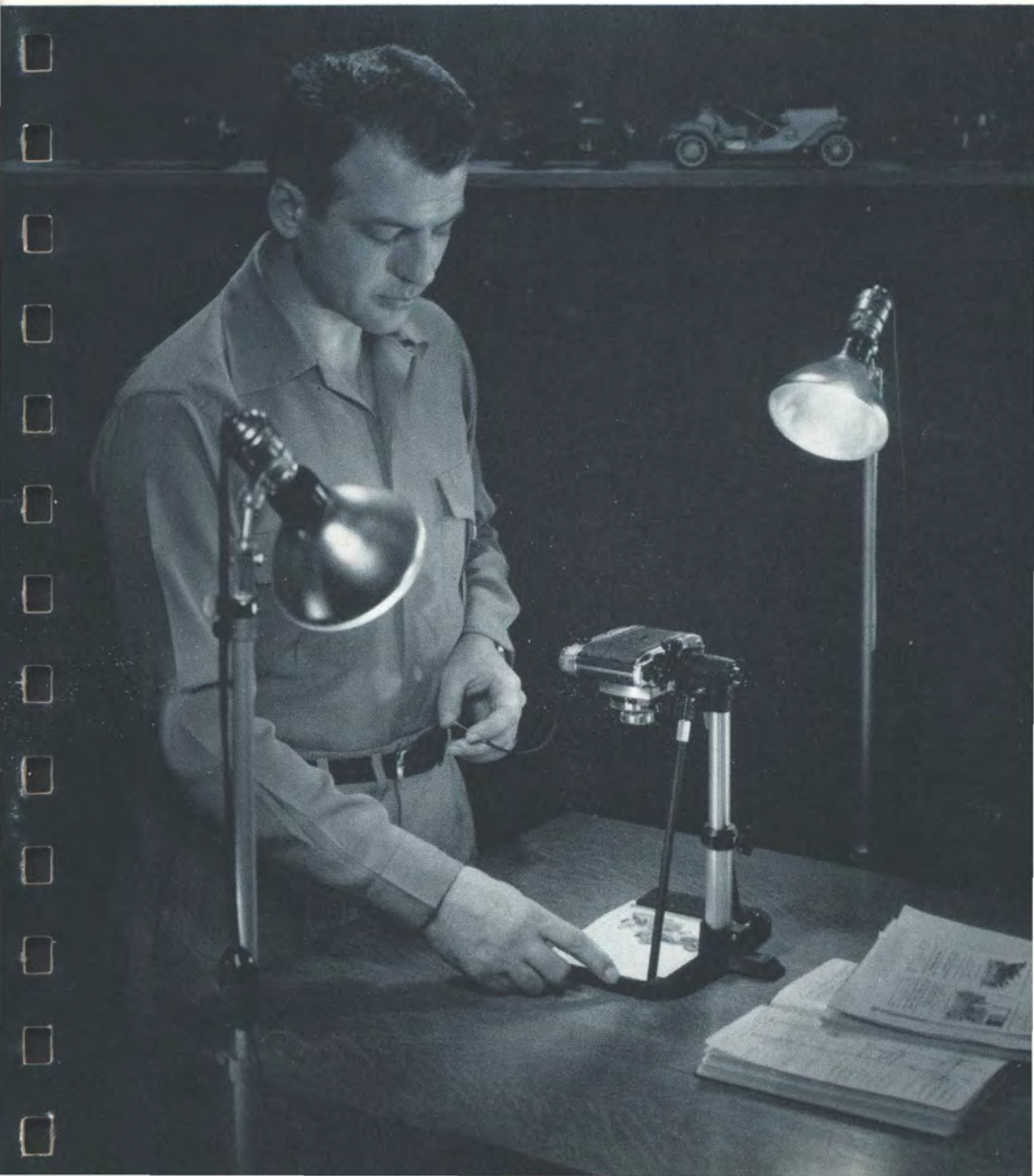
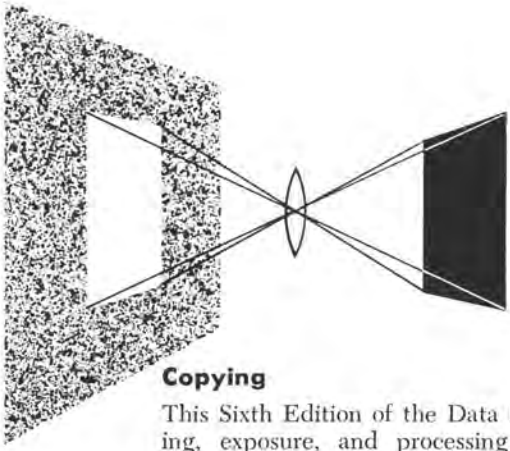
KODAK DATA BOOK

6th Edition

50¢

COPYING





SIXTH EDITION

COPYING

FIRST 1958 PRINTING

Copying

This Sixth Edition of the Data Book on Copying contains lighting, exposure, and processing recommendations for copying graphs, diagrams, negatives, prints, paintings, fabrics, and other materials. Information is included on new Kodak black-and-white and color materials suitable for use in copying. Copying techniques and equipment are discussed in some detail, and a brief summary of existing restrictions is given.

