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KODAK DATA BOOK

FILTERS AND POLA-SCREENS

For Revising Kodak Reference Handbook



**This Kodak Data Book
Is a Complete Unit on the Subject of**

FILTERS AND POLA-SCREENS

***It is also punched for insertion in the Kodak
Photographic Notebook or for use as a replace-
ment section in the Kodak Reference Handbook.***

FILTERS AND POLA-SCREENS explains and illustrates the principles underlying the use of filters with black-and-white negative materials and of Kodak Pola-Screens with all sensitive materials. Specific recommendations of value to both amateur and commercial photographers are included.

Special punching of the book makes it doubly useful: (1) It can be inserted in the *Kodak Photographic Notebook* with other Kodak Data Books or special photographic articles prepared by the Eastman Kodak Company, or (2) it provides the owner of a *Kodak Reference Handbook* with an up-to-date replacement for a Filters section bearing an earlier printing date.

If you do not own a *Kodak Reference Handbook* or a *Kodak Photographic Notebook*, see your Kodak dealer. The *Handbook* is a comprehensive, metal-ring, reference book containing sections devoted to Lenses, Films, Filters, Color Films, Papers, Formulas and Processing, and Copying. The *Notebook*, designed to serve as a supplement to the *Handbook*, is a metal-ring binder containing five separators, a quantity of notebook paper, and suggestions on how to make a valuable file of photographic information.



FILTERS AND POLA-SCREENS

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Types of
Filters

Sky Brightness
Control

Filters for
Outdoor Subjects

Contrast Filters
in Commercial
Photography

Filter
Factors

Kodak
Combination Lens
Attachments

K1

K2 • K3
Aero 1

CK-3 • X1

X2 • G

A • F

B • C5

Tricolor

Pola-Screens

DATA SHEETS

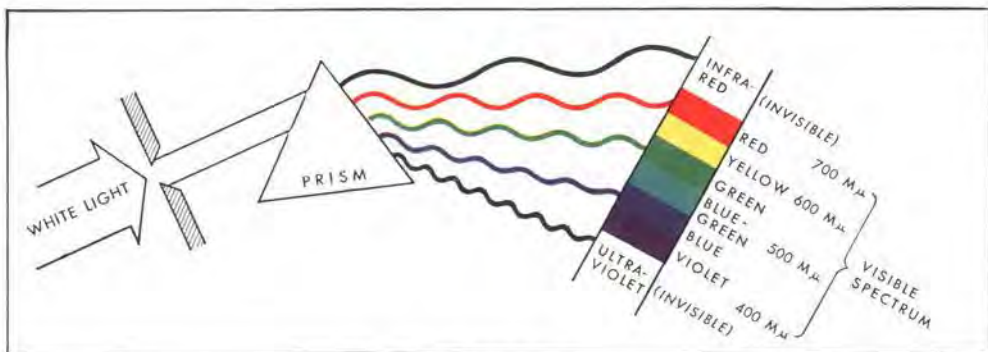


FIGURE 1.

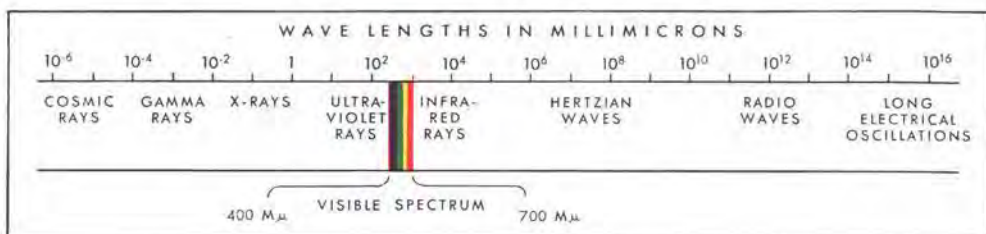


FIGURE 2.

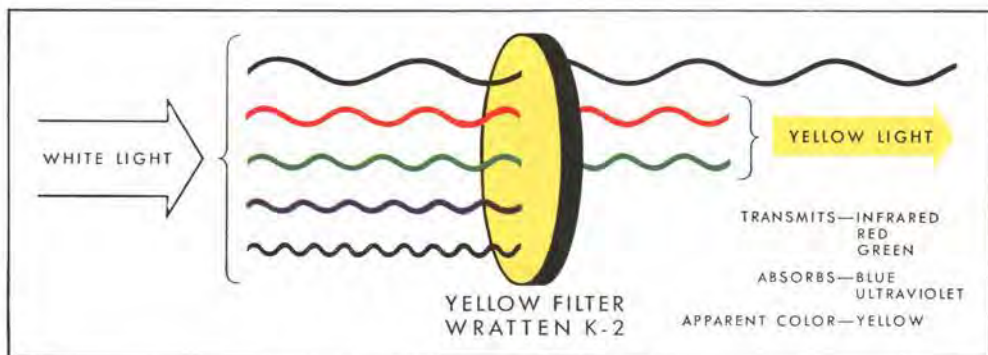


FIGURE 3.

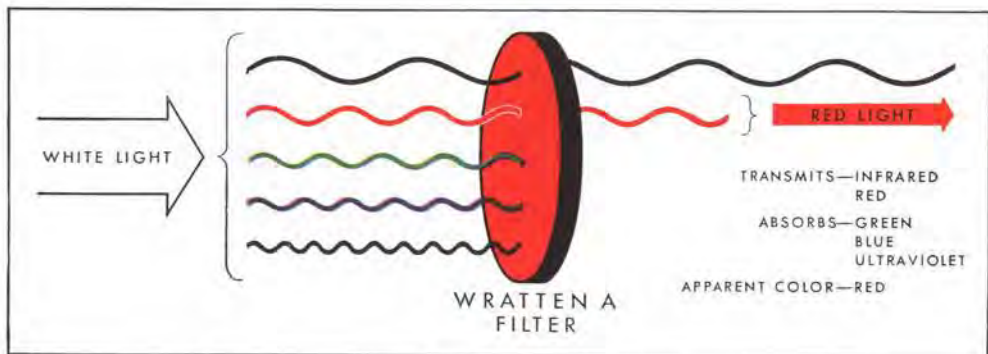


FIGURE 4.

FILTERS AND POLA-SCREENS

SKILLED photographers strive to produce record photographs that are technically correct, and pictorial photographs of artistic merit. Important in achieving both aims in black-and-white photography is the ability to exercise control over the tone reproduction of colored subjects. Such control is achieved through the proper use of filters in conjunction with Kodak Films.

More than 100 different Kodak Wratten Filters are available; all are manufactured with extreme care. Their prestige in the photographic field is the result of constant improvement in the determination and control of filter characteristics in the Kodak Research Laboratories—improvement made possible by the related knowledge of films and film sensitizing. These filters, made from organic dyes of great purity and brightness, are prepared in gelatin sheets of a prescribed thickness and are held to rigid standards by scientific control. In the manufacture of a wide range of filters with dyed gelatin, it is possible to meet high standards of reproducibility.

Gelatin film filters are used largely for experimental work; they are delicate and must be handled with care. For continued use they are supplied cemented between glass sheets—glass of the same optical quality as that used in lenses. The "B" glass is satisfactory for average photographic purposes, while "A" glass, in polished optical flats, is of the highest accuracy for scientific work and for use with lenses of long focal length.

Kodak Pola-Screens are valuable photographic tools in that they afford extensive control over reflections, and over the rendering of blue skies in color photography.

The text of this booklet explains and illustrates the theory and use of filters with black-and-white negative materials. Data Sheets for selected Wratten Filters begin on page 25. Information about Pola-Screens appears on pages 38 to 40.

LIGHT AND COLOR

WHITE light, sunlight for instance, is a composite of all the colors of the visible spectrum. When a beam of white light is passed through a prism (Figure 1), it is split up into its component parts—a band having all the colors of the rainbow. This is the visible spectrum and is but a tiny part of the electromagnetic spectrum (Figure 2).

Light rays, like radio waves, gamma rays, infrared and ultraviolet rays, x-rays, cosmic rays, and others, are forms of electromagnetic radiation—wave motions in the ether—differing from one another only in their wave length and frequency. Those rays between 400 and 700 millimicrons ($m\mu$)* in length are visible and are what we know as light.

Color is a matter of wave length, those rays from 400 to 500 $m\mu$ in length giving the sensation of blue, 500-600 $m\mu$ green, and 600-700 $m\mu$ red. When the eye receives all these waves at once, and in the proper proportions, their combined effect produces the sensation known as white.

The Action of Light Filters

The action of a filter is to stop light of certain colors. That is, rays of some colors are allowed to pass through freely, while others are partially or wholly absorbed. This is the fundamental concept of a filter, and should be kept in mind whenever a filter is to be used.

Because a filter selectively absorbs certain rays, it necessarily appears colored. A red book appears red because it *reflects* red light and *absorbs* light of other colors. A red filter appears red because it absorbs green and blue light and transmits red light freely (see Figure 4). A filter which absorbs red and green light appears blue. Looking through such a filter, red and green objects appear dark, while blue objects appear light. A filter which absorbs blue and red is green; one which absorbs only blue appears yellow because it transmits green and red, and these affect the eye as yellow. The popular Wratten K2 Filter reduces the amount of light in the blue region of the spectrum without appreciably reducing light of other colors, and appears yellow (Figure 3). However, all yellow transparent substances are not suitable as filters, because some transmit freely the ultraviolet and yet appear identical to others which absorb it completely. Such materials are valueless for photography.

Into Wratten Filters go the most efficient organic dyes that can be

*The normal units of measurement are so big that it would be cumbersome to express wave lengths of light by them. It is, therefore, customary to use the millimicron ($m\mu$) which is one millionth of a millimeter or the Ångström unit (\AA) which is one ten-millionth of a millimeter.

found—efficient in that their transmission is as high as possible in the desired spectral region, and their absorption adequate for the colors they are intended to stop. Figure 5 shows a typical filter absorption curve, which demonstrates graphically the proportion of light absorbed at any wave length. Absorption curves and wedge spectrograms are given in the filter Data Sheets, starting on page 25. The spectrograms show the color sensitivity which will be obtained by using each filter with a Kodak panchromatic material.

