KODAK
DATA BOOK

7th Edition

50¢

KODAK FILMS

FOR BLACK-AND-WHITE PHOTOGRAPHY

SEVENTH EDITION

KODAK FILMS

FIRST 1958 PRINTING

Kodak Films

This Seventh Edition of the Data Book on Kodak Films presents data sheets on the new Kodak roll films, Kodak film packs, and Kodak Royal Ortho Sheet Film. All of the other data sheets have been brought fully up-to-date. In addition, a new section on Definition explains the relationships between graininess, sharpness, and resolving power. It provides owners of the Kodak Reference Handbook with a replacement unit for any earlier edition of the Films section.

Kodak Films is one of a whole series of Data Books published by Kodak on black-and-white and color photography. Data Books are available at both the beginner and advanced levels. The scope embraces information on photographic techniques, processes, and materials in the amateur, professional, industrial, scientific, and graphic arts fields. Each Data Book is a self-contained unit, punched for Mult-O-Ring binding.

The Kodak Handbooks

There are five main reference books on Kodak products, processes, and techniques. Each of these handbooks consists of an attractive, metal-ring, stiff covered binder containing the basic Data Books relating to one particular field, tabbed separators for indexing, space for additional Data Books and free Kodak literature, and a registration card. Filling out and returning the cards contained in the *Kodak Reference Handbook*, the *Kodak Color Handbook* and the *Kodak Photographic Notebook* entitles you to receive a printed newsletter (illustrated), published several times a year. This free publication besides describing the latest Kodak techniques, materials, and processes, also announces new and revised publications as they become available at your Kodak dealers, so that you can keep your handbook up-to-date.

Other handbooks published by Kodak are: the *Kodak Professional Handbook*, the *Kodak Industrial Handbook*, and the *Kodak Graphic Arts Handbook*.

A NEW KODAK FILM

For data on Kodak Royal-X Pan Sheet and Roll Film, see the back of this page and the insert following page 68.

KODAK ROYAL-X PAN SHEET FILM

Code Notch

KODAK ROYAL-X PAN ROLL FILM

An extremely fast, panchromatic film of coarse grain, recommended for night sports-action photographs by existing illumination, action photographs when light is very poor, interiors of buildings where shortest possible exposures are needed, and any other situation where the highest emulsion speed is essential.

Darkroom Handling: Total darkness required.

Camera Loading: *Because of the extreme speed of this film, never load or unload a roll film camera in bright light.*

Exposure

Because of the special nature of the intended applications of this film, the usual general recommendations for exposure and development are not adequate. To make use of the maximum potential of this film, the exposure and development must be fitted to the subject type and lighting conditions. The following recommendations will serve as a guide.

Suggested Exposure Settings:

Lighting Conditions	Average Subject Normal Development*	Flat Subject Extended Development*
Existing Light		
Building interiors—courtrooms 4 to 8 foot-candles incident	1/25 —*f*/3.5	1/25 —*f*/4.5
Sports arenas 16 to 64 foot-candles incident	1/100—*f*/4.5	1/200—*f*/4.5
Work areas—store interiors 32 to 125 foot-candles incident	1/100—*f*/5.6	1/100—*f*/8
Heavy overcast daylight 125 to 500 foot-candles incident	1/100—*f*/16	1/100—*f*/22
Bright sunlight 5,000 to 10,000 foot-candles incident	1/400—*f*/32	—
Flash Photography		
Flash lamps at 1/400 synchronization No. 5 or 25 No. 22 or 2	*f*/4.5—100 feet *f*/8 —125 feet	*f*/5.6—125 feet *f*/11 —125 feet
Electronic Speed Lamps Small portable (500-1500 ECPS) Large portable (2000-6000 ECPS)	*f*/6.3— 50 feet *f*/6.3—100 feet	*f*/6.3— 75 feet *f*/8 —125 feet

*See development recommendations.

Exposure Meter Use: An index of 1600 should be used with most exposure meters for most applications of this film. This index makes the best possible use of the film's speed, graininess, and definition characteristics. It leads to the minimum exposures which, with the recommended normal development, yield good quality negatives for subjects of average brightness scale. For very flatly lighted subjects, good negatives can often be obtained at two or three times this index value, using extended development.

The American Standard Exposure Index is 650. This value is comparable to the daylight indexes published for other Kodak films and includes a safety factor which sets the exposure level substantially above the minimum required.

(Continued after page 68)

KODAK FILMS

FOR BLACK-AND-WHITE PHOTOGRAPHY

SEVENTH EDITION, 1956
First 1958 Printing

With its high speed and wide exposure latitude, Kodak Verichrome Pan Film is the first choice for natural-looking pictures on cloudy days as well as in sunny weather.

KODAK FILMS

FOR BLACK-AND-WHITE PHOTOGRAPHY

• This information has been prepared for the convenience of the photographic craftsman who desires more than a superficial knowledge of negative materials. Specific recommendations are included which will aid the worker in obtaining consistently finer results with Kodak Film.

Serious workers are today applying their originality and technical abilities to numerous fields of photography. For this reason, a knowledge of the many materials available as well as their suitability for each purpose is invaluable if the results are to meet today's high standards of photographic quality.

The high quality of Kodak-made photographic materials is the result of extensive research coupled with the technical experience of the manufacturing departments of the Eastman Kodak Company. The Kodak Research Laboratories are the foremost organization of the kind in the world, and the experience of the manufacturing divisions in making films and plates for over 50 years is unsurpassed. The meticulous care and laboratory control exercised in manufacture assure the user of maximum dependability in all Kodak sensitized products.

Negative materials differ widely because they are designed for various specific purposes. Their differences may be broadly classed under two heads: photographic and physical. The term "photographic" is used here to refer to such properties as gradient, color sensitivity, and speed, while "physical" refers to the type of base, antihalation feature, and so on. An understanding of these factors is of considerable aid in selecting the negative material most suitable for any purpose.

Data Sheets are given for a number of the more popular films. These contain descriptions of the photographic and physical characteristics, exposure and development recommendations, and complete working instructions. Information on the infrared films and their use is given in the Kodak Data Book on Infrared and Ultraviolet Photography.

Photographic Properties

Many emulsion properties, such as speed, exposure latitude, and development rate, are best analyzed by means of numerical measurements. The science of such analysis is known as sensitometry. The abbreviated discussion presented here is to be considered as background material only. The serious photographer should pursue the subject further in a technical treatise, such as *Fundamentals of Photographic Theory*, by James and Higgins.

CHARACTERISTIC CURVE

• The way a photographic material responds to exposure and development is most usefully described by a characteristic curve such as appears on the opposite page. To obtain such a curve the material is given a series of carefully controlled exposures. In this series each exposure step differs from the preceding step by a constant factor such as 2 or the square root of 2 (1.41). After such a step exposure, development under standardized conditions produces a gray scale with a series of steps differing in density or blackness. The light-stopping power, or density, of each of these steps is then measured on a densitometer.

In its simplest terms, this is an instrument in which a beam of light is passed through a small area of a gray scale or negative in such a way as to measure the fraction or the percentage of light that is transmitted through the image. However, the transmission decreases as the image blackness increases. It is usually more convenient and descriptive to use the opacity, which is the inverse of the transmission (1/T) and which, therefore, describes the image blackening directly. The logarithm of the opacity is defined as density and densitometers are usually calibrated to read directly in density units.

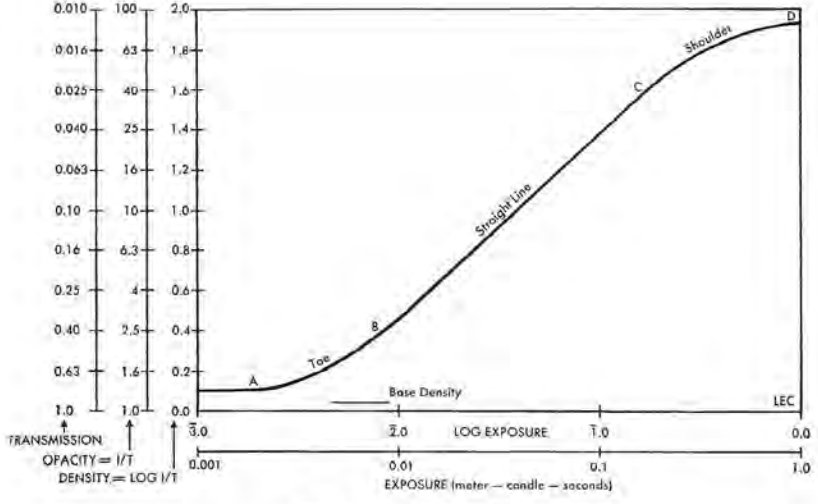
The amount of exposure that was given to each step is known in terms of the light intensity multiplied by the length of time during which it is allowed to act on the material. This, plus the measured density of each step, provides the data needed for plotting the characteristic curve. In the figure on the opposite page and in the curves given on the film data sheets the exposure is expressed in meter-candle-seconds. For a number of reasons which are beyond the scope of this discussion, density (logarithm of opacity) is plotted against the logarithm of exposure rather than the arithmetic values of expo-

sure and transmission or opacity. In order to demonstrate the relationship, both the arithmetic and logarithmic scales are shown in the figure below. It should be understood that the term exposure, as used in sensitometry, refers to the amount of radiant energy, or light, which has acted on the small area concerned. For a negative of a typical scene it will vary widely over the different parts of the image. It should not be confused with the camera exposure controls, such as the lens aperture and shutter speed settings.

The characteristic curve is often called the H & D curve, because this method of plotting was first employed by Hurter and Driffield. Such curves, representing the average product when exposed and processed under average practical conditions, are given in the Film Data Sheets. They are sufficiently accurate for all ordinary photographic work, but for special problems curves for the material to be used should be determined under the actual conditions which will be encountered.

The slope or gradient at any part of the curve indicates how rapidly the density will change with changes in exposure. Because of its general shape the characteristic curve may be divided into three distinct regions, as follows:

Toe. For exposure less than that at A, no image density results on



The Characteristic Curve

development. For greater exposures (to the right of A) the image has a measurable density and exposure differences reproduce as density differences. From A to B (the toe region) the slope or gradient increases with increasing exposure. This portion of the curve is widely used in making negatives.

Straight-Line. The portion of the curve from B to C is the range wherein the gradient is constant and the density increases as a direct or linear function of the logarithm of exposure. Thus, in this range, if the exposures for all the image areas are doubled, as by doubling the exposure time, the densities of all the areas will be increased equally, and there will be no change in the density separations between the various image areas. In addition to the toe region, the straight-line region is frequently used in making negatives.

Shoulder. Above C, in the region of overexposure, the gradient of the curve decreases for further increases in exposure. Eventually the curve becomes horizontal, with exposure differences no longer recording as density differences. Negatives recorded on the shoulder show a loss in separation of highlight tones, which is characteristic of extreme overexposure.

Gamma. The maximum gradient on the characteristic curve occurs over the straight-line region. Its numerical value, which is the tangent of the angle that the straight-line portion makes with the horizontal, is designated by the Greek letter *gamma* (γ).

Gamma provides a convenient measure of the degree of development. It can be plotted against the development time, for specified conditions of agitation and temperature, and the resulting time-gamma curve can be used to determine the developing time to produce a desired degree of development with the particular film and developer combination.

Latitude. The range of brightness values which can be reproduced by the film is indicated by the log exposure interval between a point fairly low on the toe of the curve and another point located on the shoulder. This provides a measure of the useful exposure scale of the material. With practically all modern continuous-tone negative materials the useful exposure scale is much greater than the brightness scale of ordinary subjects. Thus, there is considerable latitude in the choice of settings for shutter speed and lens opening. Actually, with most modern continuous-tone negative materials the upper limit of useful exposure is set by factors such as increased graininess, loss of definition, and difficulty of printing, long before the upper end of the exposure scale is reached.

Naturalness is the outstanding characteristic of pictures made with existing light. With Kodak Tri-X Film, pictures can be taken under lighting conditions which previously made good pictures impossible.

DENSITY SCALE OF THE NEGATIVE

• The printing characteristics of a negative depend on its general density level and its density scale.

The density level determines, to a considerable extent, the exposure required with any particular printing paper. It is determined largely by the camera exposure and the degree of development given the negative.

The density scale, which is the difference between the highest and lowest densities in the negative image, largely determines which paper printing grade will produce the most satisfactory print. It is often referred to as the "contrast" of the negative. The relations between the negative density scale, the print exposing conditions, and the choice of paper printing grade are discussed in the Data Book on Kodak Papers.

The density scale of the negative is determined primarily by the combined effects of the brightness scale of the image in the camera, the exposure level, and the degree of development. The brightness scale of the camera image is dependent on the brightness scale of the subject, as modified by flare light in the camera.

Subject Brightness Scale. The brightness scale of the subject depends on the reflecting power of the various parts of the scene and also on differences in illumination over the scene.

For example, on a dull day an open landscape has a low brightness scale, since differences in reflecting power of its various parts are chiefly responsible for its brightness differences. On the other hand, a sunlit path in the woods has a high brightness scale, since in addition to differences in reflecting power, there are also wide differences in illumination on various parts of the scene.

Continuous-tone negative materials can record a much greater scale of brightness than printing paper can reproduce accurately. Whenever possible, the brightness scale of the subject should be controlled so that it does not greatly exceed the density scale of the paper.

Flare Light. The brightness scale of the image formed by the camera's lens is always appreciably less than the subject brightness scale, because of the effect of flare light. Flare light is produced by reflection or scatter of light at the glass-air surfaces of the lens system, and by reflections within the lens mounting and camera interior. This flare light contributes a certain amount of general non-imaged light over the entire negative. In the highlight areas it adds only a small percentage to the image illumination, while in the shadow areas it may double or triple the amount of light reaching the film. The de-

gree of this effect depends on the distribution of high brightness areas in and around the subject, as well as on the construction of the camera and lens. Kodak Lumenized lenses have an anti-reflection coating on all glass-air surfaces. This reduces flare light and increases negative density scale.

Camera Exposure. Either underexposure or extreme overexposure in the camera will result in lowered density scale because the majority of the image tones will be placed on the low gradient toe or shoulder regions of the characteristic curve. Underexposed negatives have low average density; overexposed negatives have high average density.

Degree of Development. The degree of development given the negative is probably the most important factor affecting the density scale. The degree of development depends on the developing rate for the film and developer combination used, and on the time, temperature, and other conditions of development.

The developing rate for standard processing conditions depends on the activity of the developer solution and the inherent contrast characteristics, or gradient capacity, of the negative material. It can be found from the time-gamma curves which are given for the recommended developers in the data sheets for the various films. Approximate data for the developing rates of a large number of combinations of various Kodak films and developers is given in the Kodak Developing Dataguide.

With most film-developer combinations, the degree of development can be varied over a considerable range by proper selection of the developing time. For any particular film and developer, control of the developing time is the most satisfactory method of controlling the negative density scale.

The development times shown in the film Data Sheets will usually produce a degree of development suitable for the types of work for which each film is most generally used. Longer or shorter times can be used if experience indicates that an increase or decrease in the density scale is desirable for the particular working conditions.

For any one film-developer combination, the rate of development, and thus the time required to produce any particular degree of development depends very strongly on the developer temperature. The changes in time required to compensate for changes in developer temperature are shown by the time-temperature charts in the Data Sheets.

Development for Electronic Flash Tube Exposure. With most films the extremely short exposures given by high voltage studio-type elec-

tronic flash tubes cause the toe region of the characteristic curve to be extended considerably. Such negatives are likely to have rather low density scale unless they have received very full exposures. This effect can be offset to a large extent by increasing the development about 50 percent beyond the time normally used for exposures by other light sources. No change in developing time is necessary when the modern, portable, low voltage, electronic flash units are used.

Color of the Negative Image. A brownish image, given by many fine-grain developers, such as Kodak Microdol Developer and Kodak Developer DK-20, strongly absorbs the blue-violet light to which printing papers are most sensitive. As a result, the printing gradient is slightly higher than is indicated by the time-gamma curves shown in the Data Sheets, since they are based on visual measurements of density.

COLOR SENSITIVITY

• The color sensitivity of an emulsion defines the degree of its photographic response to light of various wavelengths or colors. While the average normal eye is sensitive to all these colors, the same is not necessarily true of photographic films. In fact, plain silver bromide, the fundamental sensitive element in all negative emulsions, is sensitive only to blue and ultraviolet. Incorporated in modern orthochromatic, panchromatic, and infrared emulsions, however, are sensitizing dyes, which render the film sensitive to certain other colors of light. The type of sensitizing is one of a film's most important photographic characteristics because it so profoundly affects both the handling of the material and the results obtained.

It is the color sensitivity of a negative material which determines the following:

Monochromatic Rendition of Colored Subjects. Any material which is not sensitized to green or red light will render these colors too dark, while a panchromatic material having somewhat the same sensitivity to all colors as the human eye will record colors in approximately the same relative brightness as they appear to the eye. By the use of the proper correction filter, a very close approximation to visual brightness rendering can be obtained.

The Relation of Speed in Tungsten Light to That in Daylight. Every negative material has a higher speed in daylight than in tungsten light because tungsten light contains a lower percentage of the blue-violet light to which all films are *most* sensitive.

This speed difference is less, however, in the case of films having

high sensitivity to the green, yellow, orange, and red regions of the spectrum than it is with films having their principal sensitivity in the violet, blue, and green regions. The reason for this is that the former type of emulsion (panchromatic) is able to utilize the red, orange, and yellow which form a large proportion of tungsten light.

Filters Usable and Their Factors. The filters which can be used depend on the color sensitivity of the film. Obviously, a red filter can be used only with a material sensitive to red light. Furthermore, the filter factor, or exposure increase required, also depends on the color sensitivity of the material. For example, a negative material with a large portion of its sensitivity in the blue-violet requires a much greater relative exposure through a yellow filter which eliminates most of the blue light, than a panchromatic material which, being sensitive to all colors, is able to utilize the red and green transmitted by the filter.