This edition provides owners of the Kodak Reference Handbook with a replacement unit for any earlier edition of the Copying section.

Copying 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 insertion in a metal-ring binder.

The Kodak Handbooks

Some of the Data Books, on particular subjects, have been bound in attractive, metal-ring, stiff-covered binders to form reference handbooks. Each handbook contains the basic Data Books relating to one specific field, tabbed separators for indexing, space for additional Data Books and free Kodak literature, and a registration card. Filling out and returning the card contained in the *Kodak Reference Handbook, Volumes 1 and 2*, the *Kodak Color Handbook*, the *Kodak Professional Handbook*, the *Kodak Industrial Handbook*, and the *Kodak Photographic Notebook* entitles you to receive an illustrated newsletter which is 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 for sale by your Kodak dealer, so that you can keep your handbook up-to-date.

COPYING

SIXTH EDITION, 1958

COPYING

PHOTOGRAPHERS are finding that a knowledge of copying technique is valuable in their work. Copying by photography provides accurate reproductions of photographic prints, drawings, sketches, daguerreotypes, manuscripts, typed and printed matter, and many similar subjects. A knowledge of copying technique, therefore, extends the art and proficiency of the amateur and in many cases increases the business of the professional.

Elaborate apparatus is not necessary; the photographer will probably find that his equipment is suitable or can be adapted to this type of work. Varieties of Kodak cameras, enlargers, and accessories are available for copying, and they are described here.

To meet the specialized requirements of the diverse subject matter and copying methods, the Eastman Kodak Company manufactures over twenty different sensitized products. With the uniformity of quality and ease of manipulation of Kodak materials, the photographer can easily produce copies of good quality, once his technique has been established.

In the following pages, each phase of the general preparatory work for copying, such as placement and lighting of the original, camera alignment, and exposure determination, is discussed fully. The various types of originals most frequently encountered are considered and the most suitable negative materials recommended, and any special requirements in handling or in preparation are mentioned. The use of Kodachrome, Kodacolor, Kodak Ektachrome and Ektacolor Films to copy colored originals and the use of ultraviolet and infrared illumination to photograph questioned or illegible documents are also dealt with. Data Sheets for Kodak copying materials follow the text; these include sensitometric curves, filter factors, development recommendations, exposure indexes, and other information.

A specialized technique known as "microfilming" is used for making greatly reduced copies of documents, records, newspapers, and similar originals. The copies are usually made on 35mm or 16mm width film, and are read by projecting enlarged images onto a screen or by making enlarged prints. Among the advantages of microcopies are the saving in space required for storage, the low cost involved, and the convenience in handling. The general copying techniques described here apply both to copying with larger cameras and to microfilming.

Reflex copying, also described, is a fast, economical, and accurate method of copying letters, business forms, engineering drawings, etc. No camera is required. It is a contact printing process for which certain Kodak printing papers are adaptable. For business, industrial, and, in fact, all but occasional use, however, suitable Kodagraph materials are recommended; detailed information on them is available in the Kodak Data Book *How to Use Kodagraph Reproduction Materials.*

EXPLANATION OF COPYING TERMS

COPYING terms as used in this book are defined here.

To Copy. To reproduce photographically (usually in a camera) subjects such as photographs, drawings, book pages, or paintings.

Original. The material to be copied.

Line Original. Material such as line drawings or printed matter. In these cases there are only two tones, a dark one and a light one.

Continuous-Tone Original. Material which has gradation of tones between the extremes of light and dark. Photographs and paintings are examples.

Halftone Original. A photomechanical reproduction of a continuous-tone original. Such a reproduction is made up of dots.

Reproduction. The photograph obtained by copying. Also called the "copy." (The term "copy" is used by photomechanical workers to designate the material to be copied.)

Monochrome. Single color. In a monochrome print, such as a photographic print—either black-and-white or sepia—the various tones are represented by different shades of one color.

Reflex Copying. Method of obtaining a laterally reversed reproduction by contact printing through the sensitized material.