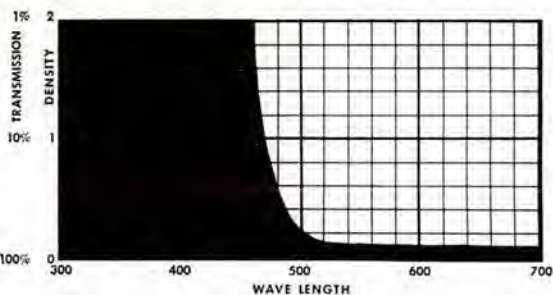


Figure 5—Typical Filter Absorption Curve. (K2 Filter)

Filter Factors

As every filter absorbs a certain proportion of light, it quite naturally reduces the amount of light reaching the film. An increase in exposure will therefore be required to compensate for the light absorbed by the filter. The number by which the exposure must be multiplied for a given filter with a particular film is called the “multiplying factor” or “filter factor” of that filter. This is dependent not only on the color of the filter itself, but also on the nature of the light source and the sensitivity of the negative material which is to be used. An explanation of the classes and types of color sensitivity into which Kodak negative materials are grouped may be found in the Data Book, *Kodak Films*, and in the Films section of the Kodak Reference Handbook. A table of these filter factors for the Wratten Filters most commonly used appears on page 18.

Since there is a difference in the color values of sunlight and tungsten light, the filter factor for the same film and filter will be different for these two light sources. Tungsten lacks the large proportion of blue and violet light characteristic of sunlight and is therefore proportionately stronger in the red. The resulting difference in filter factors is illustrated by the factors for the A filter with Type B panchromatic materials: 8 in sunlight and 4 in tungsten. This occurs because the blue portion of the spectrum absorbed by the A filter comprises about $\frac{3}{4}$ of the predominantly blue sunlight, while it comprises only $\frac{1}{2}$ of the predominantly red tungsten light.

In ordinary picture taking, a filter factor can be applied either to

the time of exposure or to the size of the lens opening. For example, if the filter factor is 2 and the normal exposure without a filter is 1/50 second at $f/11$, it will be necessary to give either 1/25 second at $f/11$ or 1/50 second at $f/8$. The *Outdoor Filter Kodaguide*, obtainable at Kodak dealers, provides filter recommendations for typical outdoor subjects and, by means of a dial calculator, gives a direct indication of the exposure required according to the filter selected.

Filter factors supplied for use with Kodak products are sufficiently accurate for all ordinary purposes. However, in certain applications which require precise exposure, considerations may be present which affect the filter factor. In such instances, the recommended factor should be treated as a guide for the determination of the appropriate exposure by means of test exposures.

TYPES OF FILTERS

COLOR FILTERS for black-and-white photography are designed for several different purposes and may be classified as: (1) *Correction* or "orthochromatic" filters which are used to alter the response of the film so that all colors are recorded at the brightness values seen by the eye. (The term "orthochromatic" used here means true color rendering and should not be confused with "orthochromatic" film which is sensitive to blue and green but not red.) (2) *Contrast filters* which distort the brightness values so that two colors having about the same brightness to the eye will have decidedly different brightnesses in the picture. (3) *Haze filters* which reduce or eliminate the effects of aerial haze. (4) *Tricolor filters* for making tricolor-separation negatives in color printing work. (5) *Neutral density filters* for reducing exposure.

Correction Filters

While panchromatic films respond to all the colors which the eye can see, they will not of themselves reproduce the tones of blue, green, and red objects in the same relative values as the eye sees them. For instance, blue and violet normally appear darker to the eye than green, yet a film is very sensitive to these colors and will record them as lighter than green. By the proper use of filters, however, the response of a film can be changed to reproduce colors in the relative brightnesses that the eye sees. The excess ultraviolet and blue-violet sensitivity common to every emulsion requires some absorption of such rays, while the added red sensitivity of some panchromatic materials demands some absorption of red light as well. Filters reducing the amount of light in the blue region of the spectrum without appreciably reducing light of other colors appear

yellow and are the most useful photographic filters. The K2, Kodak Cloud Filter, CK-3, and G filters absorb the ultraviolet completely while the K1 absorbs only part of it. All stop the blue to some extent. Those filters absorbing some of the red rays in addition to the ultraviolet and blue are the X1 and X2 light green filters.

It is well to note here that photographic lenses themselves absorb all the ultraviolet rays shorter in wave length than 330 to 350 $m\mu$, depending on the type and thickness of glass used.

For correct monochromatic rendering (that matching most closely the daylight color response of the eye) with panchromatic emulsions of Types B and C*, the following filters should be used:



Figure 6—Sensitivity of the Eye

- K2 filter with Type B materials in daylight.
- X1 filter with Type B materials in tungsten light.
- X1 filter with Type C materials in daylight.
- X2 filter with Type C materials in tungsten light.

In dealing with filters, the terms "overcorrect" and "undercorrect" are frequently and loosely used. Undercorrection usually means that the rendering resembles that of non-color-sensitized films—blues too light; greens, yellows, and reds too dark. Overcorrection usually signifies the reverse—blues too dark; greens, yellows, and reds too light. Both terms are more correctly applied to some one color, rather than all colors.

Contrast Filters

Contrast filters are used to lighten or darken certain colors in the subject for the purpose of introducing a brightness difference between two colors which would otherwise photograph nearly the same.

To the eye, objects are distinguished from their surroundings by contrast which may be of two kinds. It may be a tone contrast or a color contrast. Depending on the photographic method used, tone contrasts can be correctly reproduced, or color contrasts can be subdued or exaggerated as desired.

Thus, a red apple and its green leaves may photograph without a filter as two nearly similar tones of gray. Through the Wratten A (red) Filter, which transmits the red of the apple and absorbs the green of its leaves, the apple will be rendered light and the leaves dark; thereby a contrast which was present visually is restored. Use of the Wratten B

*See pp. 18-19 for tables of sensitizing types and filter factors for all Kodak negative materials.

(green) Filter, which absorbs the red of the apple while transmitting the green of its leaves, produces the opposite result. The approximate effect of the Wratten A, B, C-5 and G filters can be predetermined visually by means of the Contrast Viewing Kodaguide.

A discussion of the principles of contrast filters, with specific recommendations for various commercial subjects, appears on pages 15 to 17.

Sky Brightness Control

One of the most frequent uses of correction and contrast filters is to darken a blue sky to make white clouds stand out more prominently or to lend emphasis to the subject seen against the sky. In black-and-white photography, yellow or red filters are used for this purpose and their effectiveness depends upon the blueness of the sky. In some cases, the sky is not reproduced as dark as might be expected, under which conditions any one of the following factors may be responsible:

1. A misty sky does not photograph so dark as a clear sky. An over-cast sky is darkened very little by filter application.
2. The sky is frequently almost white at the horizon and shades to more intense blue at the zenith. Therefore, the filter effect at the horizon is small and becomes increasingly greater as the camera is aimed upwards.
3. The sky near the sun is brighter and less blue than elsewhere, and is, therefore, less affected by the use of a filter.
4. The depth of filter (whether yellow or red) and the film used affect the rendering of the sky. A blue sky is increasingly darkened by the following film and filter combinations.

| <i>Negative Material</i> | <i>Filter</i> | <i>Monochromatic rendering of a Clear Blue Sky</i> |
|--------------------------|---------------|--|
| Non-Color-Sensitized | None | Lighter than correct |
| Orthochromatic | None | Lighter than correct |
| Panchromatic | None | Lighter than correct |
| Orthochromatic | K2 | Practically correct |
| Panchromatic | K2 | Practically correct |
| Panchromatic | G | Darker than correct |
| Panchromatic | A | Very dark |
| Panchromatic | F | Almost black |
| Infrared-Sensitive | A | Black |

5. The exposure has some influence on the result. Slight under-exposure of the negative or dark printing appears to darken further a sky already rendered slightly dark by the use of a filter.

Overexposure of the film results in a lighter sky, and the filter effect may appear to be lost.

6. The contrast between the sky and the subject in the final print naturally depends on the lightness or darkness of the subject. With panchromatic film, the sky may be rendered dark in contrast to a light-colored subject, such as white blossoms or snow-covered trees, even when no filter is used.

The Kodak Cloud Filter is supplied in No. 6A ($1\frac{1}{8}$ -in.), 7A ($1\frac{5}{16}$ -in.), and 13 (1-in.) slip-on mounts. It is a relatively deep yellow, contrast filter for recording white clouds against a darkened blue sky. It can also be used to reduce the effect of haze in landscape scenes, or to darken the reflections of a blue sky from water surfaces. The filter factor in daylight is 2.5 with Kodak Verichrome Film; 2 with Kodak Plus-X, Super-XX, or Panatomic Film. However, with box cameras or other simple-lens cameras which do not have multiple lens openings or shutter speeds, good pictures can be made in bright sunlight with the Kodak Cloud Filter over the lens.

Kodak Pola-Screen: Another method of darkening the sky is by means of the Kodak Pola-Screen. Maximum darkening is obtained with the Pola-Screen when the camera lens axis is at right angles to the sun's direct rays (when the subject is side-lighted or the sun is directly overhead), and the indicator handle of the Pola-Screen is pointing at the sun. Even more spectacular results on black-and-white film can be obtained by using a K2, A, or X1 filter with the Pola-Screen. Although red filters cannot be used with orthochromatic films, red-filter sky effects can be obtained with these films by using the Kodak Pola-Screen and the yellow K2 filter together.

Less pronounced effects can be obtained by revolving the indicator handle so that it does not point at the sun, or by changing the angle of the lens axis relative to the sun. The effect can be previewed through the handy Kodak Pola-Screen Viewer, which attaches to the indicator handle of the Pola-Screen, or through the Pola-Screen itself.