Safelight Color or Transmission. It is the function of a safelight to transmit the color of visible light to which the film is least sensitive. For example, a negative material, such as Kodak Royal Ortho Film, which is sensitive only to blue-violet, blue, and green, may be handled without danger of fogging by a safelight transmitting only deep red. In the case of materials which are sensitive to all colors, the safelight must transmit in the region to which the eye has its maximum sensitivity in order that a minimum amount of light may be used. Hence, panchromatic materials may be handled only under a dark green safelight—and even under that light for only a brief period.

WEDGE SPECTROGRAMS

• The color sensitivity of a negative material is usually shown by wedge spectrograms, such as those on the following page. The numbers beneath the horizontal axis represent the color of light or the wavelengths in millimicrons (mμ or millionths of a millimeter). These spectrograms are positive prints from films which have been exposed to a light spectrum through a neutral density wedge. This wedge is opaque at the top, decreasing in density or opacity until it is transparent at the bottom. As the transmitted light diminishes toward the top, the height of the film image at any point is an indication of the film's response to that particular wavelength. Due to the absorption of much of the ultraviolet by the lens system of the spectrograph, the indicated ultraviolet sensitivity of all films, as shown by the wedge spectrograms, is lower than the true value. The spectrograms show relative color sensitivity only, and give no indication of film speed.

SENSITIZING CLASSES AND TYPES

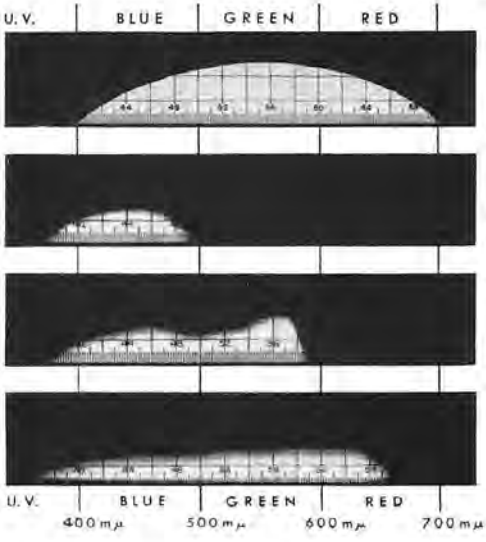
• Kodak negative materials are divided into several sensitizing classes. The negative materials of any one group are sufficiently alike in color sensitivity so that for general use the same filter factors can be used. For more critical work, however, filter factors have been determined for each film-filter-light source combination (see Data Sheets). Aside from certain special sensitizings there are three general classes as follows:

Non-Color-Sensitized or "Ordinary" materials possess only the ultraviolet and blue-violet sensitivity inherent in any silver halide.

Orthochromatic materials possess sensitivity to green, in addition to the ultraviolet and blue-violet.

Panchromatic materials are sensitive to all visible colors, including red, as well as to the invisible ultraviolet radiation.

Panchromatic materials differ somewhat with respect to their relative sensitivities to blue, green, and red light. When a distinction is made between them, those which have relatively high green sensitivity have been referred to as Type B, and those which have relatively high red sensitivity have been called Type C.



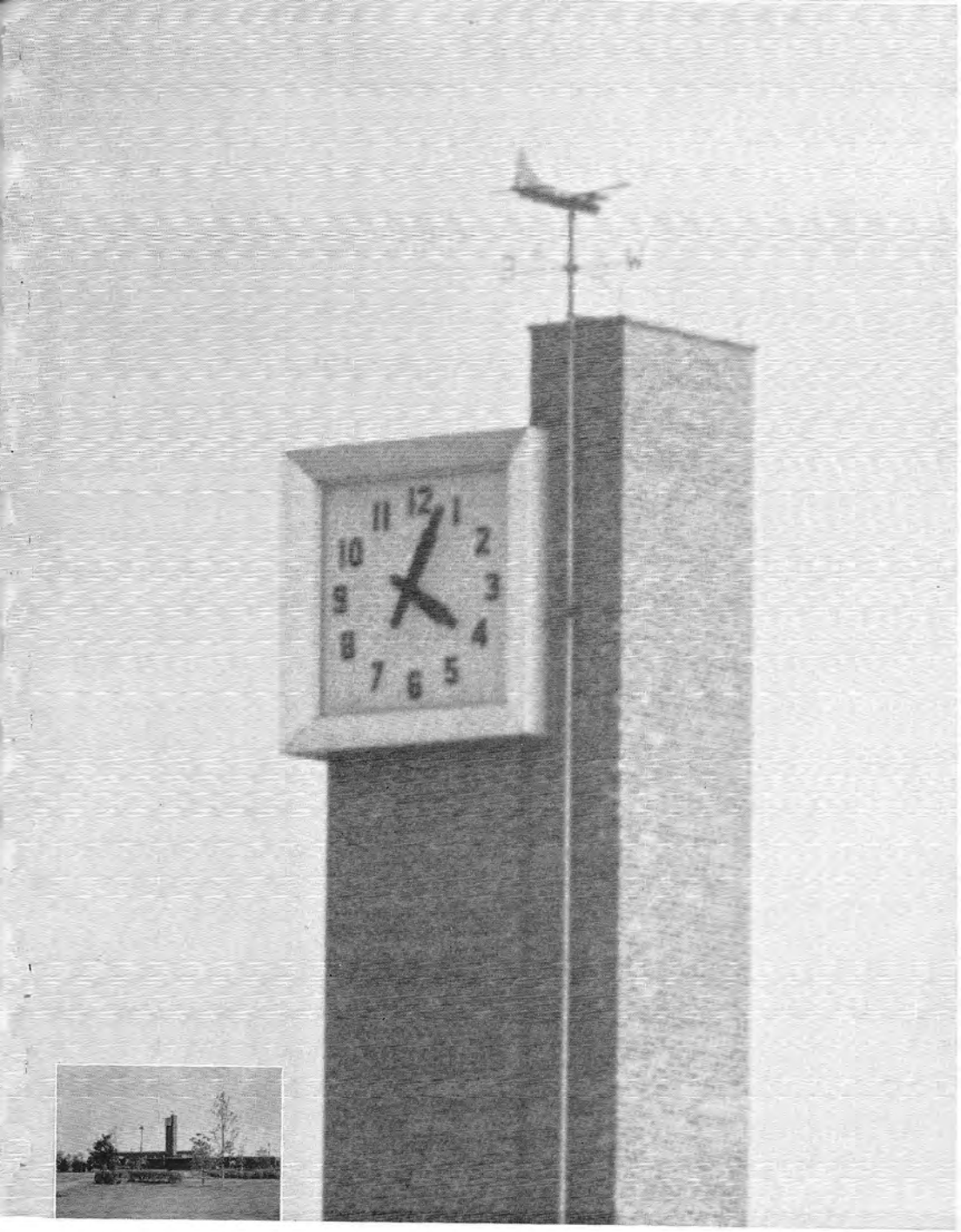
SENSITIVITY OF THE EYE
Approximate sensitivity of the normal eye.

NON-COLOR-SENSITIZED
Have only the ultraviolet and blue-violet sensitivity inherent in every silver halide emulsion.

ORTHOCHROMATIC
Ultraviolet, blue, and green sensitivity.

PANCHROMATIC
Sensitivity closely approximating that of the eye.

Spectrograms showing color sensitivity of Kodak film sensitizing types to tungsten light.



The extremely fine grain and high image sharpness of Kodak Panatomic-X Film permits mural-size enlargements of excellent quality. This portion of the clock tower in the 35mm picture (inset) was enlarged 40 diameters.

DEFINITION

• Definition is the impression of clarity of detail which is received by an observer when viewing a photograph. The terms "definition" and "sharpness" often are used interchangeably, but such usage is only partly correct. Definition refers to the over-all appearance of detail, while sharpness is one factor in definition and is concerned only with the boundaries of well-resolved elements of detail.

Definition is the composite effect of several factors, among which are sharpness, resolving power, and graininess. Usually among emulsions of the same type, resolving power and sharpness increase as graininess decreases. However, this is only a general rule, and there are exceptions.

Graininess. When a negative is viewed at a sufficiently high magnification, it is seen to possess a grainy or granular structure. This impression of nonuniformity in the image is called graininess. It is caused by the irregular distribution of the silver grains, rather than by the individual grains themselves which are visible only under magnifications much greater than are used in making ordinary enlargements.

For emulsions of a given general type, graininess tends to increase with the emulsion speed. When development is carried to the same gradient, the common developers of normal and high activity (e.g., Kodak Developers DK-50, D-72, and Dektol) produce approximately equal graininess with a given film. Some fine-grain developers (e.g., Kodak Developers DK-20 and Microdol) produce noticeably less graininess but at the expense of some loss of speed.

Graininess of the print increases with the density of the negative, so overexposure or overdevelopment of the latter should be avoided.

The graininess of both negatives and prints increases with increasing gradient of the material on which they are made. When the gradient of the negative material is low, prints are normally made on a paper which has a high gradient and vice versa, so what may be gained by holding one gradient down would be largely lost by the high gradient of the other. It is usually true, however, that a low gradient in the negative material and a correspondingly high gradient in the paper is more favorable than the alternative combination.

The graininess reproduced in the print is most apparent in the lighter middle tones, especially in large, uniform areas.

It is possible to conceal graininess somewhat by softening the focus in enlarging, or by using a paper with a rough surface, but only at some sacrifice in sharpness.

Each Kodak film in the Data Sheets has been placed in a graininess classification, such as: *Coarse, Moderately Coarse, Medium, Fine, Very Fine,* and *Extremely Fine.*

Resolving Power. Resolving power refers to the ability of an emulsion to record fine detail distinguishably. In measuring resolving power a parallel-line test chart is photographed greatly reduced in size. The lines of the test chart are separated by spaces of the same width as the lines. The image is examined under a microscope, and the number of lines per millimeter that are just recognizable as separate lines is determined. Lines closer together (more lines per millimeter) than indicated by this number will appear on the film, not as individual lines, but as an indistinct, gray mass.

The resolution of a film depends on the brightness scale of the test chart but only slightly on the degree of development of the film. The resolving power classifications given in the Data Sheets are based upon the maximum values determined for the recommended processing.

Resolution falls off greatly at high and low exposure values, reaching a maximum at some intermediate exposure, and it is for this exposure that the resolving power classification is given. The loss of resolution with over- and under-exposure is one reason for exposing miniature negatives correctly.

The maximum resolution which can be obtained in practical negative making is limited by the lens as well as by the negative material and is lower than the resolution of either one alone. In order to realize the maximum resolution of which a film is capable, the resolving power of the lens should usually be at least three times the resolving power of the material.

Resolving power measurements made on the same material by different persons may not agree, due to differences in equipment and procedure. For this reason, the films in the Data Sheet have not been given definite resolving power values, but have been placed in the following classifications:

Low Resolving Power includes films with resolving power below 60 lines per millimeter.

Moderately Low Resolving Power includes all films with values between 60 and 70 lines per millimeter.

Medium Resolving Power includes films capable of resolving 75 to 90 lines per millimeter. Most negative materials fall in this classification.

High Resolving Power includes resolving powers of 95 to 115 lines

per millimeter. The new Kodak medium-speed roll films are included in this group.

Very High Resolving Power includes films with values between 120 and 150 lines per millimeter. Most positive films, process films, and the new Kodak Panatomic-X roll and miniature films are in this classification.

Extremely High Resolving Power. There are several special purpose materials, mostly of low speed and very high contrast, having resolving power above 150 lines per millimeter which have been produced for special applications where resolution is of prime importance.

Sharpness and Acutance. If a knife edge is laid in contact with a film and the film is exposed to light, the density of the developed image does not end abruptly at the former site of the knife edge but encroaches on the shielded area, forming a diffuse boundary. The variation in density across this boundary controls the impression of sharpness.

The encroachment of density into the shielded area results from the diffusion of light within the emulsion. The amount of this diffusion is affected by the distribution of grain sizes in the emulsion as well as by the emulsion thickness. The extent of the diffusion can be minimized by using a film with a thin emulsion layer and by avoiding overexposure and overdevelopment.

Since sharpness is a subjective impression received by the observer, it is difficult to assign definite values of sharpness to photographic images. To overcome this problem, a method has been devised for making objective measurements of a quantity called *acutance* which agree with sharpness judgments made by observers. These measurements are based on the variation in density across the boundary of a knife-edge image. On the basis of such measurements, each Kodak film has been placed in one of the groups in the following series. (See Data Sheets for Kodak Films):

Low Sharpness

Moderately Low Sharpness (includes a few of the older Kodak Films)

Medium Sharpness (includes most Kodak sheet films)

High Sharpness (includes the new Kodak medium-speed roll films)

Very High Sharpness (includes the new Kodak Panatomic-X roll and miniature films)

Extremely High Sharpness (includes low-speed, high-contrast materials used for special applications where image sharpness is vital.

Limits of Definition. Graininess, resolving power, and sharpness usually exert a combined influence on definition. However, it is possible that under certain conditions any one of these may be more important than the others in controlling the definition of a photograph.

When a negative made on a coarse-grain material is enlarged, the graininess usually reaches an objectionable stage before the loss of resolution or sharpness becomes objectionable. Graininess then becomes the limiting factor in definition.

While the resolving power and sharpness of photographic films usually are related, resolving power is not a definite indication of ability to produce sharp pictures. In some cases it may be misleading. When viewing a picture at normal reading distance and under the best conditions, the eye can resolve about 10 lines per millimeter. If the resolving power of the film is too low to reproduce details about twice as fine as this in the print, the definition will be limited by the resolving power. However, when resolving power is adequate, and when graininess is not noticeable, the sharpness of the image is the important factor affecting definition. All of these factors were taken into consideration in the Data Sheet discussion of the degree of enlargement possible with each film.

In practical photography, a frequent limitation in the production of pictures with good definition is not the film characteristics, but the manner in which the photographer handles his equipment and materials. In order to realize the maximum definition which the film is capable of producing in the final print, the following precautions should be observed:

1. Use a clean camera lens of high resolving power which has been well corrected for aberrations.
2. Focus carefully, preferably with the aid of a rangefinder or ground glass (tape measure for close-ups).
3. If sharp images of both near and distant objects are desired, consult a depth-of-field table for the correct diaphragm stop.
4. Hold the camera steady; if possible, place it on a tripod or other firm support. A fast shutter speed will help to minimize the effects of camera movement.
5. Avoid excessively dense negatives produced by overexposure or overdevelopment.
6. Choose the paper printing grade which is capable of producing a good print from the negative without producing excessive contrast.
7. When making enlargements, be sure the enlarger lens is clean and the image is sharply focused on the enlarging paper.

Speed and Exposure

The speed of a film is a property of immediate practical importance since it has a direct bearing on lens settings required to yield good negatives. Speed enters into the three commonly used methods of determining exposure settings: Estimation based on experience, exposure tables and guides, and photoelectric and other exposure meters. Figures for the last application are derived from film speed.

EXPOSURE GUIDES

• The Eastman Kodak Company provides exposure tables and dial-type guides which have been derived with great care from exhaustive practical tests and from extensive data on illumination, subject brightness, film speed, and print-making requirements. The principles involved have been confirmed by a number of years' experience. For any picture-taking situation specifically covered by a Kodak exposure guide, the camera settings indicated by the guide will yield an extremely high percentage of excellent photographs.

Kodak exposure guides for black-and-white negative materials are based on the recording of important shadow detail. The exposures indicated by the guides include a safety factor of 2.5 times; that is, for a normal subject photographed under normal conditions, the exposure recommended is about 1⅓ stops greater than the least exposure required for a negative that will produce an excellent print. This safety factor allows for variations in equipment, working techniques, and judgment of subject type and illumination. Because of the latitude of black-and-white negative materials, slight variations in exposure produce no loss of image quality. Less exposure than indicated by the guides should not be given unless picture-taking conditions demand it and the photographer is thoroughly familiar with all the factors involved.

Exposure guides for color films and black-and-white reversal materials are based essentially upon the quality obtained in the important highlight areas of a photograph, since the rendering of the highlights is much more critical in color and reversal processes than in black-and-white negative making. Because these materials have limited exposure latitude, little or no safety factor can be included in the exposure guides. The guides should be followed strictly unless experience with certain equipment dictates a consistent change.

The Kodak Master Photoguide contains dial-type exposure calculators covering the use of daylight, flash, and flood light with a variety of Kodak films. The text of this booklet includes valuable information on lighting techniques, filter selection, depth of field, and other essentials for general and special application. Daylight and flash exposure of Kodak black-and-white and color films is also available in a separate guide, The Kodaguide Snapshot Dial. These guides are sold by Kodak dealers.

EXPOSURE INDEXES

• Exposure indexes are numbers assigned to photographic films and plates for use in conjunction with exposure meters and other exposure computing devices to aid the photographer in obtaining correct camera exposure. They thus relate the relative sensitivity of the film and the brightness level of the subject to the lens aperture and shutter speed settings of the camera. They are determined by a sensitometric procedure which is specified in *The American Standard Method for Determining Photographic Speed and Exposure Index, PH2.5-1954.*

"Correct camera exposure" can be defined only in terms of a careful evaluation of the desired final result which, in the case of continuous-tone negative materials, is the final print or positive image. An extensive program of research which was carried on by the Kodak Research Laboratories and which led to the sensitometric procedures specified

in the standard, demonstrated that, for any particular negative material, a certain minimum camera exposure was required to yield excellent prints. If the camera exposure was reduced below this point, there was a marked drop in the quality of the best prints that could be obtained from the resulting negatives. If the camera exposure was increased beyond this minimum, the resulting negatives increased in density, but there was no immediate drop in the quality of tone reproduction obtained in the resulting prints.

Since there may frequently be some error or uncertainty in the estimation or measurement of the brightness of the subject, it would be unwise to attempt to give the minimum exposure as a general practice, because any errors leading to less exposure would cause a definite loss in quality. The investigations mentioned above indicated that the black-and-white negative materials then in use could stand considerable increases above the minimum exposure without any drop in print tone-reproduction quality. Therefore, in order to avoid underexposed negatives, it was considered desirable to include a safety factor above the minimum exposure. The safety factor adopted for the black-and-white continuous-tone negative materials was 2.5. In other words, the exposure indexes were selected so that, on the average, when used with exposure meters calibrated in accordance with the American Standard they would lead to two and a half times the minimum exposures needed to produce top-quality negatives.

