Ektacolor negatives with Kodak Pan Matrix Film. Includes full details of control procedures.

*Included in the Kodak Color Handbook (See over).

Kodak Reference Handbook. A comprehensive reference book containing several Kodak Data Books bound in a Mult-O Ring binder. Discusses materials, processes, and exposing and processing techniques.

Kodak Color Handbook. A complete guide to taking still pictures in color. Four Kodak Color Data Books in a Mult-O Ring binder cover theory, data, and use of color materials.

Kodak Photographic Notebook. A flexible Mult-O Ring binder containing five separators and a supply of blank paper. Ideal for filing notes and booklets to supplement the Kodak Handbooks.

Kodak Master Photoguide. A pocket library of photo data with many computing aids. Contains exposure data for most types of situations encountered in the studio, at home, or in the field.

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2-53E-CH E9

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