In black-and-white photography, it is well to use the Pola-Screen for sky brightness control when the use of a yellow or red filter would noticeably distort the color rendering of foreground objects. For color photography, the Pola-Screen offers the only means of darkening the sky or penetrating blue haze without changing the color balance of the transparency or print. Penetration of blue haze is directly related to sky brightness control with the Pola-Screen; maximum haze penetration is obtained with the subject at right angles to the sun's rays. Further information on Kodak Pola-Screens is given on pages 38-40.

Haze Filters

Distant landscapes and aerial views from high altitudes appear veiled by bluish haze, even on clear days. When photographed without a filter, this veiling hides some of the detail visible in the original scene. The contrast of distant detail is degraded because the image of the haze between the scene and the camera becomes superimposed upon the image of the distant detail. True atmospheric haze is bluish and is caused by light being scattered by very small particles of dust and water vapor and to some extent by the air itself. The blue color of the sky is principally due to the scattering of blue light by the molecules of the air.

Atmospheric haze should not be confused with mist or fog, both of which are white and are composed of water droplets. True atmospheric haze scatters very little red light, some green light, more blue light, and a large amount of ultraviolet, which in photography is more important than the visible haze. Since all photographic materials are highly sensitive to violet and ultraviolet, unfiltered pictures of distant landscapes record more haze than is visible. If the photograph is taken by light of longer wave length (green, red, etc.), the amount of recorded haze decreases. The amount of recorded haze decreases steadily in the order of the table given under "Sky Brightness Control."

Neutral Density Filters for Reducing Exposure

The most frequent need for a neutral density filter arises when movies are to be made in sunlight on Cine-Kodak Super-XX Film. As the smallest aperture available on some lenses, $f/16$, is too large for scenes in bright sunlight, a gray filter known as the Kodak ND-2 Filter is supplied to reduce the exposure to one-fourth.

Occasionally one encounters very brilliant subjects, such as blast furnaces or arc-welding operations, which require dense neutral density filters. Kodak Wratten Neutral Density Filters, No. 96, are supplied in nineteen standard densities. Additional information can be obtained from the Sales Service Division, Rochester 4, New York.

Filters for Color Photography

Kodak Color Compensating Filters are used to make changes in the over-all color balance of results obtained with color films, and to compensate for possible deficiencies in the quality of the light by which color films are exposed. Kodak Light Balancing Filters are used for raising or lowering the effective color temperature of the exposing light. These filters are normally supplied in gelatin film squares. Some are also

supplied in "B" glass squares, and in "B" glass to fit Kodak Adapter Rings. Complete information on these filters is available on request.

Filters for Color-Separation Negatives

Matched sets of red, green, and blue filters are used for making tri-color-separation negatives for color printing. These are described in the Data Sheets.

THE HANDLING OF FILTERS

Kodak Wratten Gelatin Film Filters are fragile and must be treated with great care. Moisture and contact with the fingers leave indelible marks. Loose dust can be removed with a soft, dry, camel's-hair brush, but the gelatin can be cleaned in no other way.

Gelatin filters should be touched only at the edges and should be handled and cut while between sheets of paper. These filters should be stored in dust-free containers in a cool, dry place.

Gelatin filters can be used conveniently at the lens in Kodak Gelatin Filter Frames, available in two sizes to hold 2 and 3-inch gelatin squares. Kodak Gelatin Filter Frame Holders are also supplied in these two sizes to fit, respectively, the Series VI and Series VIII Kodak Combination Lens Attachments. For temporary use, (1) gelatin filters can be mounted in cardboard; (2) a circle of the filter can be cut to fit between lens elements; or (3) the filter can be simply taped over the lens.

Cemented Wratten Filters are precision units and should be treated as carefully as fine lenses. They can be cleaned with a soft cloth (slightly moistened with Kodak Lens Cleaner, which should not be permitted to touch the cemented edges of the filter) and polished with Kodak Lens Cleaning Paper. Cemented filters should never be subjected to excessive heat and should be stored in clean, dry containers such as the boxes in which they are sold.

SELECTION OF FILTERS

For Outdoor Subjects

In the following table are a number of subjects commonly encountered in outdoor photography and filters suggested for each. Where the K2, G, or C5 filter is indicated, either Verichrome or a panchromatic film can be used. Where the X1, A, or F filter is listed,

OUTDOOR PICTURES WITH VARIOUS FILTERS



No filter



Effect obtainable with X1 filter
or Pola-Screen

Negatives made on a Type C panchromatic material

The X1 filter darkens the sky without adversely affecting color rendering of the subject.



No filter



K2 filter

Negative made on an orthochromatic material

Darkening sky to accentuate blossoms. (Kodak Cloud Filter gives approximately the same effect as the K2.)



K2 and Pola-Screen



No filter



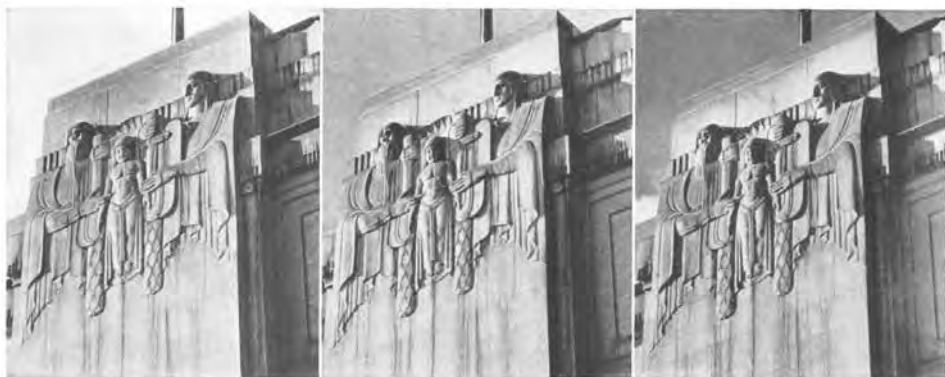
Pola-Screen

Negatives made on a panchromatic material



Pola-Screen and "A" filter

Controlling sky brightness over a wide range is possible with the Pola-Screen when photographing at right angles to the sun's rays. Night effects are obtained with the Pola-Screen and A filter together.



No filter

G filter

"A" filter

Negatives made on a Type B panchromatic material

The G and "A" filters add increasing emphasis to modeling and texture in sunlit subjects under a blue sky.



No filter

K2 filter

"A" filter

Negatives made on a Type C panchromatic material

Clouds are rendered correctly with the K2 filter, and spectacularly with the "A" filter.



Above, K2 filter; below, no filter

Above, G filter; below, C5 filter

Negatives made on a Type C panchromatic material

Control haze effect by filters. C5 adds aerial perspective; K2 and G show increasing penetration.

a panchromatic film must be used. Due to the impurity of colors occurring in nature, it is not always easy to tell just what filter will accomplish the desired result. Blue objects, for example, may also reflect a great deal of green light which, due to the predominance of blue, is not apparent to the eye. Where there is some doubt as to the proper choice of filter, it is wise to repeat the picture for each filter indicated and select the best result afterwards. In many cases the variations will be small but may make the final difference between a beautiful picture and a mere record.

| SELECTION OF FILTERS FOR OUTDOOR USE | | |
|--|--|--|
| <i>Subject</i> | <i>Effect Desired</i> | <i>Suggested Filter</i> |
| Clouds against Blue Sky Blue Sky as Background for Other Subjects | Natural | K2 |
| | Darkened | G |
| | Spectacular | A |
| | Almost Black | F |
| | Night Effect | A, plus Pola-Screen, A or F with Infrared Material |
| Marine Scenes when Sky is Blue | Natural | K2 |
| | Water Dark | G |
| Sunsets | Natural | None or K2 |
| | Increased Brilliance | G or A |
| Distant Landscapes | Addition of Haze for Atmospheric Effects | C5 |
| | Very Slight Addition of Haze | No Filter |
| | Natural | K2 |
| | Haze Reduction | G |
| | Greater Haze Reduction | A or F |
| | Haze Elimination | A or F with Infrared Material |
| Nearby Foliage | Natural | K2 or X1 |
| | Light | B, or G with Verichrome Film |
| Outdoor Portraits Against Sky | Natural | X1, K2, or Pola-Screen |
| Flowers Blossoms and Foliage | Natural | K2 or X1 |
| Red, "Bronze," Orange and Similar Colors | Lighter to Show Detail | A |
| Dark Blue, Purple and Similar Colors | Lighter to Show Detail | None or C5 |
| "Foliage" Plants | Lighter to Show Detail | B, or G with Verichrome Film |
| Architectural Stone, Wood, Fabrics, Sand, Snow, etc., when Sunlit and Under Blue Sky | Natural | K2 |
| | Enhanced Texture Rendering | G or A |

FILTERS IN COMMERCIAL PHOTOGRAPHY

FILTERS have numerous applications in commercial photography. The principles involved and specific recommendations for some of the more common subjects are described below.

Kodak panchromatic negative materials most suitable for general commercial work with filters are: Films—Super-XX, Panatomic-X, Tri-X Panchromatic, Super Panchro-Pres, Type B; Plates—Tri-X Panchromatic, Panatomic-X, Kodak Panchromatic. Tables of color sensitivity and filter factors of Kodak negative materials appear on pages 18 and 19.

General Principles of Contrast Filters

1. A colored object appears dark in the print if the negative is exposed through a filter which absorbs the color of the object. The filter allows only a little of the light reflected from this object to reach the film, so that the object appears darker in the print than in the original subject.

Consider the application of this principle to photographing blue-prints. The blue field should be made as dark as possible compared with the white lines. As a red filter absorbs blue light, the best contrast will be produced on panchromatic film with the Wratten A or F Filter. A green filter would do as well if the blue of the blueprint were a very pure color, but it reflects some green light, and therefore the contrast would not be so high with the green filter.