Subsequent practical experience and more recent research investigations have indicated that the use of such a large safety factor is sometimes undesirable. For one thing, while considerations of tone reproduction alone do permit great exposure latitude, other factors which affect the final image quality, such as minimum graininess and optimum sharpness or definition, generally do not. This is particularly true for the currently popular small negative sizes which are enlarged in printing. With these, it is advisable to keep the exposures as close to the minimum as practical, in order to obtain the lowest graininess and best definition. Furthermore, many common causes of exposure errors lead to more rather than less exposure than expected.

For instance, shutter speeds are marked for the effective exposure time for shutter operation at maximum aperture, where shutter efficiency is lowest. At the high shutter speeds and small apertures generally used with the modern fast films, the shutter efficiency is considerably higher, thus giving more exposure. Also, any changes with age will tend to slow down the shutter at its higher speeds and lead to still more exposure.

Therefore, it now appears that, in order to obtain the highest quality in the largest percentage of negatives, it is desirable to set the exposure aim point closer to the minimum exposure required. Thus, for subjects of normal brightness scale, it usually is better to use indexes approximately two times the published values, in order to avoid unnecessarily heavy exposure and its attendant disadvantages.

These considerations become particularly important for both the extremely fast films and also, at the other extreme, the slow, very fine-grain films. The latter are generally used only when extremely low graininess and the best possible definition are needed, and these may be impaired by unnecessarily heavy exposures. The very fast films are normally used only in situations where it is difficult to obtain adequate exposure. Thus, the use of any unnecessary safety factor would offset their most important characteristic, the high speed. This is the reason why the instructions for Kodak Royal-X Pan Film suggest that an index of 1600 should be used for most applications of the film. With subjects of average brightness scale, this leads to the minimum exposures which yield top-quality negatives with the recommended normal development. Thus, it contains no safety factor. The American Standard Exposure Index for this film, containing the normal safety factor, is 650, which would lead to undesirably dense negatives.

It should be emphasized that the sensitometric procedure prescribed in the standard gives a reliable measurement of the relative speeds or sensitivities of negative materials. The only question is with regard to the magnitude of the safety factor that should be used in exposing black-and-white, continuous-tone negative materials. It has long been known that some other types of materials, such as reversal films, have very little camera exposure latitude, so that their exposure indexes can contain only a small safety factor. It is now being recognized that, for the maximum attainable picture quality, this is frequently true also for black-and-white negative materials.

This discussion assumes that the material will be processed as recommended. The use of special developers or unusually high or low degrees of development may involve a change in the index.

METHODS OF USING EXPOSURE METERS

• The exposure meter cannot be used in a purely mechanical fashion. Its proper use and reasons for such use must be understood. Above all, judgment must be used as to what is measured and how. The limitations of the type of meter should be known and allowed for.

The high speed, low graininess, and wide exposure latitude of Kodak Royal Pan make it the ideal film for pictures like this one, taken in existing light only.

Reflected Light Readings from Camera Position. Exposure indexes have been correlated with the statistical average of reflected-light readings from a large number of scenes. These indexes therefore apply if certain precautions are observed.

The makers of certain reflection exposure meters recommend that a meter used in daylight should be tilted downward to avoid undue influence from the sky. Such effects can otherwise lead to underexposure. This precaution is particularly important on overcast days when the sky brightness is many times that of the landscape. Other large, bright areas must also be avoided in the meter field of view. Reflections from water, snow, white sand, and even sidewalk foreground can unduly influence the meter.

Surroundings can also be quite misleading in making meter readings for telephoto pictures. For example, a telephoto picture of a skier against a snow field will tend to be underexposed if the exposure settings are determined from an ordinary reflected light meter reading from the camera position. The opposite situation is found in the case of a stage performer in a spotlight. Because of the dark surroundings a meter might not show any reading even though the spotlighted area might have ample light for proper exposure.

Substitution of a Test Card for Indoor Subjects. One of the most successful techniques of using a reflected-light type of exposure meter involves making a reading on a card of known reflectance. For indoor work, it has been found that, on the average, a gray card having a reflectance of about 18 per cent held in the position of the subject will show very nearly the same light reading as a reading taken from the camera position for an average indoor subject under identical lighting. It follows that the exposure index, which has been adjusted to yield satisfactory exposure information when the light reflected from an average subject is measured from the camera position, will also be suitable for use with readings made on a gray card of 18 per cent reflectance. To meet this need, the Kodak Neutral Test Card has been introduced. The gray side has 18 per cent reflectance, the white side 90 per cent reflectance. If the white side of the card or any other white card of about 90 per cent reflectance is used, the exposure index must be divided by 5 and rounded to the nearest figure on the exposure meter calculator.

When the meter reading is made on a gray or white card, the card should be placed close in front of the subject, facing the camera. It should be large enough to fill the acceptance cone of the meter, which must not cast a shadow on the card. Since the highlight region is important in the exposure of reversal color film, the modeling light should appropriately influence the meter reading. A test card or flat-celled incident-light meter, when facing the camera, does not respond at all to 90° side light. Therefore, in color work, such a card or meter should face half way between the camera and modeling light, up to a 90° position of the light. All the lights should be turned on when the reading is taken. Some allowance—about half a stop—must be made if the subject is unusually light or dark in color and color film is concerned.

The palm of the operator's hand or the face of the subject is sometimes used instead of a card. Since the reflectance of average skin is about 35 per cent, the exposure index should be divided by 2 in computing exposure in the conventional manner.

Incident-Light Method. The test card method described above is essentially a measurement of illumination falling on the subject. Incident-light meters are designed to do this directly. Either type of measurement is preferable to reflection measurements of artificially-lighted subjects, since a reflection measurement may include underlighted or unlighted background areas.

It is recommended that incident-light measurements made with

the G-E Meters, Types DW-58 and earlier, be divided by two, or else the film index be divided by two. This applies whether the meter is used with or without the multiplying masks.

Some reflection-type meters can be improvised to make incident-light readings. The light entering the cell must be decreased, and this must be done in such a way that light from all directions which can illuminate a flat surface will affect the cell properly. In other words, the cone of acceptance should be nearly 180° solid angle. This can be done by a combination of a neutral density filter and an opal glass.

Since the photographer is not equipped to construct such devices with the specified light transmission, he should choose the neutral density by experiment so that there is nearly a full-scale deflection of the meter for the highest illumination he is likely to use. He can then conduct a set of photographic trials to arrive at a suitable film setting for the meter so equipped.

EXPOSURE INDEXES FOR COPYING

• The American Standard Exposure Indexes for continuous-tone materials can be used in copying. These indexes can be used directly with incident-light meters held in the plane of the original being copied. The indexes also apply directly to reflected-light meters when the reading is taken from a surface having a reflectance of 18% substituted for the original being copied. The gray side of the Kodak Neutral Test Card is recommended for this purpose.

In the absence of the proper gray card, a reflected light reading can be made on a matte white surface of 90% reflectance, such as the back of double weight white photographic paper. The reading is of course much higher. Compensation can be made by dividing the exposure index by 5 and rounding to the nearest figure on the meter calculator.

Exposure indexes for high contrast materials for line work are not yet covered by an American standard. Such values are needed so that the modern type of exposure meter can be used in line copying. These values have therefore been derived for Kodak materials and are listed as exposure indexes. These values are used in the same manner as the usual exposure indexes for continuous-tone materials. They apply directly to incident-light meters, and to 18% gray card readings with reflected-light meters. Likewise, a white card can be used with indexes divided by 5.

Unlike the indexes for continuous-tone, those for line work are intended merely for trial exposure. The first reason for this is that the exposure should be adjusted to the maximum that can be given with-

out causing filling in or veiling of the lines. Thus the exposure is affected by the reflectance of the lines or dark areas of the copy subject. The second reason is the inherently short exposure latitude of the high contrast materials.

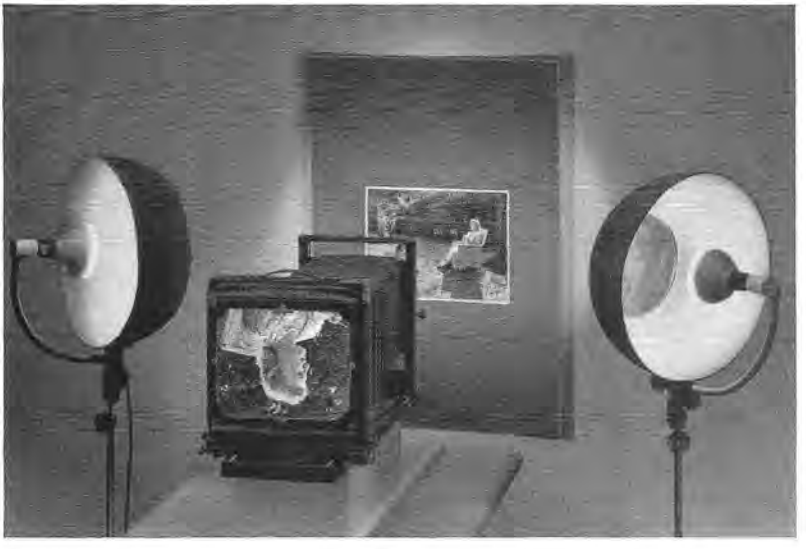
The copying indexes for some materials are lower than the lowest figure on the computer scale of some exposure meters. When this situation is encountered, multiply the index by 100 and give 100 times the calculated exposure time.

Correction for Bellows Extension. In computing exposure for copying, it is particularly important to allow for the effective increase in the *f*-value and resulting decrease in image brightness caused by extended bellows. If this factor is ignored, an error of 4 times is introduced in the exposure in the case of same size or 1:1 copying. The effective *f*-value can be found by the relation

$$\text{Effective } f\text{-value} = \frac{\text{Indicated } f\text{-value} \times \text{Lens-to-film distance}}{\text{Focal length}}$$

The lens-to-film distance is the focal length plus the distance which the lens is extended beyond its position at infinity focus. The Kodak Master Photoguide and the calculators on some exposure meters offer a most convenient means for making such calculations.

Films for copying depend on the nature of the original to be copied. For line work, Kodak Contrast Process Ortho or Contrast Process Panchromatic is suggested; for continuous-tone subjects, Kodak Commercial or Commercial Ortho Sheet Films.



PHOTOGRAPHIC CALIBRATION OF A METER

• Any published exposure index or other meter setting should be regarded by the critical worker as a basis for trial and subject to modification to produce the desired results with his own equipment and procedures. Using a typical subject, he should make a series of exposures, each differing by half a stop from the next. The midpoint of the series should be that indicated by the published meter setting for the film. If none is available for the particular meter concerned, the midpoint of the series should be arrived at either by exposure tables or by preliminary tests. Careful readings should be made with the meter using the intended technique, and complete records should be kept of the meter readings and the lens settings used. From the quality of the test pictures and the readings of the meter, a suitable index can be derived by working the calculator backwards, so to speak. It is well to make several such tests on different types of subject matter. It is also most important to allow for the influence on effective aperture of extended camera bellows if the subject is closer than 8 times the focal length of the lens.

Even though formal tests have not been carried out by the photographer, he should not hesitate to depart from the published exposure indexes if his results consistently indicate the need for such a change.

Note: If the above test is carried out for color film, appropriate indexes for black-and-white film can be derived by applying to their published indexes the ratio between the published and derived indexes for the color film used. Indexes for color films cannot be derived with sufficient accuracy from black-and-white film tests.

SETTINGS FOR METERS WITH SCHEINER AND DIN SCALES

• Experience has shown that each different make of meter using the same type of film rating scale may require a different setting for the same film. For example, a certain film was found to require a Scheiner rating of 21 for one type of meter, and a rating of 28 for another brand. Therefore, it is impractical to give conversion tables for use of the film exposure indexes with meters marked in the Scheiner and DIN systems. The proper conversion for a particular meter is best determined by making a series of trial exposures as described above.

The settings for other films can easily be calculated if it is remembered that an increase of 3° on either the Scheiner or the DIN scales corresponds to a doubling of the film exposure index. For instance, if a meter setting of 29° Scheiner is found to give proper exposure for a film having an exposure index of 50, a setting of 32° (3° higher) should be correct for a film with an exposure index of 100.

Physical Properties

BASE

• The film base is the support for the light-sensitive emulsion.

Kodak film base is made in various thicknesses for different negative materials: roll film, 35mm film, film pack, and sheet film. All Kodak films are now coated on safety base, which is slow burning, and which presents somewhat less hazard in storage than common newsprint paper in the same form and quantity.

Specially selected glass is used for Kodak plates.

OVERCOATING

• A thin transparent gelatin layer is applied over the emulsion to protect it from abrasion. All Kodak amateur roll films, film packs, miniature films, and portrait sheet films are overcoated.

NONCURLING BACKING

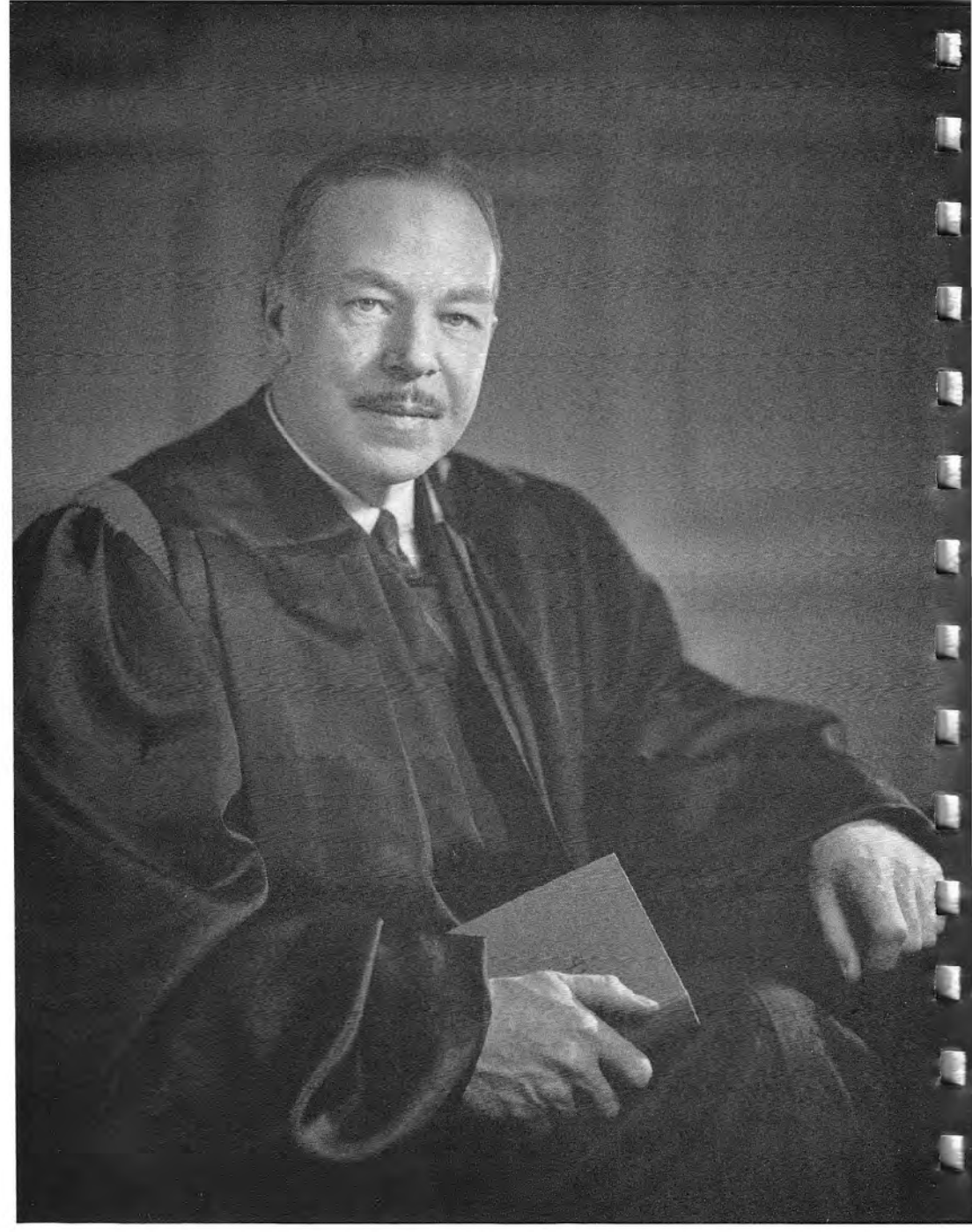
• A gelatin layer is applied to the back of the film base. The shrinkage of this layer compensates for that of the emulsion and thus prevents severe curling of the film. This backing is not needed or used on the 35mm and 70mm roll films.

ANTIHALATION FEATURE

• Light penetrating an emulsion may reflect from the back of the base and strike the emulsion once more, causing halation around the image of bright objects. Antihalation base or backing is designed to absorb such light and prevent halation. While the emulsion itself absorbs much of the light striking it, Kodak negative materials are treated in various ways to insure good antihalation properties.

In the case of the sheet films, roll films, and film packs, the antihalation feature consists of a light-absorbing dye incorporated in the non-curling backing layer. The dyes used bleach out completely in a properly compounded developer and fixing bath.

Incorporated in the base of Kodak 35mm and 70mm Film is a gray dye. Light transmitted by the emulsion must pass through the dye twice in order to get back to the emulsion and cause halation. The gray dye is therefore twice as effective as it would at first appear. This dye does not bleach out in the processing solutions, but its presence has no effect on printing quality.



An orthochromatic film, such as Kodak Royal Ortho, emphasizes strength and character in portraits of men.