Films, Plates, and Papers

KODAK SHEET FILMS

Kodak Contrast Process Panchromatic Film produces extremely high contrast and can be used with filters to copy colored line originals.

Kodak Contrast Process Ortho Film produces extremely high contrast and can be used for copying some types of colored originals; yellow filters can be used with it.

Kodak Commercial (and Matte) Film is suitable for copying black-and-white continuous-tone originals, such as photographs.

Kodak Commercial Ortho Film is recommended for copying many types of colored, continuous-tone originals, and for other commercial work which does not require a red-sensitive film.

Kodak Panatomic-X Film is a fine-grain panchromatic film of moderate speed which is excellent for copying black-and-white and colored continuous-tone originals.

Kodak Infrared Film is valuable in examining overprinted or charred documents, altered paintings, etc.

Kodak Ektachrome Film, Type B, is useful for copying colored originals. It can be processed by the user to produce positive color transparencies for viewing by transmitted light or projection.

Kodak Ektacolor Film, Type B, is a color negative film designed for development by the user. With *Kodak Pan Matrix Film* the Ektacolor negatives can be printed efficiently by the Kodak Dye Transfer Process to produce full-color prints on paper.

Kodak Super-XX Panchromatic Film is recommended for making color-separation negatives directly from colored originals. With *Kodak Matrix Film,* color prints can be made by the Kodak Dye Transfer Process.

*Kodak Gravure Copy Film** is an orthochromatic film especially suited for copying continuous-tone originals.

Kodak Ektacolor Film, Type S, is a film designed for making color negatives at exposure times of 1/25 second or shorter. It is processed by the user. The Ektacolor negatives can be used to produce full-color prints on *Kodak Color Print Material, Type C.*

Kodalith Ortho Film, Type 2, Type 3, Kodalith Super Ortho Film,

*Available from Kodak Graphic Arts dealers.

and Kodalith Pan Film are extremely high contrast films suitable for copying line originals.

KODAK PLATES

Kodak Process Plate is a blue-sensitive and rather slow high-contrast plate for copying black-and-white line originals.

Kodak Panchromatic and Panchromatic Matte Plates are well adapted to copying colored continuous-tone originals.

Kodak 33 Plate is recommended for copying black-and-white continuous-tone originals.

Kodak 33 Matte Plate includes a matte surface for retouching.

Kodak Infrared Sensitive Plate resembles Kodak Infrared Film.

Kodalith Ortho Plate is an extremely high contrast plate.

KODAK ROLL FILMS AND FILM PACKS

Kodak Panatomic-X Film in rolls can be used with normal development to produce good copies of colored and black-and-white continuous-tone originals. Line copy negatives can be made by fully developing this film in Kodak Developer D-11.

Kodak Verichrome Pan Film in rolls is suitable for copying continuous-tone originals, both black-and-white and colored. Fair negatives of line originals can be made by full development of this film in Kodak Developer D-11.

Kodacolor Film, in rolls, is a color negative film which is suitable for copying colored originals. It can be developed and printed by the user or by a processing laboratory.

Kodak Ektachrome Film, Type F, in rolls, is designed for reversal processing by the user or by a processing laboratory to provide positive color transparencies.

KODAK FILMS FOR MINIATURE CAMERAS

Kodak Plus-X 135 Film is suited to copying continuous-tone originals, both colored and black-and-white, with normal development.

Kodak Micro-File Film 135 is an extremely high-contrast panchromatic film especially suited to line copy work—colored or black-and-white. It has the finest grain and highest resolving power of all the Kodak films in this size and is therefore suitable for copying originals having very fine detail. With suitable equipment, it can be used for copies at a high degree of reduction.

Kodak Fine Grain Positive Film is a non-color-sensitive material

which is useful for black-and-white copying. By proper choice of developer, the degree of development can be varied to make it suitable for either continuous-tone or line copy work.

Kodak Infrared Film 135 resembles the other infrared materials listed here and is available in 20-exposure rolls for 35mm cameras.

Kodak Ektachrome Film, Type F, is supplied in 135 and 828 sizes with the same characteristics as Ektachrome roll film described above.

Kodachrome Film for cameras taking 135 or 828 film provides color transparencies which can be duplicated or used to obtain Kodachrome or Kodacolor Prints. It is not designed for processing by the user and should be developed by a qualified processing laboratory.

KODAK CONTACT PRINTING PAPERS

In addition to their normal function of providing positive prints from negatives, many Kodak papers lend themselves to copying by the reflex method described later. Kodagraph Contact, Kodagraph Repro-Negative, and Kodagraph Autopositive Papers are superior for copy work. The other papers listed produce satisfactory copies where a glossy, single-weight, or Ad-Type Paper is required.