2. A colored object appears light in the print if the negative is exposed through a filter which transmits the color of the object. For example, consider photographing a yellowed document. With a G (yellow) filter, which transmits yellow freely, a panchromatic negative material reproduces this paper as white.

3. To show the best detail within a colored object, photograph that object to appear light, as above. Thus, dark green leaves show best detail when the negative is exposed through a green filter, on panchromatic material, or through a deep yellow filter on orthochromatic material (another method of photographing by green light).

Selection of Filters in Commercial Work

The ability to select the proper filter for a multicolored subject requires experience and judgment. No single rule can be applied, but the following procedure is suggested.

The subject should first be carefully examined to determine how the various colors must be rendered in order to show a pattern or texture, or

Data—KODAK WRATTEN K2 FILTER (No. 8)

Color: Yellow. Absorbs ultraviolet and some blue-violet rays. Affords complete correction in daylight with Type B panchromatic materials.

Negative Materials: All panchromatic and orthochromatic materials.

Uses: (1) Darkening a blue sky to obtain cloud effects; (2) photographing through distant haze; (3) photographing foliage and grass to render it lighter than without a filter; (4) photographing gardens; and (5) photographing any scenery (distant or close) where colors, especially greens, yellows, and reds, are predominant. Among the subjects to which these filters are particularly adaptable, the more important are:

| | | |
|---------------|-----------------|----------------------|
| DISTANT VIEWS | YACHTING SCENES | CLOUDS WITH BLUE SKY |
| LANDSCAPES | MARINE VIEWS | SNOW SCENES |
| BEACH SCENES | SUNSETS | MOUNTAINS |

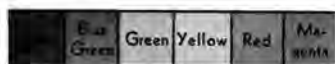
In addition, the K2 filter is valuable in much outdoor commercial work, such as architecture, and in the studio when a light rendering of red and yellow objects is required, but not so light a rendering as given by the G filter.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | | |
|-----------|--------------------------|--------------|--------|
| | ORTHOCHROMATIC | PANCHROMATIC | |
| | | Type B | Type C |
| Sunlight: | 2.5 | 2 | 2 |
| Tungsten: | 2 | 1.5 | 1.5 |

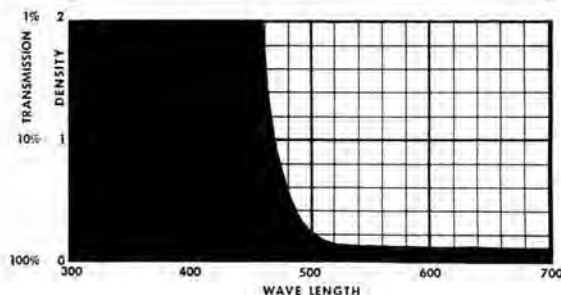
Color Rendering of brilliant printing inks in sunlight on Type B panchromatic film through K2 filter.



Spectrogram of Type B panchromatic film to tungsten light through K2 filter.



Absorption Curve of Wratten K2 Filter.



FILTER RECOMMENDATIONS FOR COMMERCIAL SUBJECTS

(Continued)

| <i>Subject</i> | <i>Effect Desired</i> | <i>Suggested Filters</i> |
|--|---|-------------------------------------|
| AUTOMOBILES: Dark colors | Lightening of tone to show shape and detail | Filter similar to color of car |
| Lettering on trucks, busses, etc. | Contrast to increase legibility | See page 15 |
| Reflections from lacquered surfaces | To subdue | Pola-Screen |
| COLORED CHINA, GLASS, PLASTICS, POTTERY, TILE, MOSAICS: | Natural rendering | K2 or X1, see p. 6 |
| | Contrast to show pattern or indicate color contrast | See page 15 |
| Reflections | To subdue | Pola-Screens at lens and lights |
| FABRICS, CLOTHING, TAPESTRIES, UPHOLSTERED FURNITURE: | Natural rendering | K2 or X1, see p. 6 |
| | Contrast to show pattern or indicate color contrast | See page 15 |
| Dark colors | Lightening of tone to show texture | Filter similar to color of material |
| FURNITURE: Red woods, as mahogany and rosewood | Best rendering of wood grain | A |
| Yellow woods and others, as maple, walnut, oak, etc. | Best rendering of wood grain | G with Commercial Ortho Film |
| Wood furniture with other colors, as in a room setting | Best grain with good rendering of other colors | K2 or G |
| LEATHER, LINOLEUM, WALLPAPER: | Natural rendering | K2 or X1, see p. 6 |
| | Contrast to show pattern or indicate color contrast | See page 15 |
| Colored leather with chromium | Lightening of leather so image of metal detail will print | Filter similar to color of leather |
| Reflections from linoleum | Subdue reflections which obscure pattern | Pola-Screen |
| PACKAGING: Colored boxes | To separate light reds from other colors | X1 or K2 |
| | To make lettering more readable, or to separate various colored parts of package design | See page 15 |
| | Penetration of colored acetate sheeting to show material or detail within | Filter similar to color of sheeting |
| | To subdue reflections from Kodapak or other clear sheeting | Pola-Screen |

FILTER FACTORS FOR KODAK FILMS AND PLATES

Color sensitivity of Kodak negative materials is indicated on next page.

[illegible]

CLASSIFICATION OF KODAK SENSITIVE MATERIALS

For Assignment of Filter Factors

Non-Color-Sensitized

FILMS: Commercial
Fine Grain Positive

PLATES: 33
33 Matte

Process
Lantern Slide (Medium, Contrast, Anti-Abrasion Contrast)

Orthochromatic

FILMS: Contrast Process Ortho
Commercial Ortho

Verichrome
Super Ortho-Press
Ortho-X

PLATES: 50
Metallographic
Super Ortho-Press

Panchromatic, Type B

FILMS: Super-XX
Plus-X
Panatomic-X
Portrait Panchromatic
Micro-File

Contrast Process Panchromatic
Super Panchro-Press, Type B
Cine-Kodak Super-X, 8mm
and 16mm
Super-XX, 16mm

PLATES: Process Panchromatic
Panatomic-X
Tri-X Panchromatic, Type B
Tri-X Panchromatic, Type B, Matte

M
Panchromatic
Panchromatic Matte

Panchromatic, Type C

FILMS: Tri-X Panchromatic

Cine-Kodak Panchromatic,
8mm

PLATES: Super Panchro-Press

COLOR RENDERING

Type B Panchromatic Film



COLOR REPRODUCTION OF ORIGINAL



WRATTEN G FILTER (No. 15)

◆ NO FILTER



WRATTEN XI FILTER (No. 11)

◆ NO FILTER

with VARIOUS FILTERS

Photoflood Illumination



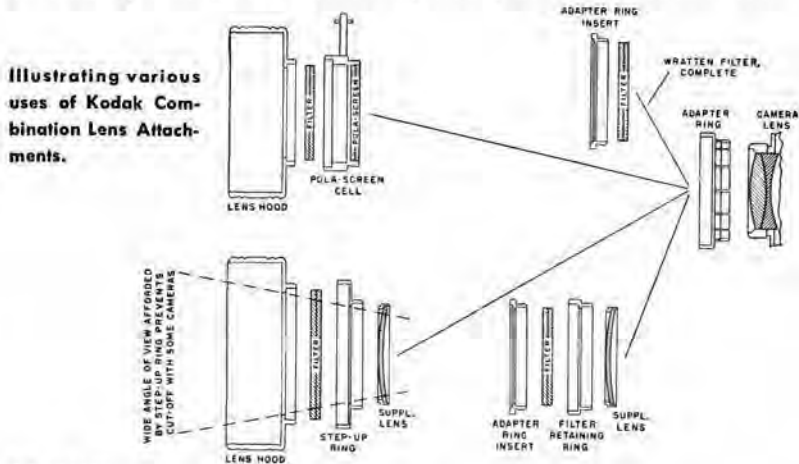
KODAK COMBINATION LENS ATTACHMENTS

KODAK Combination Lens Attachments cover a wide range of lens sizes, and facilitate the use, singly or in combination, of filters, supplementary lenses, diffusion disks, Pola-Screens, and Lens Hood—as listed on the following page. Because this system permits the interchange of several unmounted optical units, it offers maximum economy when more than one such accessory would be regularly used.

The Adapter Ring is slipped on over the lens mount, and serves as the basic attachment of the assembly. The Adapter Ring includes an Adapter Ring Insert which holds in position a filter, a supplementary lens, or a diffusion disk. If a Lens Hood is added to the assembly the Adapter Ring Insert is not used. A filter and a supplementary lens, or diffusion disk, can be used together by means of the Retaining Ring or Step-Up Ring. The Step-Up Ring also permits attachments in one size to be used with an Adapter Ring of smaller size. Filters in "B" glass, unmounted, are available in wide variety, as listed.

Kodak Portra Lenses are used for making portraits or photographs of small objects at short distances in order to secure larger images in sharp focus. The Portra lenses can be used according to tables supplied in the instruction sheets, or simply according to the image in the ground glass of cameras so equipped. *Kodak Telek Lenses* provide a telephoto effect, that is, larger images of distant subjects. The Telek lenses must be used with cameras having sufficient lens extension and a ground glass, so that focus can be set according to the ground glass image.

The *Kodak Pictorial Diffusion Disk* is used to secure a soft-focus effect in landscape photographs. The *Kodak Close-Up Diffusion Disk* combines the close-up ability of a Portra lens, above, with a soft-focus effect.