Storage and Care of Films

All photographic films are perishable products which are damaged by high temperatures and high relative humidities. For best results they must be handled and stored properly, with adequate protection against heat, moisture, harmful gases, x-rays, and radioactive substances at all times.

Kodak sheet films, film packs, 35mm films, and roll films in black-and-white and color are now supplied in water-vapor-tight packaging, so that they require no additional protection against high humidities until the package is opened. This packaging provides protection for films in tropical regions or any other locality where relative humidities of 70 percent or higher prevail, as in a number of areas in the continental United States.

STORAGE IN ORIGINAL PACKAGE

Protection from Moist Air. Films which are supplied in vapor-tight packaging require no additional protection against high relative humidities until the package is opened. For this reason, a *film package should not be opened until the film is to be used*, because the protection originally provided is then no longer effective.

Films which are in opened packages should not be stored in damp basements, ice boxes, refrigerators, or other places where the relative humidity is high. The ideal relative humidity for storage of such film packages is between 40 and 60 percent, preferably near 40 percent.

When humid storage locations cannot be avoided, or when the use of a refrigerator is necessary for cooling, films which are in opened packages should be given additional moisture protection by placing them in a can or jar which can be tightly sealed.

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

Protection from Heat. *Vapor-tight packaging is not heat-proof.* Regardless of the type of packaging, do not leave films near steam-pipes or other sources of heat. In warm weather, do not leave them on the top floors of uninsulated buildings or in closed automobile compartments.

During summer heat in temperate or tropical zones, refrigerated storage is recommended for keeping films cool, provided they are in vapor-tight packages or are sealed in cans or jars.

Where possible, the following storage temperatures should be maintained.

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

When special storage precautions are not practical for films in opened packages, it should be borne in mind that a moderate temperature and relative humidity, such as 60 F—40% R.H., are better than a low temperature with high relative humidity, such as 40 F—80% R.H.

Films in opened packages 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.

PROTECTION OF FILMS AFTER PACKAGE IS OPENED

• Under humid conditions, *films should be exposed and processed as quickly as possible after the package is opened.* High relative humidity and high temperature often cause undesirable changes in the latent image *and it is particularly important that exposed films be kept no longer than absolutely necessary before processing.*

Under adverse conditions, films should not remain in the camera or holders longer than necessary. A carrying case containing films should be protected from direct sunlight, because the temperature inside the case may rise extremely high, even in a temperate region. Similarly, films should not be left in automobile compartments or in closed automobiles parked in the sun, where the temperature may quickly reach a high value. If this is unavoidable, keep the film in an insulated container, such as a camp ice box (without ice).

Caution: To avoid condensation of moisture on the cold film surfaces, film packages removed from cold storage should be allowed to reach approximate room temperature (in from 30 minutes to 2 hours' time) before they are opened for use. Packages of plates and 100-sheet packages of film should be allowed at least four hours to warm up to room temperature.

Unused sheet films in an opened package should be sealed in a vapor-tight container before being returned to cold storage. If the prevailing relative humidity is above 60 percent, the films should first be dried by means of a suitable desiccating agent. Methods for drying films are described in the Data Book on Kodachrome Films for Miniature and Movie Cameras.

STORAGE OF PROCESSED FILMS

• To insure maximum life, developed films should be thoroughly fixed and washed. Safety base negatives may be stored at normal temperatures, such as 60 to 80 F, but nitrate base negatives (no longer manufactured by the Eastman Kodak Company) should be kept cool (preferably under 50 F) to retard decomposition. Both types of film should be stored where it is dry (under 60% R.H.) to avoid the possibility of mold or fungus growth. However, nitrate base negatives and safety base negatives should not be stored together, because gases given off by decomposition of nitrate films can cause damage to safety films. Since the silver image may be attacked by certain sulfur compounds, the materials should be protected against fumes of hydrogen sulfide and coal gas. The paper and adhesive used in storage envelopes should meet the requirements of the American Standards Association standard Z38.8.21-1950 "Photographic Filing Envelopes for Storing Processed Photographic Films, Plates and Papers."

The versatility of Super Panchro-Press, Type B, makes it an excellent choice for commercial and illustrative photography with all types of indoor and outdoor illumination.

SUGGESTED KODAK NEGATIVE MATERIALS FOR VARIOUS SUBJECTS

SUBJECT CLASSIFICATION	CHIEF REQUIREMENTS	KODAK NEGATIVE MATERIALS RECOMMENDED			
		ROLL FILM	FILM PACK	SHEET FILM	35MM FILM
ACTION					
Outdoors	Speed for Full Exposure at High Shutter Speeds	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Royal Pan	Plus-X Tri-X
Indoors or Extremely Poor Lighting	Speed in Artificial Light	Tri-X	Tri-X	Royal Pan	Tri-X
ARCHITECTURE					
Exteriors	Texture Rendition	Verichrome Pan Panatomic-X	Verichrome Pan	Super Panchro-Press, Type B Panatomic-X	Panatomic-X Plus-X
Interiors or Night	Latitude, Speed, Antihalation	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Royal Pan	Plus-X Tri-X
NEWS "Candid"	High Speed	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Royal Pan	Plus-X Tri-X
PORTRAITURE	Low Contrast High Speed	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Royal Pan	Plus-X Tri-X
	Pan Materials Smooth Skin Texture and Contours	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Portrait Panchromatic Super-XX; Tri-X Pan	Plus-X Tri-X
	Ortho Materials Strengthen Facial Characteristics			Super Speed Ortho Portrait Royal Ortho	
GENRE	Wide Exposure Latitude, Modeling	Verichrome Pan	Verichrome Pan	Super Panchro-Press, Type B Super-XX; Royal Pan	Plus-X
LANDSCAPES Atmospheric Effects	Ortho or Non-Color-Sensitized Emulsions Emphasize Haze	Verichrome Pan with C-5 Filter	Verichrome Pan with C-5 Filter	Super Speed Ortho Portrait	Plus-X with C-5 Filter
Cloudscapes Marine Views Snowscapes	Panchromatism, Use of Filters	Verichrome Pan	Verichrome Pan	Super Panchro-Press, Type B Super-XX Panatomic-X	Plus-X
Extreme Distance Spectacular Effects	Infrared Sensitivity, Filters			Infrared	Infrared
NATURE PHOTOGRAPHY	Speed—Medium Contrast	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Royal Pan	Plus-X Tri-X
	Speed—Detail Rendering	Verichrome Pan	Verichrome Pan	Super Panchro-Press, Type B Royal Pan Panatomic-X	Plus-X
	Panchromatism, Filters	Verichrome Pan	Verichrome Pan	Super Panchro-Press, Type B Super-XX; Royal Pan	Plus-X
STILL LIFE Table-Top Photography	Texture, Modeling	Verichrome Pan Panatomic-X	Verichrome Pan	Super Panchro-Press, Type B Portrait Panchromatic	Panatomic-X Plus-X

SUGGESTED KODAK NEGATIVE MATERIALS FOR SPECIAL USE

SUBJECT CLASSIFICATION	CHIEF REQUIREMENTS	KODAK NEGATIVE MATERIALS RECOMMENDED			
		ROLL FILM	FILM PACK	SHEET FILM	35MM FILM
COLOR-SEPARATION NEGATIVES	Balanced Rendering by Red, Green, and Blue Light	Not Recommended	Not Recommended	Super-XX (Separation Negative Plate, Type 1)	Not Recommended
BLACK-&-WHITE NEGATIVES FROM COLOR TRANSPARENCIES	Panchromatism	Panatomic-X Verichrome Pan	Verichrome Pan	Super Panchro-Press, Type B Panatomic-X Royal Pan	Panatomic-X Plus-X
COPIES Line—Black-and-White	High Contrast	(High Contrast Development) Panatomic-X	Verichrome Pan	Contrast Process Ortho	Micro-File
Line—Color	High Contrast, Color Sensitivity	Panatomic-X	Verichrome Pan	Contrast Process Panchromatic	Micro-File
COPIES Continuous-Tone—B. & W.	Medium Contrast	Panatomic-X Verichrome Pan	Verichrome Pan	Commercial	Fine Grain Positive Panatomic-X Plus-X
Color	Medium Contrast, Color Sensitivity	Panatomic-X Verichrome Pan	Verichrome Pan	Super Panchro-Press, Type B Panatomic-X Royal Pan	Panatomic-X Plus-X
DUPLICATES By Means of Intermediate Negatives or Positives	Medium Contrast, Negligible Graininess	Panatomic-X Verichrome Pan	Verichrome Pan	Commercial (Kodak 33 Plate)	Fine Grain Positive Panatomic-X
LANTERN SLIDES	Extremely Fine Grain, Good Contrast			(Kodak Lantern Slide Plates)	Fine Grain Positive Micro-File
MEDICAL PHOTOGRAPHY Predominantly Red Subjects	Panchromatic Materials	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super Panchro-Press, Type B Royal Pan	Plus-X Tri-X
Surgery, etc.	Panchromatic Materials	Verichrome Pan Tri-X	Verichrome Pan Tri-X	Super-XX Royal Pan	Plus-X Tri-X
Pale Red Areas (To Reproduce Darker)	Orthochromatic Materials	Verichrome Pan with #58 Filter	Verichrome Pan with #58 Filter		Plus-X with #58 Filter
Sub-Surface, Veins, etc.	Infrared Sensitivity			Infrared	Infrared
PHOTOMICROGRAPHY General Use	High Resolving Power and Contrast	Panatomic-X	Verichrome Pan	Super Panchro-Press, Type B Super-XX Panatomic-X	Plus-X Panatomic-X
Metallurgy	Panchromatic Materials	Panatomic-X	Verichrome Pan	Contrast Process Pan (Kodak M Plate)	Micro-File Panatomic-X
	Orthochromatic Sensitivity	Panatomic-X with #58 Filter	Verichrome Pan with #58 Filter	Contrast Process Ortho (Kodak Metallographic Plate)	Panatomic-X, #58 Filter
ASTRONOMY and Spectroscopy	Speed and Contrast	Tri-X	Tri-X	Super Panchro-Press, Type B (Spectroscopic Plates)	Tri-X

OVER

SPEED AND DEVELOPMENT DATA FOR KODAK PLATES

KODAK PHOTOGRAPHIC PLATES	Exposure Index*			Recommended Kodak Developers and Developing Times at 68 F—Tank	Kodak Safelight Filter, Wratten Series
	Daylight	Tungsten	White-Flame Arc		
Non-Color-Sensitized					
33	20	5	12	DK-50, 6 min; Maximum contrast: D-11, 8 min (tray).	1
33 Matte	20	5	12		
Process	——	12†	32†	D-8 (2:1), 2 min (tray); D-11, 5 min.	
Lantern Slide, Medium	——	12†	——	Versatol (1:3), Dektol (1:2), or D-72 (1:2), 1-3 min (tray); Warm tones: D-32, 5 min (tray); Soft results: DK-50, 2-3 min (tray).	1
Contrast / Anti-Abrasion Contrast	——	8†	——	Versatol (1:3), Dektol (1:2), or D-72 (1:2), 2-6 min (tray); High contrast: D-11, 5 min (tray).	
Orthochromatic					
Super Ortho-Press	64	32	64	Press: DK-60a, 4½ min; Dektol (1:1) or D-72 (1:1), 2½ min. Commercial: DK-60a, 4 min; DK-50, 5 min. Photomicrography: DK-50, 10 min; D-19, 4 min.	2
50	32	12	——	DK-50, 5 min; DK-50 (1:1), 7½ min; D-61a (1:3), 8½ min.	
Panchromatic Type B					
Tri-X Pan, Type B / Tri-X Pan, Type B Matte	160	100	160	General photography: DK-50, 5 min. Color separation: D-11 and DK-50 (See directions with material).	
Separation Negative, Type 1	64	50	80	General photography: DK-50, 5 min. Color separation: D-11 and DK-50 (See directions with material).	TD‡
Separation Negative, Type 1 Matte	64	50	80		
Panchromatic and Matte	16	10	16	DK-50, 4 min; D-76, 9 min. Color separation: D-11 and DK-50 (See directions with material).	
Panchromatic Type C					
Super Panchro-Press	100	80	——	Press: DK-60a, 5 min. Commercial: DK-60a, 4 min; DK-50, 5½ min. Color separation: DK-50 (See directions with material).	TD‡

*These settings are recommended for meters marked for American Standard Exposure Indexes. They take into account the ultraviolet absorption of average process lenses.

†For Line Copying—for *incident-light meters* directly or for *reflected-light meters* with a Kodak Neutral Test Card (18% gray side) at the copy board. For readings on a matte white card, divide these values by 5.

‡Total Darkness. A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Data Sheets for Kodak Films

On the following data sheets detailed information is presented on Kodak roll films, film packs, miniature films, and sheet films as indexed on the right. Although the sheets contain more information than any one photographer may need, they are purposely made comprehensive so as to meet specific as well as general requirements. Much of this information is also given in the instruction sheets packed with the films. Since recommendations may change, whenever there is a discrepancy between the Data Sheet and the instruction sheet for a product, it is better to follow the instruction sheet in the particular package of film.

Data on Exposure include such subjects as exposure indexes, filter factors, and Flash Exposure Guide Numbers, and in some instances tables of camera settings for exposures by daylight or by flood lamps.

Information on Processing includes a listing of Kodak developers and development times at 68 F recommended for various purposes. Time-temperature development charts show the times at other temperatures to produce the same degrees of development.

The Sensitometric Data include both characteristic and time-gamma curves, plus descriptions of such film properties as color sensitivity, and definition.

For additional information on camera films and plates not covered in this book, the following Kodak publications are recommended: *Kodak Color Handbook, Kodak Graphic Arts Handbook, Kodak Industrial Handbook, Eastman Motion Picture Films for Professional Use,* and the Kodak Data Books on *Slides, Copying, Infrared and Ultraviolet Photography, Negative Making for Professional Photographers, Kodak Photographic Plates for Scientific and Technical Use,* and *Kodak Materials for Aerial Photography.* For specialized uses of Kodak films, write the Sales Service Division of the Eastman Kodak Company, 343 State Street, Rochester 4, New York.

KODAK VERICHROME PAN FILM IN ROLLS AND PACKS

A high-speed, fine-grain, panchromatic film with wide exposure latitude. It is an improved replacement for Kodak Plus-X Roll Film as well as for Verichrome Film. It is the first choice for general picture-making use in all types of roll film cameras.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**80** *Tungsten*—**64**

These settings are recommended for meters marked for American Standard Exposure Indexes. Normally they provide a safety factor in exposure when the film is developed as recommended.

Filter Factors: Increase normal exposure by filter factor given below:

Roll Film and Film Pack

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 11 (X1)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	1.5	2*	2.5	4	8	6	5	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	4*	5	6	8	2.5

*For correct monochromatic rendering of colored objects.

828 Film

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 11 (X1)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	1.5	2*	2.5	4	8	6	6	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	1.5	4*	5	6	12	2.5

*For correct monochromatic rendering of colored objects.

Daylight Exposure Table: Lens openings at 1/100 second.

Subject Type	Clear Sun	Hazy Sun	Cloudy-Bright	Cloudy-Dull or Open Shade (4)
Light Subject (1)	*f*/22	*f*/16	*f*/11	*f*/8
Average Subject (2)	*f*/16	*f*/11	*f*/8	*f*/5.6
Dark Subject (3)	*f*/11	*f*/8	*f*/5.6	*f*/4

(1) Light Subject: Distant scenery, near-by people in marine, beach, snow scenes. Light subjects predominating.

(2) Average Subject: Near-by people, gardens, houses, scenes not in shade. Light and dark objects in about equal proportions. Use this class if in doubt.

(3) Dark Subject: People in dark clothing; dark foliage, animals, buildings.

(4) Open-Shade Subject: Subjects shaded from the sun but lighted by a wide area of unobstructed clear sky. Larger lens openings are needed as the sky area decreases.

Flood Lamp Exposures: Two No. R2 Reflector Flood Lamps, or two No. 2 Flood Lamps in 12-inch average reflectors, giving comparable light output.

Side Light-to-Subject Distance	4½ ft	6½ ft	8 ft	9 ft	10 ft
Camera Light-to-Subject Distance	6½ ft	9 ft	11 ft	13 ft	14 ft
Lens Opening at 1/25 second	*f*/8	*f*/5.6	*f*/4.5	*f*/4	*f*/3.5

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

Between-The-Lens Shutters	No. 8*	No. 5* or 25*	No. 2† or 22†	SM* or SF*	M-2‡	Focal-Plane Shutters	No. 31† or 2A†	No. 6* or 26*
1/25	110	200	280	110	130	1/50	160	160
1/50	110	170	250	110	—	1/100	110	100
1/100	100	150	220	95	—	1/250	70	60
1/200	90	120	170	85	—	1/500	50	45

*In 4- to 5-inch polished reflectors.
†In 6- to 7-inch polished reflectors.
‡In 3-inch polished reflectors.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

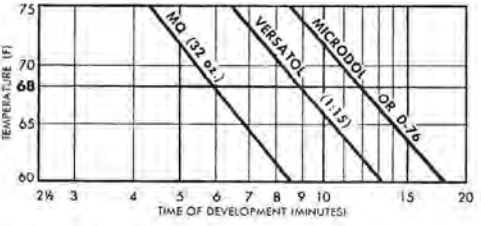
Recommended Development at 68 F for Roll Film and Film Pack:

Kodak Developer	Tray (continuous agitation)	Small Tank (30 sec. agitation)	Large Tank (1 min. agitation)
D-76*	11 minutes	12 minutes	14 minutes
Microdol (fine grain)*	11 minutes	12 minutes	14 minutes
Universal M-Q (32 oz.)*	5 minutes	6 minutes	7 minutes
Versatol (1:15)†	8 minutes	9 minutes	10 minutes

*These developers are available in prepared powder form in several package sizes.
†Kodak Versatol is supplied in concentrated liquid form.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates may form a scum on the surface of the film.