*Kodagraph Autopositive Paper** is an extremely high-contrast material of low sensitivity which yields positive photocopies from positive originals upon exposure to yellow or orange light followed by conventional photographic processing.

*Kodagraph Repro-Negative Paper** is a low-speed, medium high-contrast material for making positive photocopies from negative originals or negative copies from positive originals. It can be handled under normal room illumination.

*Kodagraph Contact Paper**, both Standard and Extra-Thin, is a very high-contrast, very high-density paper especially designed for use on standard office-type contact printing equipment.

Kodak Velox Paper, F-5, is a high-contrast, fast, contact printing paper on glossy single weight stock.

Kodak Azo Paper, F-5, has about half the speed of Velox. It is a high-contrast, glossy contact paper on single weight stock.

Kodak Ad-Type Paper, A-4, for contact printing has the same speed as Azo. It is coated on lustre, light-weight stock which is designed to fold without cracking.

*Available from Kodak Graphic Arts and Industrial dealers.

Equipment

MANY different types of equipment can be used for copying. The choice depends on the quantity and class of work to be done, the type of copy desired, etc. Copying setups range from the simple roll-film camera and enlarger stand arrangement to elaborate, specialized apparatus manufactured especially for large-volume copying. Between these extremes is a variety of permanent and semipermanent assemblies for use with either a special camera for copying or a camera which is also used for other work.

Equipment required for copying, in addition to a camera, includes an easel to hold the material to be copied, a lighting arrangement that will give even illumination, and some provision for aligning the camera to obtain critical focus and an undistorted copy image. Copying equipment can be arranged horizontally or vertically.

A horizontal arrangement lends itself to the handling of large-size originals and the use of mass-production copying methods, while a vertical setup occupies less floor space and is preferred for copying material of uniform size up to about 11 by 14 inches. Either style can be built easily. A vertical setup can be adapted from a regular enlarger stand, provided the enlarger has a means of conveniently substituting a camera for the enlarging head.

COPYING STANDS

Vertical Stand. For the photographer who does only occasional copying, the use of an enlarger-stand assembly like that provided for a Kodak Flurolite Enlarger, plus a camera will prove practical. Correct alignment of the camera can be accomplished by using a spirit level and a plumb bob.

Horizontal Stand. A permanent horizontal copying stand similar to that illustrated on page 6 can be built. No dimensions are given as these depend upon the type of camera and lens used and the maximum size of originals to be copied. The block on which the camera is mounted should be high enough to place the lens axis at the center of the easel. The camera can be fastened to this support by a ¼-inch, 20-thread-per-inch bolt to engage with the tripod bushing. The back of the camera can be kept parallel with the easel by attaching along the length of the bench two strips of molding to serve as guide rails when moving the block and camera toward or away from the easel.

Compactness can be achieved by placing the lights and reflectors on swinging, telescoping arms attached to the bench. This will permit rapid manipulation of the lights which, when not in use, can be folded against the bench.

Easels: If a vertical enlarger stand is used, the baseboard of the stand can be used as an easel. Since material to be copied is sometimes in a curled or wrinkled condition, a sheet of ¼-inch, flawless, plate glass should be placed over the original. With both vertical and horizontal stands, many photographers use a large contact-printing frame to hold an original flat. The printing frame can be held to a horizontal stand by cleats attached to the easel. Focusing and composing can be done most efficiently if the easel or printing frame provides a guide, such as ruled lines, to aid in centering the original. With the original centered and the camera lens correctly aligned, the problem of getting the entire image on the film plane is greatly simplified.

ENLARGERS

Some enlargers are so designed that, with the addition of the proper accessory camera back adapter, they can be converted into efficient copying units. The enlarger stand serves as a support for the camera unit, and the baseboard serves as an easel.

APPROXIMATE SIZE OF ORIGINAL AND PERCENT REDUCTION

	CAMERA BACK ADAPTER			
Size of Negative	2¼ x 3¼ Inches		35 mm	
Focal Length of Lens	75 mm (3 inches)	101 mm (4 inches)	75 mm (3 inches)	101 mm (4 inches)
COPY RESTING ON BASEBOARD OR EASEL				
Size (in inches) of smallest original to fill negative	5¼ x 7¾	5½ x 8	3 x 4½	1¼ x 1¾
Percent reduction	57	55	68	30
Size (in inches) of largest original* to fill negative	17 x 25	17 x 25	4¾ x 7	6½ x 9¾
Percent reduction	87	87	89	90
COPY RAISED ABOUT 3 INCHES ABOVE EASEL				
Size (in inches) of smallest original to fill negative	2½ x 3½	—	⅞ x 1¼	—
Percent reduction	1	—	Slight enlargement	—

*Larger sizes can be copied by using the floor as an easel.