DATA ON KODAK COMBINATION LENS ATTACHMENTS

KODAK ADAPTER RING SIZES

| Series IV Filter Size 1 1/4 in. For Lenses 5/8 to 1 1/4 in. | | Series V Filter Size 1 1/8 in. For Lenses 3/4 to 1 1/8 in. | | Series VI Filter Size 1 3/8 in. For Lenses 1 1/4 to 1 3/4 in. | | Series VII Filter Size 2 in. For Lenses 1 1/2 to 2 in. | | Series VIII Filter Size 2 1/2 in. For Lenses 2 1/8 to 2 3/8 in. | | Series IX Filter Size 3 1/4 in. |
|---|------|--|------|---|------|--|------|---|------|---------------------------------------|
| in. | mm | in. | mm | in. | mm | in. | mm | in. | mm | Adapter Ring No. |
| 5/8 | 16.5 | 3/4 | 19 | 1 1/4 | 31.5 | 1 1/2 | 42.5 | 2 1/8 | 52 | No. 91* No. 92* |
| 1 1/4 | 18 | 1 1/8 | 20.5 | 1 3/8 | 33 | 1 3/4 | 44.5 | 2 1/2 | 54 | |
| No. 41* | | 1 1/4 | 22 | 1 3/8 | 35 | 1 1/2 | 46 | 2 1/8 | 55.5 | |
| No. 42* | | 1 1/4 | 24 | 1 1/2 | 35.5 | 1 3/4 | 47.5 | 2 1/4 | 57 | |
| | | 1 | 25.5 | 1 1/8 | 36.5 | 1 1/2 | 49 | 2 1/8 | 58.5 | |
| | | 1 1/8 | 26 | 1 1/4 | 37 | 2 | 50.5 | 2 3/8 | 60 | |
| | | 1 1/8 | 27 | 1 1/2 | 38 | | | 2 1/2 | 62 | |
| | | 1 3/8 | 28.5 | 1 3/8 | 39.5 | | | 2 1/2 | 63.5 | |
| | | 1 1/2 | 30 | 1 3/8 | 41 | | | 2 3/8 | 67 | |
| | | No. 18* | | 1 1/2 | 42 | | | | | |
| | | No. 19* | | No. 24* | | | | | | |
| | | No. 21* | | No. 25* | | | | | | |
| | | No. 22* | | No. 26* | | | | | | |
| | | | | No. 27* | | | | | | |
| | | | | No. 28* | | | | | | |

* (Screw-in)

Kodak and Kodak Wratten Filters in many varieties for black-and-white and color photography are carried in stock to fit all six series of Kodak Adapter Rings. Some varieties, however, are normally supplied only in certain specific sizes. Varieties and sizes not regularly carried in stock are available on special order.

Diffusion Disks

Series Available

Kodak Close-Up Diffusion Disk..... V, VI
Kodak Pictorial Diffusion Disk..... V, VII

Supplementary Lenses

Kodak Portra Lens 1+ (For close-ups)..... IV, V, VI, VII
Kodak Portra Lens 2+ (For close-ups)..... V, VI, VII
Kodak Portra Lens 3+ (For close-ups)..... V, VI
Kodak Telek Lenses 1-, 2-, 3-, 4- (For distant subjects)..... VI, VII

Kodak Lens Hood

..... IV, V, VI, VI-A, VII, VIII
(VI-A required for Kodak Bantam Special or Retina II Cameras)

Kodak Pola-Screen

..... IV, V, VI, VII, VIII, IX
Kodak Pola-Screen Viewer fits handle of Pola-Screen, all series.

Kodak Retaining Ring

..... IV, V, VI, VII, VIII
Permits two attachments to be used together. (e.g. supplementary lens and filter.) See illustration.

Kodak Step-Up Rings

..... IV-V, V-VI, VI-VII, VII-VIII
Permit attachments in one Series size to be used in combination with an Adapter Ring in the next smaller Series size. One set of attachments can thus be made to serve several cameras. The Step-Up Ring can also be used to prevent cut-off, which occurs with some lenses when two attachments are used simultaneously. See illustration.

Kodak Gelatin Filter Frame Holder—Series VI, accepts 2-inch Wratten Gelatin Filter Frame.
Series VIII, accepts 3-inch Wratten Gelatin Filter Frame.

Cine-Kodak Filters and Pola-Screens:

In addition to the Kodak Lens Attachments listed above, the CK-3, ND-2 and all Kodak Wratten Filters are supplied in the W, Z, and U11 mounts for Cine-Kodak Cameras. The Kodak Pola-Screen is supplied in the W mount.



24 FILTERS

Harkness Memorial Tower
Yale University, New Haven, Conn.
K-2 Filter and Pola-Screen, Plus-X

Data—KODAK WRATTEN K1 FILTER (No. 6)

Color: Very light yellow. Absorbs some of the ultraviolet and some blue-violet rays.

Negative Materials: All panchromatic and orthochromatic materials.

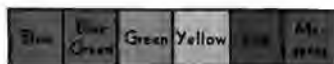
Uses: This filter affords partial correction. That is, it darkens a blue sky and shows up clouds, but not so much so as the K2 or the Kodak Cloud Filter. Red and yellow subjects, such as flowers, are rendered lighter than with no filter, but not so light as with the other two filters mentioned. The K1 filter is useful when some correction is desired, and short exposure is necessary.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | | |
|-----------|--------------------------|--------------|--------|
| | ORTHOCHROMATIC | PANCHROMATIC | |
| | | Type B | Type C |
| Sunlight: | 2 | 1.5 | 1.5 |
| Tungsten: | 1.5 | 1.5 | 1.5 |

Color Rendering of brilliant printing inks in sunlight on Type B panchromatic film through K1 filter.

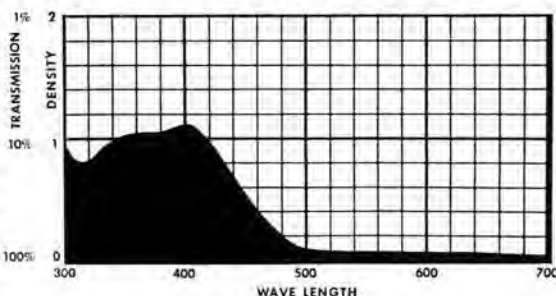


Spectrogram of Type B panchromatic film to tungsten light through K1 filter.



Absorption Curve of Wratten K1 Filter.

NOTE: The height of the absorption curve at a certain wave length indicates both transmission and density of the filter to light of that particular color. Transmission equals the ratio of transmitted to incident light, and is usually expressed as a per cent. Density is the common logarithm of $\frac{I}{\text{transmission}}$.



Data—KODAK WRATTEN K2 FILTER (No. 8)

Color: Yellow. Absorbs ultraviolet and some blue-violet rays. Affords complete correction in daylight with Type B panchromatic materials.

Negative Materials: All panchromatic and orthochromatic materials.

Uses: (1) Darkening a blue sky to obtain cloud effects; (2) photographing through distant haze; (3) photographing foliage and grass to render it lighter than without a filter; (4) photographing gardens; and (5) photographing any scenery (distant or close) where colors, especially greens, yellows, and reds, are predominant. Among the subjects to which these filters are particularly adaptable, the more important are:

| | | |
|---------------|-----------------|----------------------|
| DISTANT VIEWS | YACHTING SCENES | CLOUDS WITH BLUE SKY |
| LANDSCAPES | MARINE VIEWS | SNOW SCENES |
| BEACH SCENES | SUNSETS | MOUNTAINS |

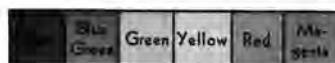
In addition, the K2 filter is valuable in much outdoor commercial work, such as architecture, and in the studio when a light rendering of red and yellow objects is required, but not so light a rendering as given by the G filter.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | | |
|-----------|--------------------------|--------------|--------|
| | ORTHOCHROMATIC | PANCHROMATIC | |
| | | Type B | Type C |
| Sunlight: | 2.5 | 2 | 2 |
| Tungsten: | 2 | 1.5 | 1.5 |

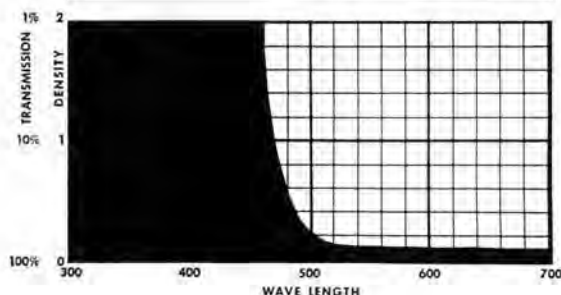
Color Rendering of brilliant printing inks in sunlight on Type B panchromatic film through K2 filter.



Spectrogram of Type B panchromatic film to tungsten light through K2 filter.



Absorption Curve of Wratten K2 Filter.



Data—KODAK WRATTEN K3 FILTER (No. 9)

Color: Deep yellow.

Negative Materials: All orthochromatic and panchromatic materials.

Uses: Produces a darker rendition of blues than K2 for sky effects. Used to photograph blue or purple type as black in photomechanical work.

Filter Factors:

Negative Materials

| | ORTHOCHROMATIC | PANCHROMATIC | |
|-----------|----------------|--------------|--------|
| | | Type B | Type C |
| Sunlight: | 2.5 | 2 | 2 |
| Tungsten: | 2 | 1.5 | 1.5 |

Spectrogram: Type B panchromatic film to tungsten light through the K3 filter.



Data—KODAK WRATTEN AERO 1 FILTER (No. 3)

Color: Light yellow. Absorbs ultraviolet, violet, and some blue.

Negative Materials: All panchromatic and orthochromatic materials.

Uses: Particularly for aerial photography to penetrate slight haze, or at low altitudes where very short exposure is required to overcome rapid motion of the plane relative to the ground. Used also by professional motion-picture photographers where light yellow filter is required.

Filter Factors:

Negative Materials

| | ORTHOCHROMATIC | PANCHROMATIC | |
|-----------|----------------|--------------|--------|
| | | Type B | Type C |
| Sunlight: | 2 | 1.5 | 1.5 |
| Tungsten: | 1.5 | .. | .. |

Spectrogram: Type B panchromatic film to tungsten light through Aero 1 filter.



Data—CINE-KODAK CK-3 FILTER

Color: Deep yellow. Absorbs ultraviolet, violet, and some of the blue rays.

Sensitive Materials: All Cine-Kodak black-and-white films and panchromatic negative films.