Time-Temperature Development Chart For Roll Film and Film Pack: Showing developing times at various temperatures corresponding to recommended times at 68 F. *Best results are obtained at 65 to 70 F.*



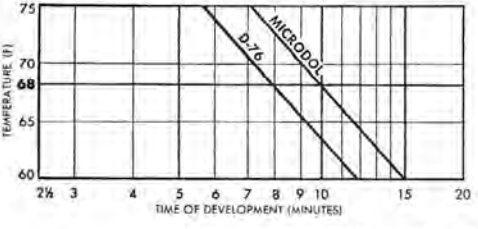
Recommended Development at 68 F for 828 Film:

Kodak Developer	Tray (continuous agitation)	Small Tank (30 sec. agitation)	Large Tank (1 min. agitation)
D-76*	7 minutes	8 minutes	9 minutes
Microdol (fine grain)*	9 minutes	10 minutes	11 minutes

*These developers are available in prepared powder form in several package sizes.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates may form a scum on the surface of the film.

Time-Temperature Development Chart For 828 Film: Showing developing times at various temperatures corresponding to recommended times at 68 F. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Roll Film and Film Pack (For Verichrome Pan 828, see spectrograms, on page 39.)

Spectrogram to Sunlight

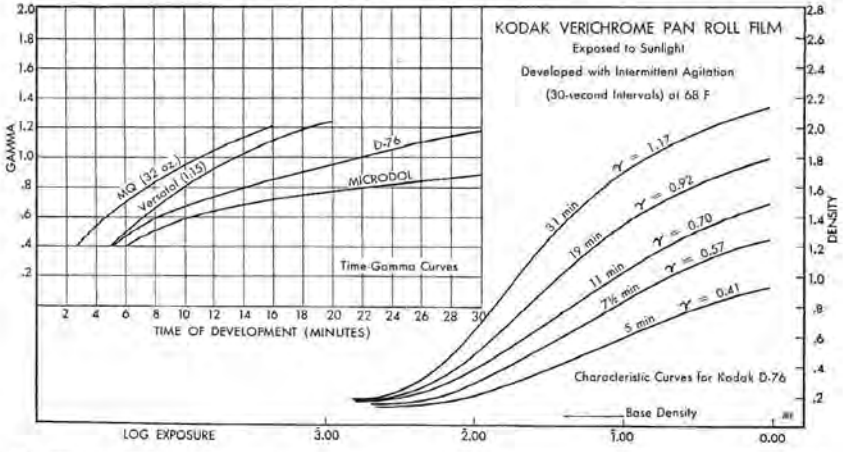
Spectrogram to Tungsten Light

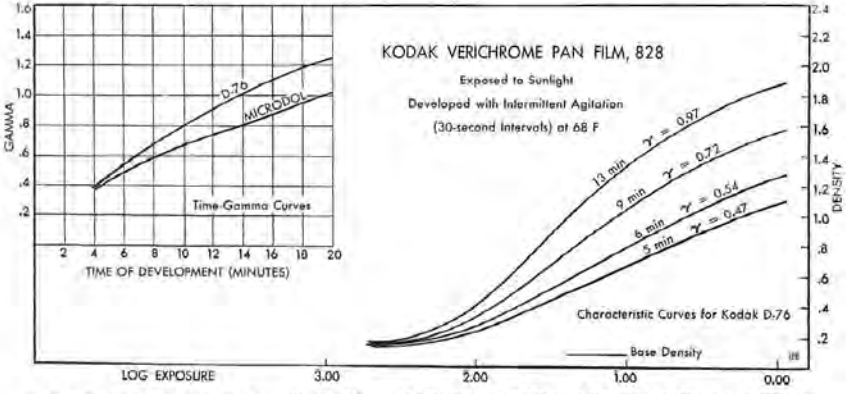
Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Fine	High	High	Great

*For good quality negatives of suitable subjects.

Sensitometric Curves: For average product and average processing.





Rolls and Packs Available: *Roll Films:* VP127, VP120, VP620, VP116, VP616, VP118, VP124, VP130, VP122, and VP828. *Film Packs:* VP520, VP518, VP541, and VP523.

KODAK PLUS-X FILM (35mm)

A high-speed, fine-grain, panchromatic film. Its excellent gradation and wide exposure latitude make it ideally suited to most picture-taking situations.

Exposure

Exposure Index: *Daylight*—**80** *Tungsten*—**64**

These indexes are for meters marked for American Standard Exposure Indexes. They apply when the film is developed as recommended. When they are used with an exposure meter, the indicated exposure settings will give, on the average, about two times the minimum exposure needed to produce top quality negatives. If these settings lead consistently to denser negatives than are desired (not the result of overdevelopment) the exposure should be cut in half, in some cases even more.

Safelight—Filter Factors—Daylight Exposures—Flood Lamp Exposures—Flash Exposure Guide Numbers—Recommended Development—See Verichrome Pan 828.

Sensitometric Data

Verichrome Pan 828 and Plus-X

Spectrogram to Sunlight

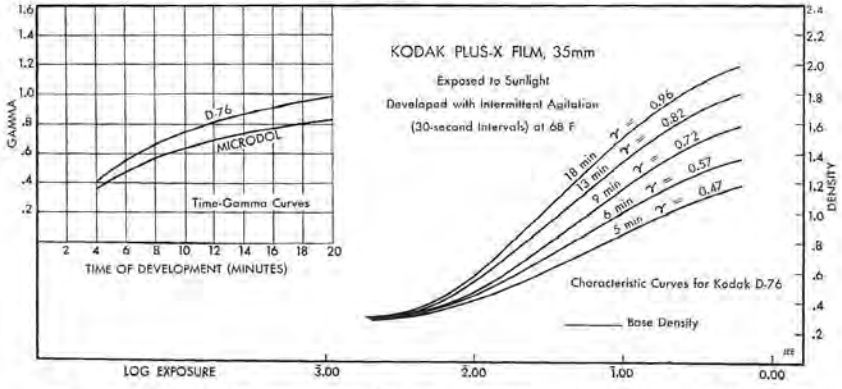
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Fine	High	High	Great

*For good quality negatives of suitable subjects.

Sensitometric Curves: For average product and average processing.



Rolls Available: PX135 magazine (20 or 36 exposures), and bulk rolls *35mm, perforated, frame-numbered*, PX410 (27½ ft), PX401 (50 ft), PX402 (100 ft). Also in *35mm and 70mm, unperforated, not frame-numbered*, bulk rolls.

KODAK TRI-X FILM IN ROLLS, PACKS, AND MAGAZINES

A very fast, panchromatic film of moderate graininess for indoor and outdoor use under adverse lighting conditions. It is especially valuable for photography by existing light at low levels of illumination, as well as for work where high shutter speeds are required and for exposures with electronic speed flash lamps. It is too fast for satisfactory use in box cameras under normal outdoor conditions.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**200** *Tungsten*—**160**

These indexes are for meters marked for American Standard Exposure Indexes. They apply when the film is developed as recommended. When they are used with an exposure meter, the indicated exposure settings will give, on the average, about two times the minimum exposure needed to produce top quality negatives. If these settings lead consistently to denser negatives than are desired (not the result of overdevelopment) the exposure should be cut in half, in some cases even more.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 11 (X1)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	1.5	2*	3	4	8	8	6	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	3*	5	6	12	2.5

*For correct monochromatic rendering of colored objects.

Daylight Exposures: Basic setting for sunlit subjects—1/100 second at *f*/22.

Flood Lamp Exposures: Two No. R2 Reflector Flood Lamps, or two No. 2 Flood Lamps in 12-inch average reflectors, giving comparable light output.

Side Light-to-Subject Distance	5 ft	7 ft	10 ft	12 ft	14 ft
Camera Light-to-Subject Distance	7 ft	10 ft	14 ft	18 ft	20 ft
Lens Opening at 1/25 sec.	*f*/11	*f*/8	*f*/5.6	*f*/4.5	*f*/4

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

Between-The-Lens Shutters	No. 8*	No. 5* or 25*	No. 2† or 22†	SM* or SF*	M-2‡	Focal-Plane Shutters	No. 31† or 2A†	No. 6* or 26*
Open, 1/25	180	300	450	160	200	1/50	250	250
1/50	180	280	400	160	—	1/100	180	150
1/100	170	240	350	150	—	1/250	110	95
1/200	140	180	260	140	—	1/500	80	70
1/400	110	140	200	110	—			

*In 4- to 5-inch polished reflectors.
†In 6- to 7-inch polished reflectors.
‡In 3-inch polished reflectors.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Approximate Settings for Existing Light:

Brightly lit interiors of public buildings	1/50	*f*/4.5
Brightly lit offices, daylight	1/50	*f*/8
Spot lit athletic, stage, or ice show	1/200	*f*/2
Home interiors, bright artificial light	1/25	*f*/3.5
Home interiors, daylight	1/50	*f*/5.6
Television pictures	1/25	*f*/4.5
Brightly lit downtown areas at night	1/25	*f*/3.5

These suggestions can be only approximate, since illumination levels may vary widely. In many cases somewhat more exposure will lead to better results, provided the situation permits larger apertures or longer exposure times. Where possible, use a sensitive incident light meter to check the exposure settings.

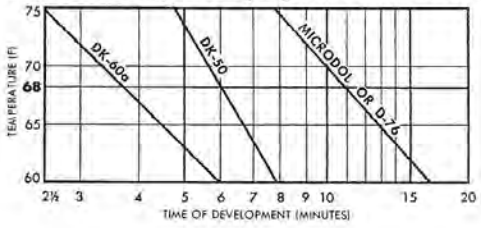
Recommended Development at 68 F.

KODAK DEVELOPERS	Tray (continuous agitation)	Small Tank (30 sec. agitation)	Large Tank (1 min. agitation)
D-76*	10 minutes	11 minutes	13 minutes
Microdol*	10 minutes	11 minutes	13 minutes
DK-50*	5 minutes	6 minutes	7 minutes
DK-60a*	3½ minutes	3¾ minutes	4¼ minutes

*These developers are available in prepared powder form in several package sizes.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates should not be used as they may form a scum on the surface of the film.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to recommended times at 68 F. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrograms:

Spectrogram to Sunlight

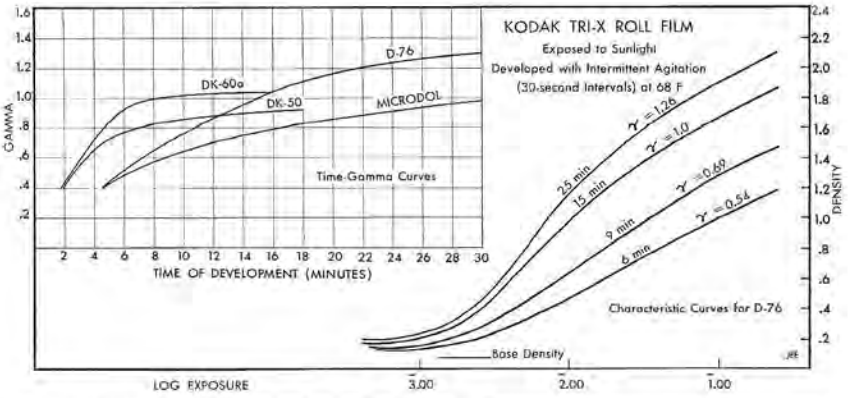
Spectrogram to Tungsten Light

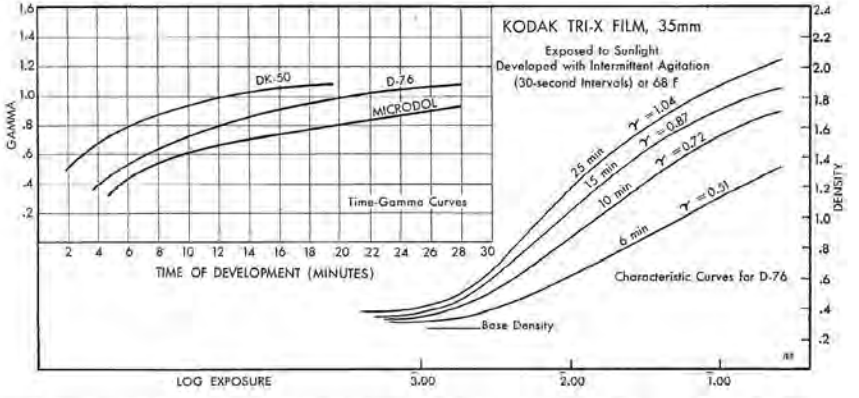
Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Medium	Medium	Medium	Moderate

*For good quality negatives of suitable subjects.

Sensitometric Curves:





Rolls and Packs Available: *Roll Films:* TX127, TX620, TX120, TX828. *Film Packs:* TX520, TX518, TX541, TX523. *35mm:* TX135 magazine (20 or 36 exposures), and bulk rolls *35mm, perforated, frame-numbered*, TX410 (27½ ft), TX401 (50 ft), TX402 (100 ft). Also in *35mm and 70mm, unperforated, not frame-numbered*, bulk rolls.

KODAK PANATOMIC-X FILM IN ROLLS AND MAGAZINES

An extremely fine-grain, high-definition, panchromatic film of moderate speed and contrast for use whenever a considerable degree of enlargement is required. It represents a significant improvement in graininess and definition over the original Panatomic-X Film, which was discontinued several years ago.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**25** *Tungsten*—**20**

These indexes are for meters marked for American Standard Exposure Indexes. They apply when the film is developed as recommended. When they are used with an exposure meter, the indicated exposure settings will give, on the average, about two times the minimum exposure needed to produce top quality negatives. If these settings lead consistently to denser negatives than are desired (not the result of overdevelopment) the exposure should be cut in half. If still thinner negatives are desired for finer grain and more rapid enlarging, even less exposure can be used.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 11 (X1)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	1.5	2*	2.5	4	8	6	8	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	1.5	4*	5	6	16	2.5

*For correct monochromatic rendering of colored objects.

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

Subject Type	Clear Sun	Hazy Sun	Cloudy-Bright	Cloudy-Dull or Open Shade (4)
Light Subject (1)	*f*/16	*f*/11	*f*/8	*f*/5.6
Average Subject (2)	*f*/11	*f*/8	*f*/5.6	*f*/4
Dark Subject (3)	*f*/8	*f*/5.6	*f*/4	1/25 at *f*/4

(1) **Light Subject:** Distant scenery, near-by people in marine, beach, snow scenes. Light subjects predominating.

(2) **Average Subject:** Near-by people, gardens, houses, scenes not in shade. Light and dark objects in about equal proportions. Use this class if in doubt.

(3) **Dark Subject:** People in dark clothing; dark foliage, animals, buildings.

(4) **Open-Shade Subject:** Subjects shaded from the sun but lighted by a wide area of unobstructed clear sky. Larger lens openings are needed as the sky area decreases.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

Between-The-Lens Shutters	No. 8*	No. 5* or 25*	No. 2† or 22†	SM* or SF*	M-2‡	Focal-Plane Shutters	No. 31† or 2A†	No. 6* or 26*
1/25	60	110	160	60	75	1/50	90	90
1/50	60	100	140	60	—	1/100	65	55
1/100	60	85	120	55	—	1/250	40	35
1/200	50	65	95	50	—	1/500	28	—

*In 4- to 5-inch polished reflectors.
‡In 3-inch polished reflectors.
†In 6- to 7-inch polished reflectors.

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

Flood Lamp Exposures: Two No. R2 Reflector Flood Lamps, or two No. 2 Flood Lamps in 12-inch average reflectors, giving comparable light output.

Side Light-to-Subject Distance	3½ ft	4½ ft	5 ft	5½ ft
Camera Light-to-Subject Distance	5 ft	6½ ft	7 ft	7½ ft
Lens Opening at 1/25 second	*f*/5.6	*f*/4.5	*f*/4	*f*/3.5

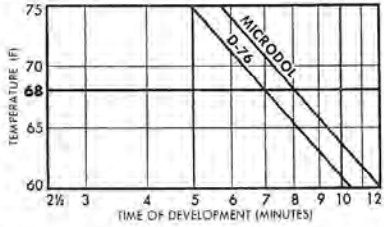
Recommended Development at 68 F for Roll Film and 828 Film:

Kodak Developer	Tray (continuous agitation)	Small Tank (30 sec. agitation)	Large Tank (1 min. agitation)
D-76*	6 minutes	7 minutes	8 minutes
Microdol* (fine grain)	7 minutes	8 minutes	9 minutes

*These developers are available in prepared powder form in several package sizes.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates may form a scum on the surface of the film.

Time-Temperature Development Chart for Roll Film and 828 Film: Showing developing times at various temperatures corresponding to recommended times at 68 F. *Best results are obtained at 65 to 70 F.*



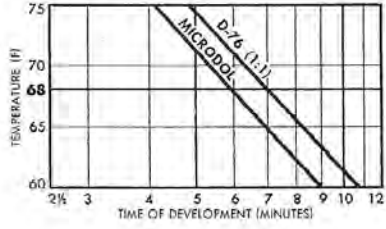
Recommended Development at 68 F for 35mm Film:

Kodak Developer	Tray (continuous agitation)	Small Tank (30 sec. agitation)	Large Tank (1 min. agitation)
D-76* (diluted 1:1)	6 minutes	7 minutes	8 minutes
Microdol* (fine grain)	5 minutes	6 minutes	7 minutes

*These developers are available in prepared powder form in several package sizes.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates may form a scum on the surface of the film.