Uses: The CK-3 filter is intended primarily for use with Cine-Kodak and other amateur motion-picture cameras.

Sky and Other Outdoor Contrast Effects: The CK-3 filter renders a blue sky darker than normal to emphasize clouds or such foreground objects as buildings, people, trees, etc. In marine scenes, it darkens the water surface in proportion to the amount of blue light which the water reflects from the sky. Red and yellow subjects are rendered lighter, and blue subjects darker, than the eye sees them.

Haze Penetration: The CK-3 filter penetrates distant haze to a greater extent than the eye; therefore, it finds application in distant views, mountain scenery, etc.

Telephoto Lenses: Because of the effect of the CK-3 filter on haze, all distant scenes taken with Cine-Kodak lenses of long focal length are benefited by the use of this filter. Such pictures taken without filters tend to lack contrast.

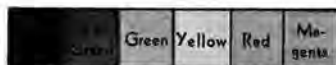
Moonlight Effects: When this filter is used with Cine-Kodak Super-X Film (8mm or 16mm), moonlight effects are secured at $f/16$, in back-lighted marine scenes in sunlight.

Available Forms: As glass filters only in slip-on and adjustable mounts as currently listed.

Filter Factors:

| | Panchromatic Material | |
|-----------|-----------------------|--------|
| | Type B | Type C |
| Sunlight: | 2 | 2 |
| Tungsten: | 1.5 | 1.5 |

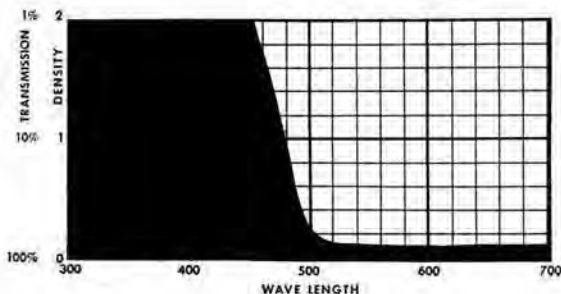
Color Rendering of brilliant printing inks in sunlight on panchromatic film through CK-3 filter.



Spectrogram of Type B panchromatic film to tungsten light through CK-3 filter.



Absorption Curve of CK-3 filter.



Data—KODAK WRATTEN X1 FILTER (No. 11)

Color: Light green. Absorbs ultraviolet, violet, some blue, and some deep red.

Negative Materials: To be used with Types B and C panchromatic materials.

Uses: The X1 filter is used with Type C panchromatic film to obtain correct monochromatic rendering of multicolored subjects, such as flowers, photographed in daylight. The X1 filter is also recommended in preference to a yellow filter for making outdoor portraits against a sky. The use of a yellow filter in this instance may result in a chalky rendering of flesh tones.

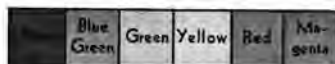
In addition, the X1 filter is the correction filter for Type B panchromatic materials in tungsten light. Where improvement in tone rendering is desired, the X1 filter should be tried before any of the contrast filters.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | |
|-----------|--------------------------|--------|
| | PANCHROMATIC | |
| | Type B | Type C |
| Sunlight: | 4 | 5 |
| Tungsten: | 3 | 4 |

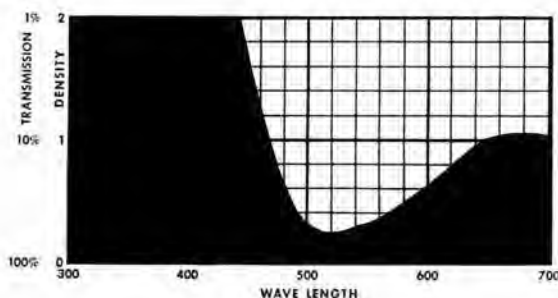
Color Rendering of brilliant printing inks under tungsten light on Type B panchromatic film through X1 filter.



Spectrogram of Type B panchromatic film to tungsten light through X1 filter.



Absorption Curve of Wratten X1 Filter.





(Photograph courtesy American Airlines, Inc.)

"NIAGARA FALLS FROM THE AIR"—From a Kodak panchromatic film negative exposed through a Wratten G Filter. The yellow filter helps penetrate the bluish atmospheric haze.

Data—KODAK WRATTEN X2 FILTER (No. 13)

Color: Green. Similar absorption to X1, but transmits less red.

Negative Materials: Type C panchromatic materials in tungsten light.

Uses: The X2 filter is used with Type C panchromatic materials under tungsten light to reproduce monochromatically the colors of the subject in the same relative values as the eye would see them by daylight. The X2 filter prevents lips, cheeks, flowers, and other reds from photographing too light.

Filter Factors:

| | | |
|-----------|--------------------------|--------|
| | <i>Negative Material</i> | |
| | PANCHROMATIC | |
| | Type B | Type C |
| Sunlight: | 5 | 6 |
| Tungsten: | 4 | 5 |

Spectrogram: Type C panchromatic film to tungsten light through the X2 filter.



Data—KODAK WRATTEN G FILTER (No. 15)

Color: Deep yellow. Absorbs ultraviolet, violet, and most of the blue rays.

Negative Materials: All panchromatic and orthochromatic materials.

Uses: *Sky and Other Outdoor Contrast Effects:* The Wratten G Filter renders a blue sky darker than is correct in order to emphasize the foreground subject—a building, for example. In a similar way, in marine scenes, the G filter darkens the water surface. The bluer the water appears, the more pronounced is the effect. Thus, subjects on the water may be rendered light in contrast to the water. Red and yellow subjects, such as flowers, are rendered lighter than the eye sees them. Blue subjects are rendered darker than the eye sees them.

Texture Rendering Outdoors: The G filter produces an enhanced rendering of texture in sunlit outdoor subjects photographed under a blue sky. The small shadows which reveal texture are illuminated by bluish light from a blue sky; such shadows are intensified by any filter which absorbs blue light. The G filter, therefore, enhances the texture in such subjects as architectural stone, sand, fabrics, and so on, when photographed in sunshine under a blue sky.

Haze Penetration: The G filter penetrates distant haze to a greater extent than the eye—a valuable property in distant mountain and aerial photography.

Telephoto Lenses: Because of the effect on haze, all distant scenes taken with telephoto or other long-focus lenses are improved by the G filter. Telephoto pictures taken without filters tend to lack contrast. With lenses longer than 10 inches in focal length, gelatin filters or A glass filters should be used.

Contrast Uses in the Studio: In the studio, the G filter has two general uses; producing contrast between the blue parts and the yellow, brown, orange, or red parts of a subject, and producing detail in any yellow, brown, or orange subject. Showing grain in yellow and brown wooden furniture is an example of this.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | ORTHOCROMATIC | Negative Material | |
|-----------|---------------|-------------------|--------|
| | | PANCHROMATIC | |
| | | Type B | Type C |
| Sunlight: | 5 | 3 | 2.5 |
| Tungsten: | 3 | 2 | 2 |

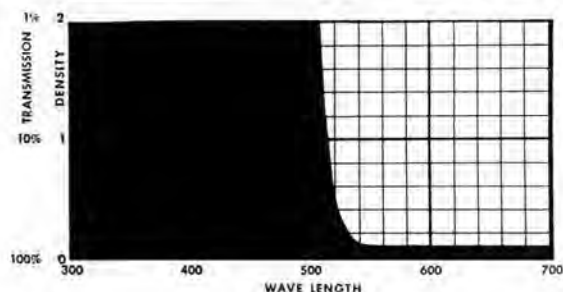
Color Rendering of brilliant printing inks under tungsten light on Type B panchromatic film through G filter:



Spectrogram of Type B panchromatic film to tungsten light through G filter.



Absorption Curve of Wratten G Filter.



Data—KODAK WRATTEN A FILTER (No. 25)

Color: Red. Absorbs ultraviolet, blue-violet, blue, and green rays.

Negative Materials: All panchromatic films and plates.

Uses: *Sky and Other Outdoor Contrast Effects:* The A filter's applications outdoors are similar to those of the G filter, but the effects are more pronounced. As compared with the G filter, the A filter renders red and yellow objects lighter, blue objects darker, and enhances the texture of outdoor subjects. The A filter renders blue skies dark which is helpful in producing spectacular photographs of buildings and so forth. The A filter likewise penetrates aerial haze; green foliage, however, will be darkened. Slight underexposure through an A filter produces moonlight effects. This filter renders sunsets spectacular, for the red and yellow parts are reproduced bright against blue sky and gray clouds.

Contrast Effects in the Studio: In the studio, the A filter is most useful in producing contrast—for example, in photographing a blueprint to show the lines light against a dark background. The A filter renders blue and green as dark; and yellow, orange, and red as very light. This filter is also valuable in producing detail in brown or red subjects, such as mahogany furniture.

Infrared Photography: The A filter is also normally used with Kodak Infrared-Sensitive Plates and Kodak Infrared Films. The exposure time for such materials is the same whether the G, the A, or the F filter is used.

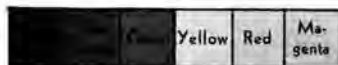
Color-Separation Negatives: The A is the red filter of the standard tricolor set.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | | |
|-----------|--------------------------|--------|
| | <i>Negative Material</i> | |
| | PANCHROMATIC | |
| | Type B | Type C |
| Sunlight: | 8 | 6 |
| Tungsten: | 4 | 3 |

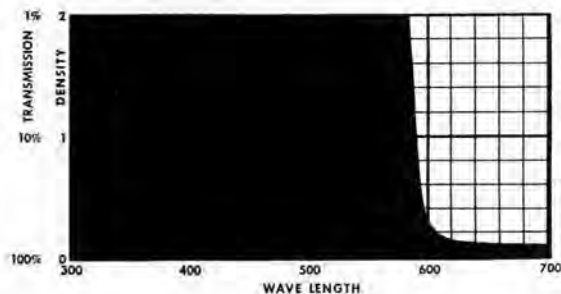
Color Rendering of brilliant printing inks under tungsten light for any panchromatic material through the Wratten A Filter.



Spectrogram of Type B panchromatic film to tungsten light through the Wratten A Filter.



Absorption Curve of Wratten A Filter.



Data—KODAK WRATTEN F FILTER (No. 29)

Color: Deep red. Absorbs ultraviolet, blue-violet, blue, green and yellow-green rays.

Negative Materials: All panchromatic films and plates.

Uses: *Contrast Uses in the Studio:* The F filter's higher filter factor more or less confines its use to studio application with panchromatic materials, preferably Type C materials. The differences in rendering between the A and F filters are most noticeable in the rendering of greens and blue-green. The F filter in general renders such colors darker. Light blue subjects, such as blue typewriting, are rendered very dark.

Since this filter is a deeper red than the A, the effects with the F filter are more pronounced than with the A filter.

Dark Sky Effects Outdoors: When exposure time permits, the F filter can be used when a light subject is photographed against a blue sky to produce a very dark background.

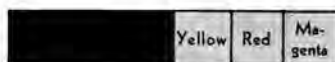
Special Separation Negatives: The F filter is useful along with the C4 (No. 49) and the N (No. 61) filters in making separation negatives from Kodachrome originals.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | |
|-----------|--------------------------|--------|
| | PANCHROMATIC | |
| | Type B | Type C |
| Sunlight: | 16 | 8 |
| Tungsten: | 8 | 4 |

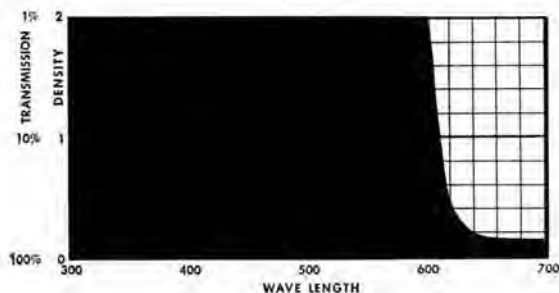
Color Rendering of brilliant printing inks under tungsten light on any panchromatic film through Wratten F Filter.



Spectrogram of Type B panchromatic film to tungsten light through the Wratten F Filter.



Absorption Curve of Wratten F Filter.



Data—KODAK WRATTEN B FILTER (No. 58)

Color: Green. Absorbs ultraviolet, violet, blue, and red.

Negative Materials: All panchromatic films and plates.

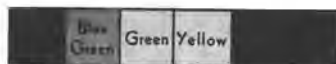
Uses: This is a contrast filter useful in rendering green subjects lighter than blue and red ones. Its use also results in good detail rendering in green subjects. Interesting photographs of trees against the sky can be made with the B filter. This filter is used with the A and the C5 filters in making separation negatives directly from original subjects.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | | |
|-----------|--------------------------|--------------|--------|
| | ORTHOCHROMATIC | PANCHROMATIC | |
| | | Type B | Type C |
| Sunlight: | 8 | 8 | 10 |
| Tungsten: | 5 | 8 | 10 |

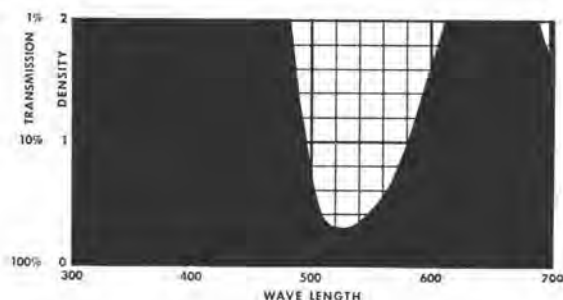
Color Rendering of brilliant printing inks under tungsten light with any panchromatic film through Wratten B Filter.



Spectrogram of Type B panchromatic film to tungsten light through Wratten B Filter.



Absorption Curve of Wratten B Filter.



Data—KODAK WRATTEN C5 FILTER (No. 47)

Color: Blue. Absorbs red, yellow, green, and ultraviolet.

Negative Materials: Orthochromatic and panchromatic.

Uses: This is primarily the blue filter for direct separation negatives, but it serves as a contrast filter when blue subjects are to be rendered as light as possible. Results with the C5 filter and panchromatic film are very similar to those obtained on non-color-sensitized film with no filter. In outdoor photography the C5 filter enhances aerial haze and thus adds "atmospheric quality" to pictorial landscapes.

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes.

Filter Factors:

| | <i>Negative Material</i> | | |
|-----------|--------------------------|--------------|--------|
| | ORTHOCHROMATIC | PANCHROMATIC | |
| | | Type B | Type C |
| Sunlight: | 3 | 5 | 5 |
| Tungsten: | 4 | 10 | 10 |

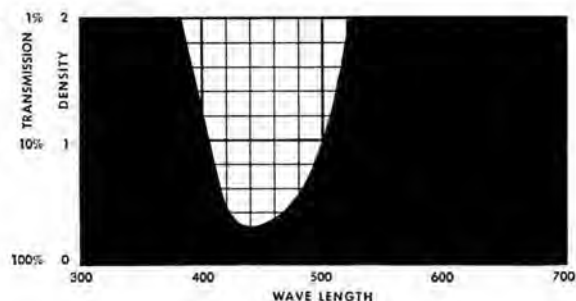
Color Rendering of brilliant printing inks under tungsten light on any panchromatic film through Wratten C5 Filter.



Spectrogram of Type B panchromatic film to tungsten light through Wratten C5 Filter.



Absorption Curve of Wratten C5 Filter.



Data—KODAK WRATTEN TRICOLOR FILTERS

(For Direct Color-Separation Negatives from Original Subject Matter)

| Filter | Number | Color |
|--------|----------------|-------|
| A | Wratten No. 25 | Red |
| B | Wratten No. 58 | Green |
| C5 | Wratten No. 47 | Blue |

Negative Materials: Kodak Super-XX Panchromatic Sheet Film, Kodak Separation Negative Plate, Type 1.

Uses: These filters comprise the standard set for making color-separation negatives of original subjects. For such negatives from Kodachrome or Ektachrome transparencies, narrower-cutting tricolor sets are recommended, see page 37.

Approximate Exposure Ratios: Based on 60 seconds' exposure through a Wratten A (No. 25) Filter. Determine the exposure for the red filter by trial. Multiply this exposure by the ratios for the green and blue filters given below:

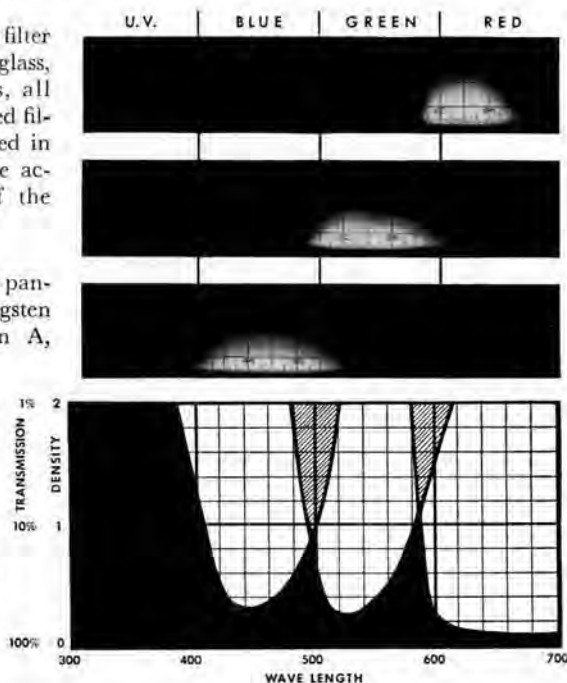
| | Filter | White Flame Arc (Anode in Lower Position) | Photo flood | High-Efficiency Tungsten |
|---|-------------|--|-------------|-----------------------------|
| | | | | |
| KODAK SUPER-XX PANCHROMATIC SHEET FILM | A (No. 25) | 1.0 | 1.0 | 1.0 |
| | B (No. 58) | 0.8 | 1.8 | 2.0 |
| | C5 (No. 47) | 0.3 | 1.1 | 2.0 |
| KODAK SEPARA- TION NEGATIVE PLATE, TYPE 1 | A (No. 25) | 1.0 | 1.0 | 1.0 |
| | B (No. 58) | 0.6 | 1.0 | 1.4 |
| | C5 (No. 47) | 0.4 | 1.5 | 2.7 |

Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes. Cemented filters should be purchased in matched sets to assure accurate registration of the three film images.

Spectrograms of Type B panchromatic film to tungsten light through Wratten A, B, and C5 Filters.

Absorption Curves of Wratten A, B, and C5 Filters.

The shaded areas indicate the overlap in transmissions of the various filters.



Data—KODAK WRATTEN TRICOLOR FILTERS

(For Color-Separation Negatives from Kodachrome and Ektachrome Transparencies)

| <i>Filters for Kodachrome and Ektachrome</i> | <i>Color</i> |
|--|--------------|
| Wratten No. 29 (F) | Red |
| Wratten No. 61 (N) | Green |
| Wratten No. 49 (C4) + No. 2B | Blue |

Negative Materials: Kodak Super-XX Panchromatic Sheet Film, Kodak Separation Negative Plate, Type 1.

Uses: Matched sets of narrow-cutting filters for making color-separation negatives from Kodachrome or Ektachrome transparencies.