Time-Temperature Development Chart For 35mm Film: Showing developing times at various temperatures corresponding to recommended times at 68 F. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight

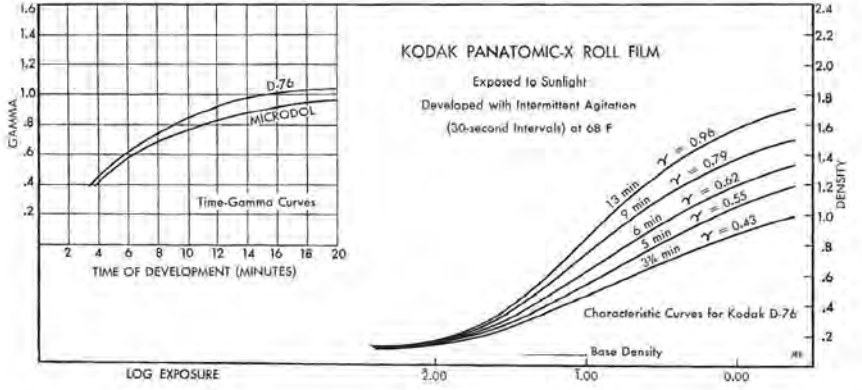
Spectrogram to Tungsten Light

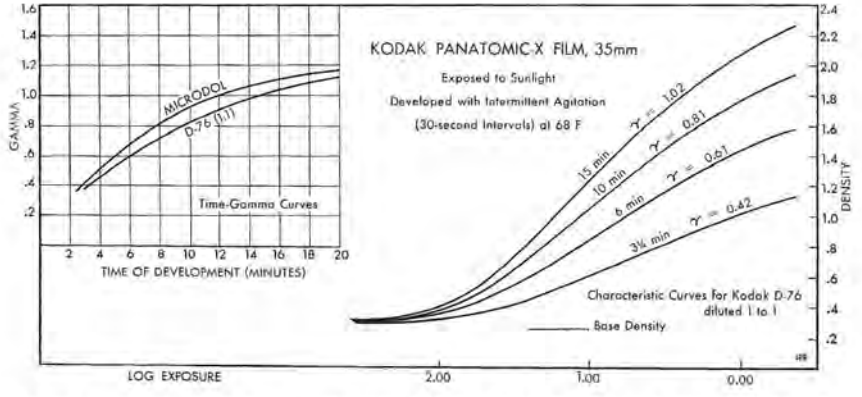
Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Extremely Fine	Very High	Very High	Extremely Great

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Characteristic Curves: For average product and average processing.





Rolls Available: *Roll Films:* FX127, FX120, FX620, FX828. *35mm:* FX135 magazine (20 or 36 exposures), and bulk rolls *35mm, perforated, frame-numbered,* FX410 (27½ ft), FX401 (50 ft), FX402 (100 ft).

KODAK FINE GRAIN POSITIVE FILM

This film has a low-speed, blue-sensitive emulsion useful for printing positive transparencies, from continuous-tone or line negatives, for use in miniature slide projectors. If black-and-white transparencies are mounted in cardboard mounts, they may buckle when projected; for best results, they should be mounted between sheets of glass. This film is not recommended for general camera work but can be used for copying.

Safelight: Use a Kodak Safelight Filter, Wratten Series 1A (light red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet. A Series 0A filter (greenish yellow) can be used up to 2 minutes at 4 feet from the film with the 15-watt bulb in the lamp.

For Transparencies

Relative Printing Speed:

Fine Grain Positive—about one-half the speed of Kodabromide Paper No. 2.

The exact printing speed will depend on the development time to be used. Transparencies can be printed by projection or by contact with reduced illumination in the printer.

Develop at 68 F for times given in the following table, to obtain contrasts corresponding approximately to the grade of paper given:

Equivalent Grade of Paper			Development Time With Continuous Agitation at 68 F Kodak Developers: Dektol (1:2); Versatol (1:3); or D-72 (1:2)	
Azo	*Kodabromide*			
Contact Printed	Contact Printed	Projection Printed	*Films Printed by Contact*	*Films Printed by Projection*
0	1	—	1¼ minutes	—
1	2	1	3½ minutes	1¼ minutes
2	3	2	5 minutes	3½ minutes
3	4	3	7 minutes	5 minutes
4	5	4	—	7 minutes

Examples: If a negative is known to yield good prints by contact on Kodak Azo Paper, Grade No. 1, then a transparency properly exposed by contact on Kodak Fine Grain Positive Film should develop to the proper contrast in approximately 3½ minutes (column 4). If the negative is printed by *projection* on Fine Grain Positive Film, development time should be reduced to 1¼ minutes (column 5). Likewise, a negative should produce good transparencies with this film and processing, if it is known to yield good prints by projection on Kodabromide Paper, Grade No. 1 (column 3).

If the contrast of the negative is judged by tests, it is suggested that the test exposures be made on Kodabromide Paper, even for transparencies printed by contact, since the intensity of the printing illumination suitable for Kodak Fine Grain Positive Film is too low for regular contact papers, such as Azo.

For higher contrast from low-contrast negatives, develop in Kodak Developer D-11 for 7 minutes.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

Fix 2 to 4 minutes at 65 to 70 F in a solution prepared from Kodak Acid Fixer or in Kodak Fixing Bath F-5. *Agitate films frequently during fixing.*

In many cases, slides of either continuous-tone or line subjects can be improved by short immersion in Kodak Farmer's Reducer or Kodak Reducer R-4a for clearing highlights.

If surface abrasion marks cause difficulty in clear areas of line copies or transparencies, it may be helpful to make the exposure through the base of the film to form the image in the depths of the emulsion. Then, when Farmer's Reducer is used to remove the abrasions, its action is less likely to affect the image densities.

Wash 20 to 30 minutes in running water; then place the film in a tray of clean water, swab it with cotton while under water, and rinse it under a faucet. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in the Kodak Hypo Clearing Agent solution for 1 or 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Toners Suitable: Kodak Sepia Toner, Kodak Sulfide Toner T-10 (sepia), Kodak Iron Toner T-11 (blue), Kodak Dye Toner T-20, Kodak Toner T-18.

Exposure and Development Recommendations for Copying

Kind of Original	Copying Indexes		Recommended Development	
			Kodak Developer	Time at 68 F with Continuous Agitation
Continuous-Tone	*Daylight* **1.2**	*Tungsten* **0.3**	D-76	3 minutes
Line	**40**	**10**	D-11	7 minutes

The above Copying Indexes are recommended for meters marked for American Standard Exposure Indexes. They are for trial exposure only. They apply to *incident-light meters* directly and to *reflected-light meters* used with the Kodak Neutral Test Card (18% gray side) at the copy board. A matte white card will serve, in which case use one-fifth the above values, e.g., 0.06 and 2.0 as tungsten values for the two conditions given above. Since these numbers are too low to appear on the meter calculator scale, multiply them by 100, and give 100 times the calculated exposure time.

Allow for the increase in the effective *f*-number caused by extended bellows.

Exposure Example for Copying: With two No. 1 photoflood lamps in satin-finished reflectors at 40 inches: Fine Grain Positive Film (developed in Kodak D-76 for continuous-tone originals) about 30 seconds at *f*/11.

Rinse, fix, wash, and dry as recommended for transparencies.

Note: Kodak Developers D-11, D-76, and Dektol (powder form), and Kodak Versatol Developer (concentrated liquid form) are available in several sizes.

Forms Available: Kodak Fine Grain Positive Film *35mm, perforated, not frame-numbered,* P402 (100 ft) rolls; and *35mm, unperforated, not frame-numbered,* P426 (100 ft) rolls on 1-inch wood cores; also some sheet-film sizes.

Kodak Fine Grain Positive Film *35mm, perforated, not frame-numbered,* P417 (100 ft) rolls on No. 10 spools.

KODAK ROYAL PAN SHEET FILM — Code Notch

A very fast, panchromatic film of moderate contrast, low graininess, wide exposure and development latitude and color sensitivity suitable for all types of indoor and outdoor illumination. It is ideal for all kinds of photography where high speed and low graininess are needed.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**200** *Tungsten*—**160**

These indexes are for meters marked for American Standard Exposure Indexes. They apply when the film is developed as recommended. When they are used with a meter, the indicated exposure settings will give, on the average, about two times the minimum exposure needed to produce top quality negatives. If these settings lead consistently to denser negatives than are desired (not the result of overdevelopment) the exposure should be cut in half, in some cases even more.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No.6 (K1)	No.8 (K2)	No.15 (G)	No.11 (X1)	No.29 (F)	No.25 (A)	No.58 (B)	No.47 (C5)	Pola-Screen
Sunlight	1.5	2*	3	4	25	8	8	6	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	3*	12	5	6	12	2.5

*For correct monochromatic rendering of colored objects.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	Lumaclad or Polished Reflectors†						
Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	180‡	160	300	370	450	1/50	250
1/50	180	160	280	330	400	1/100	180
1/100	170	150	240	290	350	1/250	110
1/200	140	140	180	220	260	1/500	80
1/400	110	110	140	170	200		

†For satin-finished reflectors, use ½ lens opening larger.
‡For 1/25 only. For open flash, use 200.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer§	Continuous Agitation (Tray)	Intermittent Agitation‖ (Tank)
For Normal Use:		
DK-60a	2¾ minutes	4 minutes
DK-50	3 minutes	5 minutes
When Less Contrast Is Desired:		
DK-50 (1:1)	5 minutes	8 minutes
For Rapid Processing:¶		
Dektol (full strength)	2 minutes	—

§These developers are available in prepared powder form in several package sizes.
‖Agitation at one-minute intervals during development.
¶Short development times may lead to unevenness. Tray processing with continuous agitation is recommended for best uniformity.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates should not be used as they may form a scum on the surface of the film.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

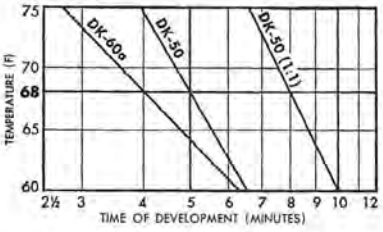
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in the Kodak Hypo Clearing Agent solution for 1 or 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight

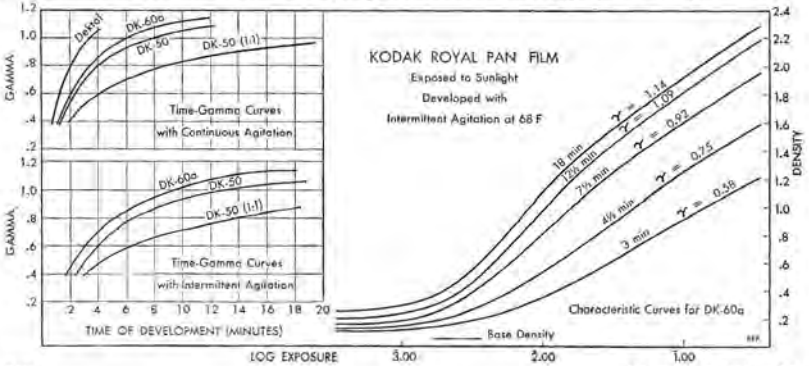
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Medium	Medium	Medium	Moderate

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK TRI-X PANCHROMATIC SHEET FILM

Code Notch

An extremely fast, panchromatic, antihalation film of moderate contrast. It is suitable for portraiture and for commercial and illustrative work whenever short exposures are required.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**200** *Tungsten*—**160**

These settings are recommended for meters marked for American Standard Exposure Indexes. Normally they provide a safety factor in exposure when the film is developed as recommended.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No.6 (K1)	No.8 (K2)	No.15 (G)	No.11 (X1)	No.13 (X2)	No.25 (A)	No.58 (B)	No.47 (C5)	Pola-Screen
Sunlight	1.5	2	2.5	5*	6	6	10	5	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	4	5*	3	10	10	2.5

*For correct monochromatic rendering of colored objects.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	Lumaclad or Polished Reflectors†						
Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	180‡	160	300	370	450	1/50	250
1/50	180	160	280	330	400	1/100	180
1/100	170	150	240	290	350	1/250	110
1/200	140	140	180	220	260	1/500	80
1/400	110	110	140	170	200		

†For satin-finished reflectors, use ½ lens opening larger.
‡For 1/25 only. For open flash, use 200.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer§	Continuous Agitation (Tray)	Intermittent Agitation‖ (Tank)
For Normal Use:		
DK-60a	4 minutes	5 minutes
DK-50	5 minutes	7 minutes
When Less Contrast Is Desired:		
DK-50	4 minutes	5 minutes

§ These developers are available in prepared powder form in several package sizes.
‖ Agitation at one-minute intervals during development.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

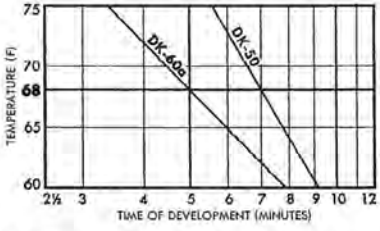
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight

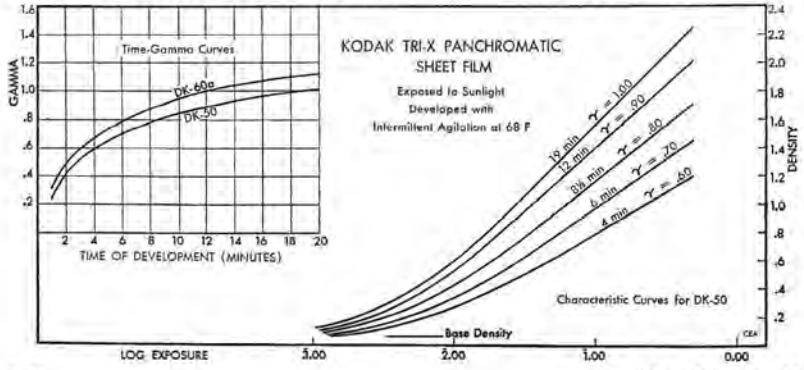
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Moderately Coarse	Medium	Moderately Low	Low

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK SUPER PANCHRO-PRESS TYPE B SHEET FILM

Code Notch

A high-speed panchromatic, antihalation film of moderately fine grain. Its high quality and great versatility make it equally suitable for portraiture, commercial, illustrative, and press photography. This film produces excellent negatives with all types of indoor and outdoor illumination.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**125** *Tungsten*—**100**

These settings are recommended for meters marked for American Standard Exposure Indexes. Normally they provide a safety factor in exposure when the film is developed as recommended.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 11 (X1)	No. 29 (F)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	1.5	2*	3	4	16	8	8	5	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	3*	8	4	8	10	2.5

*For correct monochromatic rendering of colored objects.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

Lumaclad or Polished Reflectors†

Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	140‡	130	240	300	350	1/50	200
1/50	140	130	220	260	320	1/100	140
1/100	130	120	190	230	270	1/250	90
1/200	110	110	140	180	210	1/500	65
1/400	85	85	110	130	160		

†For satin-finished reflectors, use ½ lens opening larger.
‡For 1/25 only. For open flash, use 160.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer§	Continuous Agitation (Tray)	Intermittent Agitation‖ (Tank)
For Normal Use:		
DK-60a	3½ minutes	4¼ minutes
DK-50	4 minutes	5 minutes
When Less Contrast Is Desired:		
DK-50	3½ minutes (full strength)	7 minutes (diluted 1:1)
For Rapid Processing:		
Dektol (diluted 1:1)	2½ minutes	—

§Available in prepared powder form in several package sizes.
‖Agitation at one-minute intervals during development.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 about 30 seconds with agitation at 65 to 70 F. A running water rinse can be used if an acid rinse bath is not available.

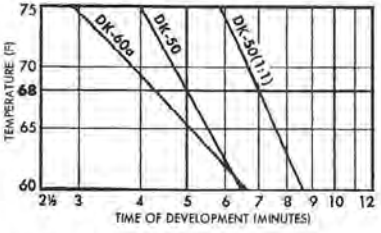
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

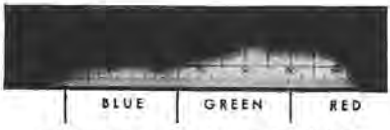
Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight



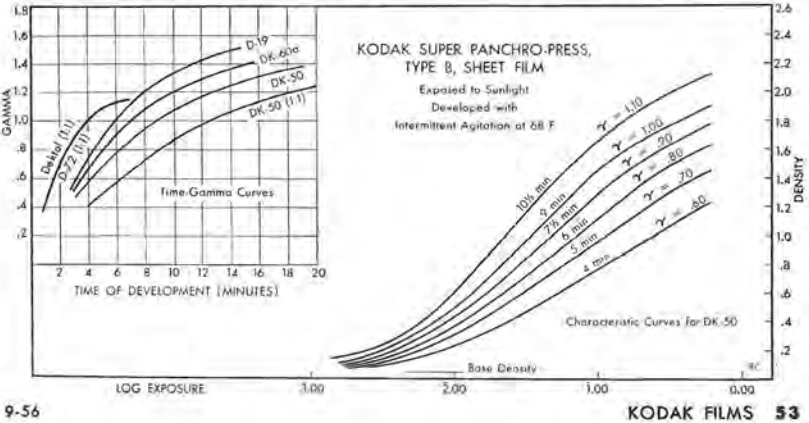
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Medium	Medium	Medium	Moderate

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK SUPER-XX PANCHROMATIC SHEET FILM

Code Notch

A high-speed, panchromatic, antihalation film of moderate contrast and low enough graininess to permit reasonable enlargement without loss of quality. It is suitable for general indoor and outdoor use, portraiture, commercial and illustrative work, and for color-separation negatives.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**100** *White-Flame Arc*—**125** *Tungsten*—**80**

These settings are recommended for meters marked for American Standard Exposure Indexes. Normally they provide a safety factor in exposure when the film is developed as recommended.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No.6 (K1)	No.8 (K2)	No.15 (G)	No.11 (X1)	No.25 (A)	No.29 (F)	No.58 (B)	No.47 (C5)	Pola-Screen
Sunlight	1.5	2*	3	4	8	16	8	5	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	3*	4	8	8	10	2.5

*For correct monochromatic rendering of colored objects.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	Lumaclad or Polished Reflectors†						
Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	120‡	120	220	260	320	1/50	180
1/50	120	120	200	230	280	1/100	130
1/100	120	110	170	200	240	1/250	80
1/200	100	100	130	160	190	1/500	55

†For satin-finished reflectors, use ½ lens opening larger.
‡For 1/25 only. For open flash, use 140.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer§	Continuous Agitation (Tray)	Intermittent Agitation‖ (Tank)
For Normal Use:		
DK-60a	3½ minutes	4¼ minutes
DK-50	4½ minutes	6 minutes
D-76	9 minutes	11 minutes
When Less Contrast Is Desired:		
DK-50 (1:1)	6 minutes	8 minutes