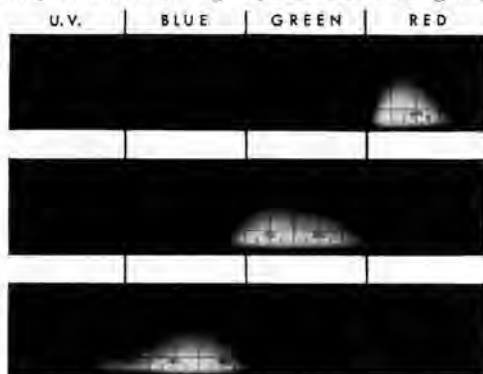
Approximate Exposure Ratios:* Based on 60 seconds' exposure through a Wratten No. 29 (F) Filter. Determine the exposure for the red filter by trial. Multiply this exposure by the ratios for the green and blue filters given below:

*Bare lamps, no optical system. Condensers may, and heat-absorbing glass will change ratios.

| | <i>Filters for Kodachrome and Ektachrome</i> | <i>High-Efficiency Tungsten</i> |
|---|--|---------------------------------|
| KODAK SUPER-XX PANCHROMATIC SHEET FILM | No. 29 (F) | 1.0 |
| | No. 61 (N) | 1.0 |
| | No. 49 (C4) + No. 2B | 3.4 |
| KODAK SEPARATION NEGATIVE PLATE, TYPE 1 | No. 29 (F) | 1.0 |
| | No. 61 (N) | 0.7 |
| | No. 49 (C4) + No. 2B | 5.2 |

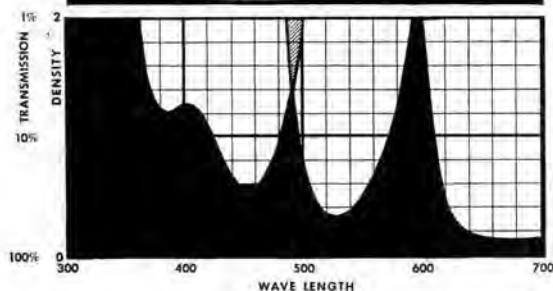
Available Forms: Gelatin filter film, cemented in B glass, cemented in A glass, all common sizes. Gelatin recommended for separation negatives by projection. Cemented filters should be purchased in matched sets to assure accurate registration of the three images.

Spectrograms of Type B panchromatic film to tungsten light through Wratten Filters No. 29 (F), No. 61 (N), and No. 49 (C4).



Absorption Curves of Wratten Filters No. 29 (F), No. 61 (N), and No. 49 (C4).

The shaded areas indicate the overlap in transmissions of the various filters.



KODAK POLA-SCREENS

KODAK Pola-Screens offer a means of subduing undesirable reflections from nonmetallic surfaces. The Pola-Screen is rotated until the desired effect is observed, then placed over the camera lens. A Pola-Screen Viewer permits this adjustment to be made with the Pola-Screen on the lens.

Information on controlling sky brightness with Kodak Pola-Screens is given on page 9.

How the Pola-Screen Works

Ordinary unpolarized light vibrates in all planes perpendicular to the direction of its propagation; polarized light, in only one plane, as shown in Figure 8. The Pola-Screen is in effect an optical slit which transmits only light vibrating in the plane of that slit. The intensity of light already polarized can be controlled by rotation of a Pola-Screen in its path. The beam is entirely cut off when its vibration plane and that of the Pola-Screen are "crossed," and wholly transmitted when these vibration planes are parallel.

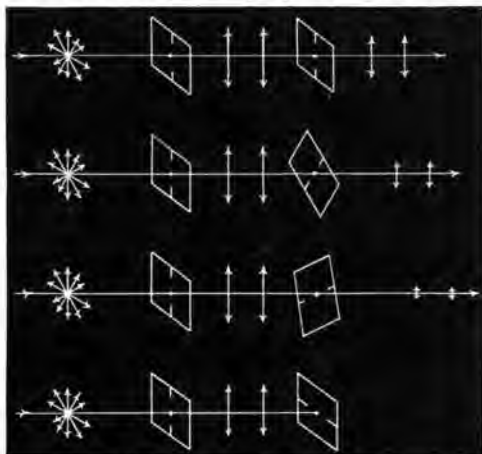


Figure 8—Effect of rotation of one Pola-Screen relative to another. The amount of light let through by the second Pola-Screen is cut down as the Pola-Screen is turned. When the vibration plane of the second Pola-Screen is at right angles to the first, practically no light gets through.

There are two common sources of polarized light in nature. (1) Light reflected at approximately 35° from nonmetallic surfaces, such as wood, glass, water, or paint, is polarized. The effect is less at other angles and disappears entirely at 0° and 90° . (2) Light from a clear, blue sky at right angles to the sun is strongly polarized; at other angles polarization is not complete and vanishes at 0° and 180° from the sun.

Exposure Increase

When photographing at right angles to the sun's rays to darken a blue sky, the specular reflections from the subject are partially polarized.



Taken at 1/50 second at $f/5.6$ without a Pola-Screen.



Taken through Kodak Pola-Screen with Indicator Handle toward the sun, 1/50, $f/4$.

These two photographs taken on Kodachrome Film show the effect of the Kodak Pola-Screen in darkening a blue sky at right angles to the sun and in subduing reflections from nonmetallic surfaces. The subduing of specular reflections from colored objects results in greater purity of color.

The light from these reflections is therefore decreased by the Pola-Screen, and the subject as a whole is rendered darker unless compensation is made in exposure. The change needed for a glossy subject is larger than for a matte-surfaced one. In general, the increase for a subject of average gloss (a landscape, for example) is about four times, or two lens stops.

Copying and Reflection Control with Pola-Screens at Lens and Lights

Complete control of reflections can be obtained in the studio by using Kodak Pola-Lights for illumination and a Kodak Pola-Screen over the camera lens. Since the subject is illuminated by polarized light, the light reflected specularly from any surface is also polarized, and reflections can be controlled by rotating the Pola-Screen in front of the camera lens. By this means, reflections from any type of surface not necessarily oblique to the camera axis can be subdued to almost any degree.

Data—KODAK POLA-SCREENS

Colors: Neutral gray. Transmits plane polarized light of all visible colors. Absorbs ultraviolet rays.

Sensitive Materials: Can be used with all sensitive materials, including Kodachrome, Ektachrome and Kodacolor Films.

Uses: *Darkening the Sky in Black-and-White Photography.*

A blue sky can be darkened to about the same extent as with an "A" filter without distorting the color rendering of the foreground.

Dark Blue Sky Effects in Color Photography.

Pola-Screens offer the only known means of sky brightness control in color photography.

Photographing through Glass or Water.

When the camera axis is about 35° to the surface, the Pola-Screen can subdue reflections from glass or water to show detail beyond or below.

Subduing Oblique Reflections to Show Texture.

Reflections from lights or light backgrounds can be subdued to show texture in non-metallic surfaces where the angle of reflection is about 35° to the surface. Reflection control on metal surfaces requires Pola-Screens at the lights as well as the lens.

Reflection Control in Copying.

The Pola-Screen at the lens alone has no application to copying. However, Pola-Screens can be placed over both the lens and the lights to achieve complete control over reflections from rough, matte, or damaged prints, from paintings, murals, and billboards, and from any objects having troublesome reflections. A specially designed Kodak Baffle with Pola-Screen is supplied for use over lights.

Exposure Increase: Since the camera must point at right angles to the direct rays of the sun for the darkest sky effects, the subject will be lighted from the side or overhead, depending on the hour of the day. This affects the exposure required. For an average subject photographed through the Pola-Screen on Kodachrome Film, Daylight Type, a typical exposure for still cameras is 1/25 second at *f*/4.5; for motion picture cameras at normal speed, *f*/3.5. For Kodacolor Film, a typical exposure is 1/50 second at *f*/5.6. When photographing through glass or water, additional increase may be necessary, depending on the amount of useful light reflected from the subject after surface reflections have been reduced by the Pola-Screen.

Types of Pola-Screens: Kodak Pola-Screens in all series for Kodak Combination Lens Attachments and in W mounts for Cine-Kodak *f*/1.9, 1-inch lenses. Kodak Pola-Screens are suitable for use with both black-and-white and color film.

Kodak Pola-Screens in metal cells 2½, 3½, and 4½ inches in diameter for use (with the Kodak Pola-Screen Holder of appropriate size) with lenses ranging from 1¼ to 5⅝ inches in diameter. The Pola-Screens currently supplied in these sizes can be used for either black-and-white or color photography.

Kodak Baffles with Pola-Screens are specially designed for use over lights. Complete Kodak Pola-Lights with Stands are also supplied. They can be used for black-and-white photography or color photography. With Kodachrome Film, Type A or Type B; or Kodak Ektachrome Film, Type B; and the recommended light sources it will be necessary to use one or more Kodak Color Compensating Filters along with the Pola-Screen at the camera lens. The CC-30B Filter is recommended for a trial exposure. The resulting transparency can then be judged to determine if further color correction is needed.

Kodak Pola-Screen Viewer: The Kodak Pola-Screen Viewer is a miniature Pola-Screen mounted to slip onto the handle of Pola-Screens in all Series sizes. In this position, its plane of polarization is parallel to that of the Pola-Screen. By examining the scene through the viewer, the degree of polarization can be judged visually without removing the Pola-Screen from the camera lens.

The Kodak Combination Filter Case affords protection against dirt and breakage, and keeps filters handy for immediate use. Available in Series V and Series VI Sizes.



All Kodak lens accessories are described in detail in *Kodak Filters and Lens Attachments*, a booklet on sale at Kodak dealers.

To clean filters, brush gently to remove gritty particles; then wipe them with Kodak Lens Cleaning Paper, dampened slightly with Kodak Lens Cleaner if necessary.



SELECTED KODAK PUBLICATIONS

On Sale at Kodak Dealers

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

Kodak Lenses, Shutters, and Porta Lenses. A Data Book to read for better understanding of lenses and shutters. Optical formulas, graphs, and Data Sheets make it a valuable reference book.

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

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

Kodachrome Films for Miniature and Movie Cameras. A Data Book on still photography and home movies in color. Discusses lighting, exposure, and many special subjects. Illustrated in color.

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

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

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

Kodak Photographic Notebook. A loose-leaf, metal-ring binder containing five separators, a quantity of notebook paper, and an introduction with suggestions on how to make the notebook into a valuable supplement to the *Kodak Reference Handbook*.

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

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

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

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