§Available in prepared powder form in several package sizes.
‖Agitation at one-minute intervals during development.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

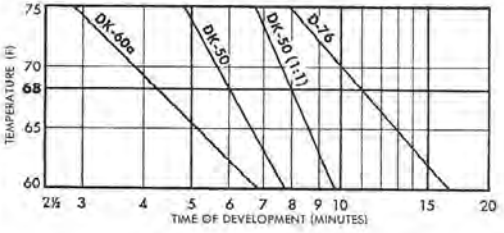
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

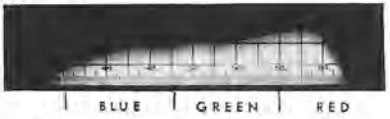
Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight



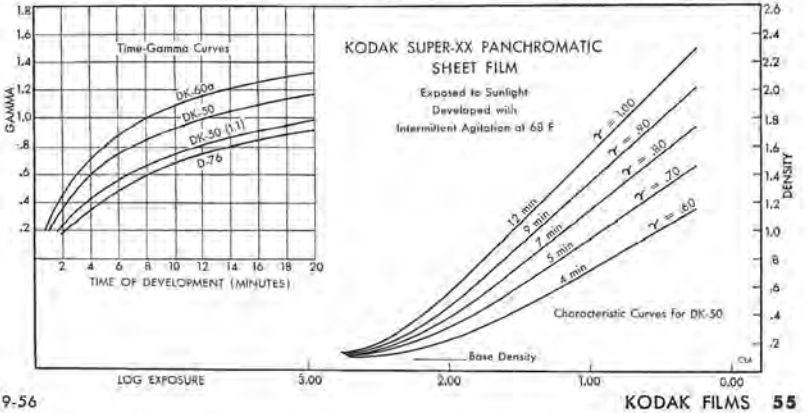
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Medium	Medium	Medium	Moderate

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK PORTRAIT PANCHROMATIC SHEET FILM

Code Notch

A panchromatic, antihalation film of moderately high speed and good exposure latitude. Its many uses include portraiture by daylight or tungsten light, landscape work, and general photography of colored objects when accurate rendering of colors in tones of gray is required.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Index: *Daylight*—**50** *Tungsten*—**32**

These settings are recommended for meters marked for American Standard Exposure Indexes. Normally they provide a safety factor in exposure when the film is developed as recommended.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No.6 (K1)	No.8 (K2)	No.15 (G)	No.11 (X1)	No.29 (F)	No.25 (A)	No.58 (B)	No.47 (C5)	Pola-Screen
Sunlight	1.5	2*	3	4	16	8	8	5	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	3*	8	4	8	10	2.5

*For correct monochromatic rendering of colored objects.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	Lumaclad or Polished Reflectors†						
Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	80‡	75	140	170	200	1/50	120
1/50	80	75	120	150	180	1/100	80
1/100	75	70	110	130	150	1/250	50
1/200	65	60	80	100	120	1/500	35

†For satin-finished reflectors, use ½ lens opening larger.
‡For 1/25 only. For open flash, use 90.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer§	Continuous Agitation (Tray)	Intermittent Agitation‖ (Tank)
For Normal Use:		
DK-60a	3½ minutes	4¼ minutes
DK-50	4 minutes	5 minutes
DK-50 (diluted 1:1)	7 minutes	9 minutes
When Less Contrast Is Desired:		
DK-50 (diluted 1:1)	5 minutes	7 minutes

§Available in prepared powder form in several package sizes.
‖Agitation at one-minute intervals during development.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

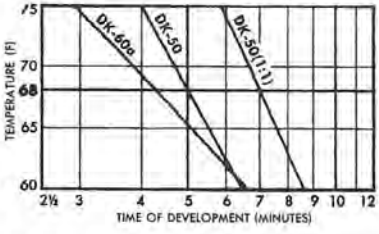
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight

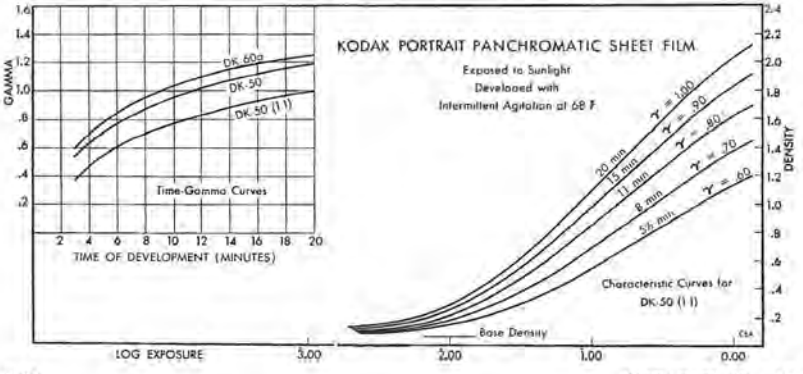
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Medium	Moderately Low	Moderately Low	Low

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK PANATOMIC-X SHEET FILM — Code Notch

A panchromatic, antihalation film of moderate speed and contrast, adapted by its fine grain to use whenever a considerable degree of enlargement is required. It is excellent for copying, and for general use in commercial work when high speed is not necessary.

Safelight: *Total darkness required.* A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds *only*, at 4 feet, after development is half completed.

Exposure

Exposure Indexes for meters marked for American Standard Exposure Indexes:

Daylight—**32** *Tungsten*—**25** *White-Flame Arc*—**40**

For Copying: These settings are recommended for trial exposures and apply to *incident-light meters* directly and to *reflected-light meters* with the Kodak Neutral Test Card (18% gray side) at the copy board. A matte white card will serve, in which case use one-fifth the above values, e.g., 5, as the tungsten value.

Allow for the increase in effective *f*-number caused by extended bellows.

Filter Factors: Increase normal exposure by filter factor given below:

KODAK WRATTEN FILTERS	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 11 (X1)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	1.5	2*	3	4	8	8	5	2.5
Photoflood or high-efficiency tungsten	1.5	1.5	2	3*	4	8	10	2.5

*For correct monochromatic rendering of colored objects.

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	LUMACLAD OR POLISHED REFLECTORS†						
BETWEEN-LENS SHUTTERS	4- to 5-inch			6- to 7-inch		FOCAL-PLANE SHUTTERS	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	70‡	65	120	150	180	1/50	100
1/50	70	65	110	130	160	1/100	70
1/100	65	60	95	110	140	1/250	45
1/200	55	55	70	90	100	1/500	32

†For satin-finished reflectors, use ½ lens opening larger.
‡For 1/25 only. For open flash, use 80.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

KODAK DEVELOPER	Continuous Agitation (Tray)	Intermittent Agitation‖ (Tank)
For Normal Use:		
D-76§	9 minutes	11 minutes
DK-50§	3½ minutes	4¼ minutes
DK-60a§	3 minutes	—
For Minimum Graininess:		
Microdol§	11 minutes	14 minutes
DK-20	12 minutes	16 minutes

§These developers are available in prepared powder form in several package sizes.
‖Agitation at one-minute intervals during development.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

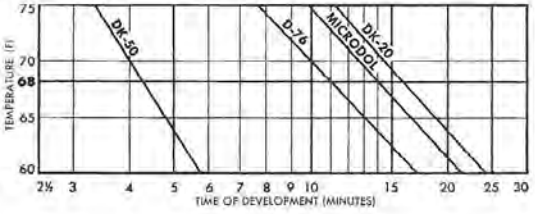
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight

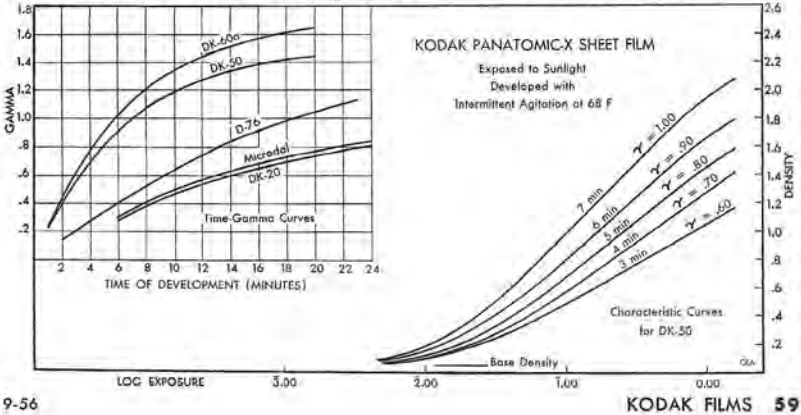
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Fine	High	High	Great

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK ROYAL ORTHO SHEET FILM — Code Notch

A very fast, orthochromatic film of moderate contrast and medium graininess. It is well suited to both press photography and portraiture, as well as many types of commercial and illustrative photography. The orthochromatic sensitivity aids in securing good rendering of flesh tones in flash pictures and is also particularly suitable for portraits of men.

Safelight: Use a Kodak Safelight Filter, Wratten Series 2 (dark red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet.

Exposure

Exposure Index: *Daylight*—**200** *Tungsten*—**125**

These indexes are for meters marked for American Standard Exposure Indexes. They apply when the film is developed as recommended. When they are used with an exposure meter, the indicated exposure settings will give, on the average, about two times the minimum exposure needed to produce top-quality negatives. If these settings lead consistently to denser negatives than are desired (not the result of overdevelopment), the exposure should be cut in half, in some cases even more.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 58 (B)	No. 47 (C5)	No. 47B	Pola-Screen
Sunlight	2	2	3	6	5	6	2.5
Photoflood or high-efficiency tungsten	1.5	2	3	5	8	10	2.5

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	Lumaclad or Polished Reflectors*						
Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	160†	140	260	350	400	1/50	220
1/50	160	140	240	300	350	1/100	160
1/100	140	130	210	260	300	1/250	100
1/200	130	120	160	190	240	1/500	75
1/400	100	90	120	160	180		

*For satin-finished reflectors, use ½ lens opening larger.
†For 1/25 only. For open flash, use 180.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer‡	Continuous Agitation (Tray)	Intermittent Agitation§ (Tank)
For Normal Use:		
DK-60a	2¾ minutes	4 minutes
DK-50	3 minutes	5 minutes
When Less Contrast Is Desired:		
DK-50 (1:1)	5 minutes	8 minutes
For Rapid Processing:‖		
Dektol (full strength)	2 minutes	—

‡These developers are available in prepared powder form in several package sizes.
§Agitation at one-minute intervals during development.
‖Short development times may lead to unevenness. Tray processing with continuous agitation is recommended for best uniformity.

Note: Kodak Developer DK-20 and other developers containing silver halide solvents such as thiocyanates or thiosulfates should not be used as they may form a scum on the surface of the film.

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

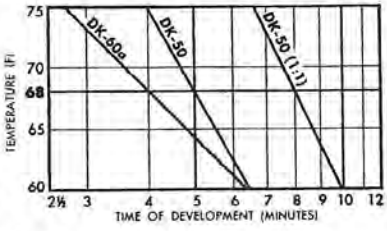
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

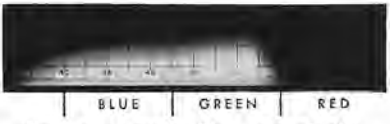
Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight



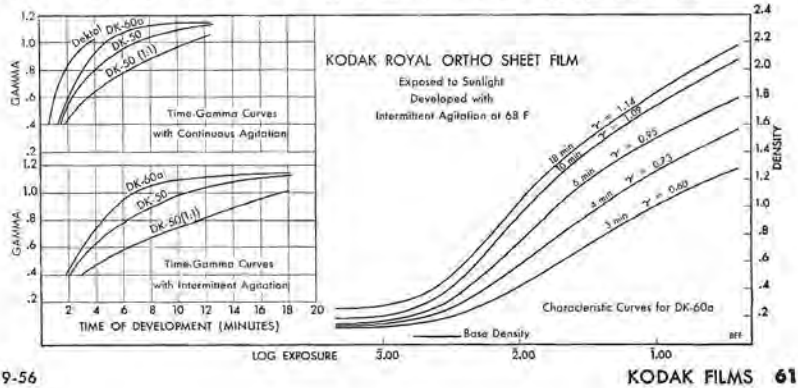
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Medium	Medium	Medium	Moderate

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK SUPER SPEED ORTHO PORTRAIT SHEET FILM

Code Notch

A moderately fast, orthochromatic, antihalation film with a long scale of gradation giving good tonal separation even in extreme highlights and deep shadows. It can be used with all normal types of lighting, and is suitable for use under a wide range of studio conditions.

Safelight: Use a Kodak Safelight Filter, Wratten Series 2 (dark red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet.

Exposure

Exposure Index: *Daylight*—**50** *Tungsten*—**25**

These settings are recommended for meters marked for American Standard Exposure Indexes. Normally they provide a safety factor in exposure when the film is developed as recommended.

Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filters	No. 6 (K1)	No. 8 (K2)	No. 15 (G)	No. 58 (B)	No. 47 (C5)	Pola-Screen
Sunlight	2	2.5	5	8	3	2.5
Photoflood or high-efficiency tungsten	1.5	2	3	5	4	2.5

Flash Exposure Guide Numbers: To get *f*-number, divide guide number by lamp-to-subject distance in feet, taken to a point midway between nearest and farthest details of interest. In small white rooms, use one stop smaller.

	Lumaclad or Polished Reflectors*						
Between-Lens Shutters	4- to 5-inch			6- to 7-inch		Focal-Plane Shutters	6- to 7-inch
	No. 8	SM, SF	No. 5, 25	No. 11, 40	No. 2, 22		No. 31, 2A
Open, 1/25	70†	65	120	150	180	1/50	100
1/50	70	65	110	130	160	1/100	70
1/100	65	60	95	110	140	1/250	45
1/200	55	55	70	90	100	1/500	32

*For satin-finished reflectors, use ½ lens opening larger.
†For 1/25 only. For open flash, use 80.

Caution: Since lamps may shatter when flashed, the use of a Kodak Flashguard or similar shield over the reflector is recommended. *Do not flash lamps in an explosive atmosphere.*

Processing

Develop at 68 F for approximate times given below:

Kodak Developer‡	Continuous Agitation (Tray)	Intermittent Agitation§ (Tank)
For Normal Use:		
DK-60a	3½ minutes	4¼ minutes
DK-60a (diluted 1:1)	6 minutes	8 minutes
DK-50	4 minutes	5 minutes
DK-50 (diluted 1:1)	8 minutes	10 minutes
When Less Contrast Is Desired:		
DK-60a (diluted 1:1)	4½ minutes	6 minutes
DK-50 (diluted 1:1)	5 minutes	7 minutes

‡These developers are available in prepared powder form in several package sizes.
§Agitation at one-minute intervals during development.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F about 30 seconds with agitation. A running water rinse can be used if an acid rinse bath is not available.

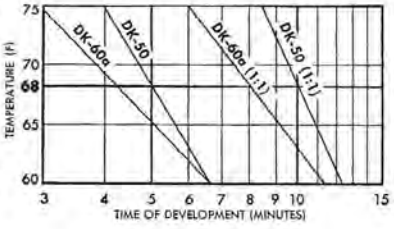
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Color Sensitivity: Orthochromatic.

Spectrogram to Sunlight

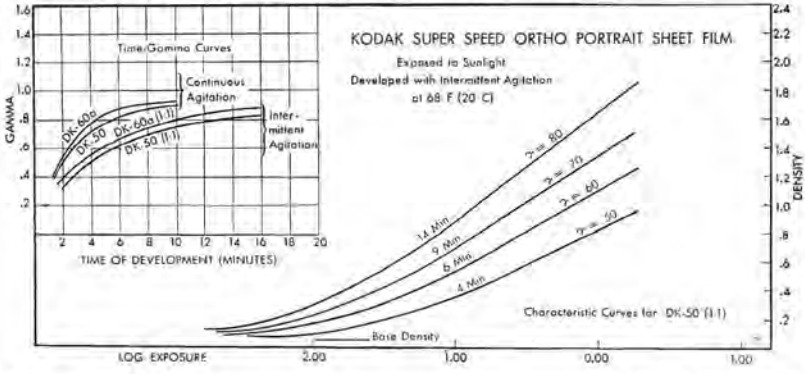
Spectrogram to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Moderately Coarse	Moderately Low	Moderately Low	Low

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: For average product and average processing.



KODAK COMMERCIAL, COMMERCIAL MATTE, AND COMMERCIAL ORTHO SHEET FILMS

Kodak Commercial Film is a blue-sensitive, antihalation film of medium speed and capable of giving moderately high contrast. It is suitable for copying continuous-tone subjects, for duplicating by means of an intermediate step, photogravure, and other work not requiring green or red sensitivity.

Kodak Commercial Matte Film has a matte emulsion and a matte back to permit pencil retouching on either or both sides without retouching fluid.

Kodak Commercial Ortho Film is an orthochromatic, antihalation film of medium speed, capable of giving moderately high contrast. It is suitable for commercial work when red sensitivity is not required (as in copying some types of colored continuous-tone originals or photographing light-colored furniture).

Safelight: Commercial Film (also Matte) requires a Kodak Safelight Filter, Wratten Series 1 (red); and the Commercial Ortho, a Kodak Safelight Filter, Wratten Series 2 (dark red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet.

Exposure

Exposure Indexes for meters marked for American Standard Exposure Indexes:

	Daylight	*Tungsten*	*White-Flame Arc*
COMMERCIAL (ALSO MATTE)	**20**	**6**	**16**
COMMERCIAL ORTHO	**32**	**10**	**25**

For Copying: These settings apply to *incident-light meters* directly and to *reflected-light meters* with the Kodak Neutral Test Card (18% gray side) at the copy board. A matte white card will serve, in which case use one-fifth the above values, e.g., 1.2 and 2 as tungsten values for the two films, respectively.

Allow for the increase in effective *f*-number caused by extended bellows.

Filter Factors: Increase normal exposure by filter factor given below:

KODAK WRATTEN FILTERS		No. 6 (K1)	No. 8 (K2)	No. 9 (K3)	No. 15 (G)	No. 58 (B)	No. 47 (C5)	No. 47B	Pola-Screen
Commercial Ortho	Sunlight	2.5	8	12	16	25	3	—	2.5
	Tungsten	2	4	6	8	12	3	5	2.5
	White-Flame Arc*	5	20	30	40	60	4	4	—

*With the positive carbon in the lower position for direct-current arc lamps.

Processing

Develop at 68 F for approximate times given below. These recommendations are for copying work, with exposure times of the order of 10 seconds.

KODAK DEVELOPER†		Continuous Agitation (Tray)	Intermittent Agitation‡ (Tank)
Commercial (also Matte)	DK-50 (full strength)	2½ minutes	—
	DK-50 (1:1)	4 minutes	5 minutes
	D-11	8 minutes (maximum contrast)	—
Commercial Ortho	DK-50 (full strength)	3½ minutes	4¼ minutes
	DK-50 (1:1)	4½ minutes	6 minutes
	D-11	8 minutes (maximum contrast)	—

†These developers are available in prepared powder form in several package sizes.
‡Agitation at one-minute intervals during development.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 about 30 seconds, or in Kodak Stop Bath SB-1a at least 10 seconds, with agitation, at 65 to 70 F. A running water rinse can be used if an acid rinse bath is not available.

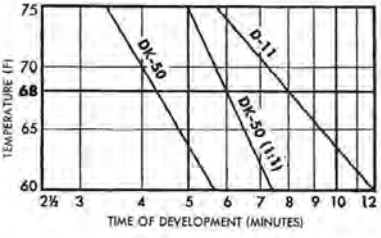
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash for 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Notching Code:

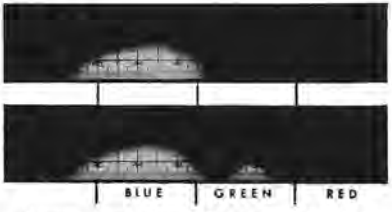
Commercial | Commercial Matte | Commercial Ortho

Sensitometric Data

Color Sensitivity:

COMMERCIAL (ALSO MATTE)
Blue sensitive only

COMMERCIAL ORTHO
Orthochromatic



Spectrograms to Tungsten Light

Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Commercial: Fine	Medium	Medium	Moderate
Commercial Ortho: Medium	Moderately Low	Medium	Moderate

*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: See page 68.

KODAK CONTRAST PROCESS ORTHO, AND CONTRAST PROCESS PANCHROMATIC SHEET FILMS

KODAK CONTRAST PROCESS ORTHO FILM is a very fine-grain orthochromatic, antihalation film of very high contrast. It is capable of giving sharp separation of light and dark tones in copies of written or printed matter and other line originals (black-and-white or having yellow, light-blue, or green backgrounds).

KODAK CONTRAST PROCESS PANCHROMATIC FILM is a fine-grain, panchromatic, antihalation film of very high contrast. It gives sharp separation of light and dark tones in copies of line originals and written or printed matter. It is suitable for all types of colored originals and can be used with all filters.

Safelight: Contrast Process Ortho requires the Kodak Safelight Filter, Wratten Series 1 (red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet. Contrast Process Panchromatic requires *total darkness*. A Kodak Safelight Filter, Wratten Series 3 (dark green), in a suitable safelight lamp with a 15-watt bulb can be used for a few seconds at not less than 4 feet.

Exposure

Exposure Indexes for meters marked for American Standard Exposure Indexes. They take into account the ultraviolet absorption of average process lenses.

	Tungsten	*White-Flame Arc*
CONTRAST PROCESS ORTHO	**50**	**100**
CONTRAST PROCESS PANCHROMATIC	**80**	**100**

These settings are recommended for trial exposures in copying. They apply to *incident-light meters* directly and to *reflected-light meters* used with the Kodak Neutral Test Card (18% gray side) at the copy board. A matte white card will serve, in which case use the marked figure nearest one-fifth the above values, e.g., 10 and 16 as tungsten values for the two films respectively.

Allow for the increase in effective *f*-number caused by extended bellows.

Filter Factors: Increase normal exposure by filter factor given below:

KODAK WRATTEN FILTERS		No.6 (K1)	No.8 (K2)	No.9 (K3)	No. 15 (G)	No. 29 (F)	No. 25 (A)	No. 58 (B)	No. 47 (C5)	No. 47B	Pola-Screen
Contrast Process Ortho	White-Flame Arc*	2	3	4	6	—	—	6	6	8	2.5
	Tungsten	1.5	2	2	3	—	—	4	8	12	2.5
Contrast Process Panchromatic	White-Flame Arc*	—	2	2.5	3	32	10	10	10	12	2.5
	Tungsten	—	1.5	1.5	1.5	10	5	6	16	24	2.5

*With the positive carbon in the lower position for direct-current arc lamps.

Processing

Develop at 68 F for approximate times given below:

KODAK DEVELOPER†	Continuous Agitation (Tray)	Intermittent Agitation‡ (Tank)
D-11 (High contrast)	4 minutes	5 minutes
D-8 (Max. contrast) (2:1)§	2 minutes	—

†These developers are available in prepared powder form in several package sizes.
‡Agitation at one-minute intervals during development.
§2 parts stock solution, 1 part water. Shake stock solution bottle well before diluting D-8 Developer for use. Do not use D-8 Developer above 70 F.

Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 about 30 seconds, or Kodak Stop Bath SB-1a at least 10 seconds, with agitation, at 65 to 70 F. A running water rinse can be used if an acid rinse bath is not available.

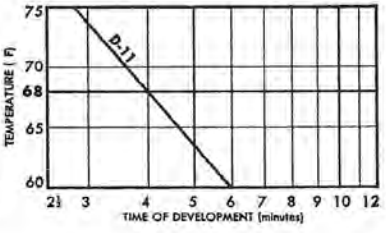
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Kodak Hypo Clearing Agent can be used after fixing to reduce washing time or conserve water or both. First, remove excess hypo by rinsing the film in water for 30 seconds. Then bathe the film in Kodak Hypo Clearing Agent solution for 1 to 2 minutes, with moderate agitation, and wash it for 5 minutes using a water flow sufficient to give at least one complete change of water in 5 minutes.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Notching Code:

Contrast Process Ortho

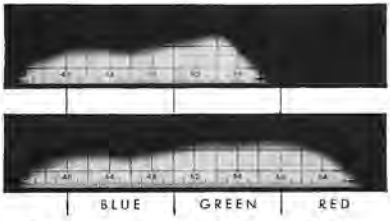
Contrast Process Panchromatic

Sensitometric Data

Color Sensitivity:

CONTRAST PROCESS ORTHO
Orthochromatic

CONTRAST PROCESS PANCHROMATIC
Panchromatic, Type B



Spectrograms to Tungsten Light

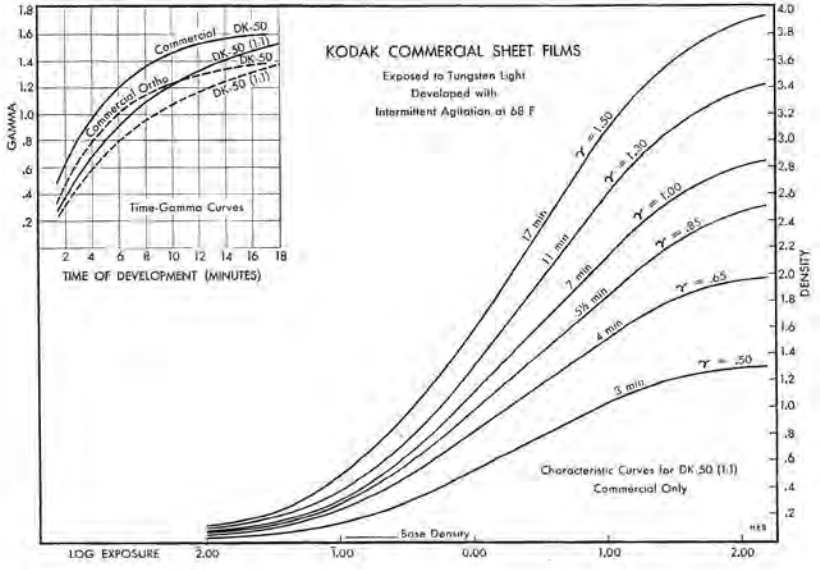
Definition:

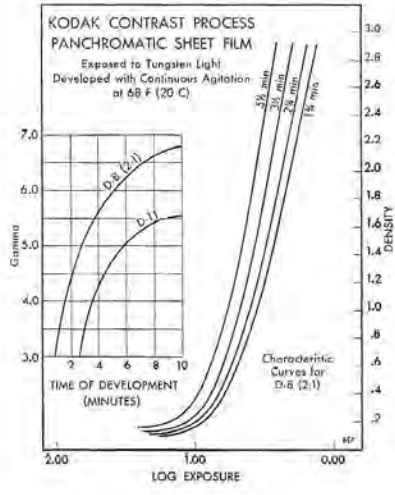
Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Fine	Very High	Extremely High	Extremely Great

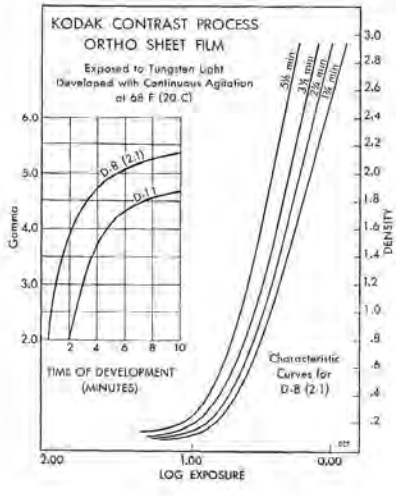
*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: See page 68.

Sensitometric Curves: For average product and average processing.







Filter Factors: Increase normal exposure by filter factor given below:

Kodak Wratten Filter	No. 8 (K2)	No. 15 (G)	No. 25 (A)	No. 58 (B)	No. 47 (C5)
Sunlight	2.0	2.5	8	8	6
Tungsten	2.0*	2.0	5	8	12

*For the roll film, use 1.5.

Processing

Develop at 68 F for approximate times given below:

Kodak Developers*	Tray (Continuous Agitation)	Small Tank (30 sec agitation)	Large Tank (1 min agitation)
For Normal Use:			
DK-50	5 minutes	6 minutes	7 minutes
DK-60a	4½ minutes	5 minutes	6 minutes
Extended Development:			
DK-50	8 minutes	9 minutes	10 minutes
DK-60a	7 minutes	8 minutes	9 minutes

For exposures made with high-voltage electronic speed flash lamps, it may be desirable to develop somewhat longer (up to 50%) than the times above.

*These developers are available in prepared powder form in several package sizes.

Note: Fresh developers should be used, as partially exhausted developers may produce a deposit of dichroic fog. This can usually be swabbed off while the film is still wet. For best uniformity, tray development is recommended. Some developers other than DK-50 or DK-60a may reduce the emulsion speed, increase the fog, or both. If the user wishes to try other developers, a comparison should be made with the developers recommended above.

Kodak Developer DK-20 and other developers containing silver halide solvents, such as thiocyanates or thiosulfates, should not be used, as they may form a scum on the surface of the film.

Fog: A slight fog density is normal.

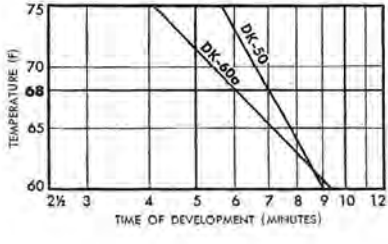
Rinsing: An acid stop bath must be used. Rinse in Kodak Indicator Stop Bath or Kodak Stop Bath SB-5 at 65 to 70 F for 30 seconds to one minute with agitation. Drain the film for 2 to 5 seconds before immersing it in the fixer.

Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 3 to 5 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing and do not overwork the fixing bath.* Fixer capacity is approximately 100 8 x 10-inch sheets (or their equivalent in other sizes) per gallon of Kodak Acid Fixer or Kodak F-5 and 120 8 x 10-inch sheets (or their equivalent in other sizes) per gallon of Kodak Rapid Fixer (1:3).

Wash 20 to 30 minutes in running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois or a soft viscose sponge.

Dry in a dust-free place.

Time-Temperature Development Chart: Showing developing times at various temperatures corresponding to certain recommended times at 68 F. For other times at 68 F, additional lines can be drawn parallel to the existing diagonal line for the developer concerned. *Best results are obtained at 65 to 70 F.*



Sensitometric Data

Spectrogram to Sunlight

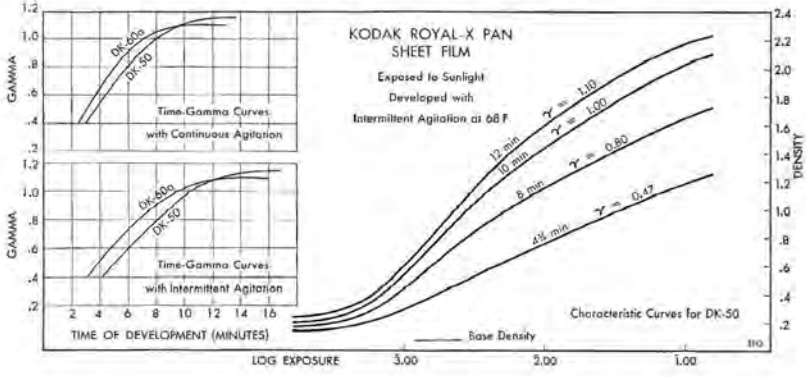
Spectrogram to Tungsten Light

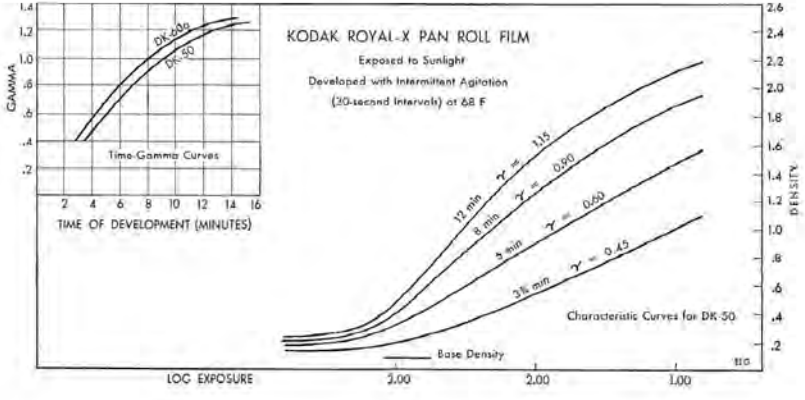
Definition:

Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Coarse	Moderately Low	Medium	Low

*For good quality negatives of suitable subjects.

Sensitometric Curves: For average product and average processing.





FROM EXPOSURE TO NEGATIVE WITH

KODAK CHEMICAL PREPARATIONS

DEVELOPERS

Kodak DK-50: Extremely popular with commercial and portrait photographers, DK-50 keeps well with use, has high capacity, and can be used with or without dilution in a tank or tray.

Kodak DK-60a: A fast-acting developer recommended for general use. Produces brilliant negatives with short development time.

Kodak D-76: Unsurpassed by any other developer in ordinary use for its ability to give full emulsion speed and maximum shadow detail with normal contrast, D-76 has long been a favorite of pictorialists.

Kodak Microdol: No other developer can match Microdol for fine-grain results with minimum effect on emulsion speed and with relatively short time of development. Produces extremely low fog level.

STOP BATH

Kodak Indicator Stop Bath: Bottled in concentrated liquid form, Indicator Stop Bath is yellow before use, turning purple when exhausted. Simply dilute for use with films, plates, and papers.

FIXING BATHS

Kodak Acid Fixer: A single-powder preparation containing fixer and hardener, this rapid, long-lasting, high-capacity fixer can be used for films, plates, and papers. It is packed in convenient darkroom sizes.

Kodak Rapid Fixer (with Hardener): Compounded for very rapid fixing and hardening of films and plates when diluted 1:3. For prints, dilute 1:7. This concentrated easy-to-prepare hardening fixing bath has long life and high-capacity.

OTHER PREPARATIONS

Additional Kodak Chemical preparations recommended for convenience in use or for improving negative quality include: Hypo Clearing Agent, Chromium Intensifier, Farmer's Reducer, Reducer and Stain Remover, Anti-Calcium, Anti-Fog No. 1, Anti-Foam, Desensitizer, Photo-Flo Solution, and others. See your Kodak dealer for complete information.

THE KODAK MASTER PHOTOGUIDE: A 34-page, pocket-size booklet containing on-the-spot picture-taking information for still pictures. Convenient dial computers, tables and brief text present practical data on exposure, filters, depth of field, use of Kodak Portra and Telek Lenses, and other essentials of general and special application.

THE KODAK PHOTOGRAPHIC NOTEBOOK: An aid to keeping photographic notes, other Kodak supplementary literature. Each notebook contains: (1) a list of special photographic articles which are available on request from the Sales Service Division, and Kodak booklets on sale at Kodak dealers; (2) notebook paper; and (3) tabbed separator pages for index purposes.

THE KODAK REFERENCE HANDBOOK: Practical information in Data Book form arranged in a convenient two-volume set. Volume 1 contains: (1) Flash Technique; (2) Kodak Lenses, Shutters, and Portra Lenses; (3) Kodak Films; and (4) Filters and Pola-Screens. Volume 2 contains: (1) Enlarging With Kodak Materials and Equipment; (2) Kodak Papers; (3) Processing Chemicals and Formulas; and (4) Copying.

THE KODAK COLOR HANDBOOK: Devoted to color photography of professional caliber. Consists of four Kodak Color Data Books: (1) Color As Seen and Photographed; (2) Color Photography Outdoors; (3) Color Photography in the Studio; and (4) Kodak Color Films. These books provide authoritative information on taking still pictures in color with Kodak materials.

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