FOR PRESS OR VIEW CAMERAS THE FOLLOWING LENSES ARE RECOMMENDED	
LENSES	NEGATIVE SIZES IN INCHES
Kodak Ektar **6, 7½, 12** inch, **f/4.5**	**4 x 5** to **8 x 10**
Kodak Wide-Field Ektar **80, 100, 135, 190, 250**mm, **f/6.3**	**3¼ x 4¼** to **11 x 14**
Kodak Commercial Ektar **8½, 10, 12, 14** inch, **f/6.3**	**5 x 7** to **8 x 10**
Kodak Ektar **8** inch, **f/7.7**	**5 x 7** and **4 x 5**
Kodak Ektar **127**mm, **f/4.7**	**3¼ x 4¼**
Kodak Ektar **101**mm, **f/4.5**	**2¼ x 3¼**

Lenses: Kodak enlarging lenses can be used for copying. The 3- or 4-inch lenses are recommended. The 2-inch lenses are not recommended for copying. Since enlarger lenses are not equipped with shutters, exposures are made by uncapping and recapping the lens. It is therefore necessary to use small lens openings so that exposures will be long enough to be measured with reasonable accuracy.

Kodak Ektar Lenses, 127mm *f*/4.7 and 101mm *f*/4.5 are mounted in 2⅝-inch-square lens boards. Besides being more convenient for use in copying, these lenses can be used when the enlarger is converted for use as a view camera.

CAMERAS FOR COPYING

Although maximum efficiency is obtained with special copying cameras and stands, the photographer can often use the camera he has at hand. If a view camera or studio camera is available, it should be given preference over other types for general copying work. Ground-glass focusing, a long bellows extension, and front-and-back focusing are desirable. A ground glass is a convenient aid to focusing, while a long bellows extension permits the making of copies which are either actual size or larger, and front-and-back focusing gives increased control over the image size.

Ordinary Roll-Film Cameras, though not so well suited to copying as cameras with ground-glass screens, can be used with supplementary lenses for photographing originals larger than 7 by 9 inches.

In the table on the following page, subject distances are given for Kodak Portra Lenses 1+, 2+, and 3+. These subject distances apply to all cameras and must be measured accurately between the subject and the supplementary lens. Exposures should always be made at a small aperture when a supplementary lens is used.

The camera can be mounted by a tripod screw for either a horizontal or vertical outfit. The camera-subject alignment for a horizontal stand must be secured by accurate measurement and careful construction of the parts involved. See page 7.

SUBJECT DISTANCE AND APPROXIMATE FIELD SIZE FOR KODAK PORTRA LENSES USED WITH KODAK ROLL-FILM CAMERAS

+1

Camera Focus Scale Setting in Feet	Distance from Subject to Portra Lens in Inches	APPROXIMATE FIELD SIZE IN INCHES			
		24 x 36mm Negative* Focal Length of Lens— 48 to 52mm	28 x 40mm Negative Focal Length of Lens— 48 to 52mm	2¼ x 2¼-in. Negative Focal Length of Lens— 75 to 80mm	2¼ x 3¼-in. Negative Focal Length of Lens— 100 to 105mm
Inf	39	18 x 26⅜	20⅜ x 30¼	26½ x 26½	21¼ x 31¼
50	37	17 x 25⅛	19⅜ x 28¾	25 x 25	20 x 29⅜
25	34¾	16 x 23⅜	18¼ x 26¾	23¼ x 23¼	18¾ x 27½
15	32¼	14⅞ x 22	16⅞ x 24¾	21⅞ x 21⅞	17½ x 25¾
10	29⅝	13⅝ x 20⅛	15½ x 22¾	20 x 20	16 x 23½
8	27⅞	12⅞ x 19	14⅝ x 21⅜	18⅞ x 18⅞	15 x 22
6	25½	11¾ x 17⅜	13⅝ x 20	17¼ x 17¼	13¾ x 20¼
5	23¾	10⅞ x 16⅛	12½ x 18¼	16 x 16	12¾ x 18¾
4	21⅝	10 x 14¾	11⅜ x 16⅝	14⅝ x 14⅝	11¾ x 17¼
3½	20⅜	9⅛ x 13½	10⅝ x 15½	13¾ x 13¾	11 x 16⅛
3	18⅞	8⅝ x 12¾	9⅞ x 14½	—	—
2½	16⅞	7⅞ x 11⅝	8¾ x 12¾	—	—

+2

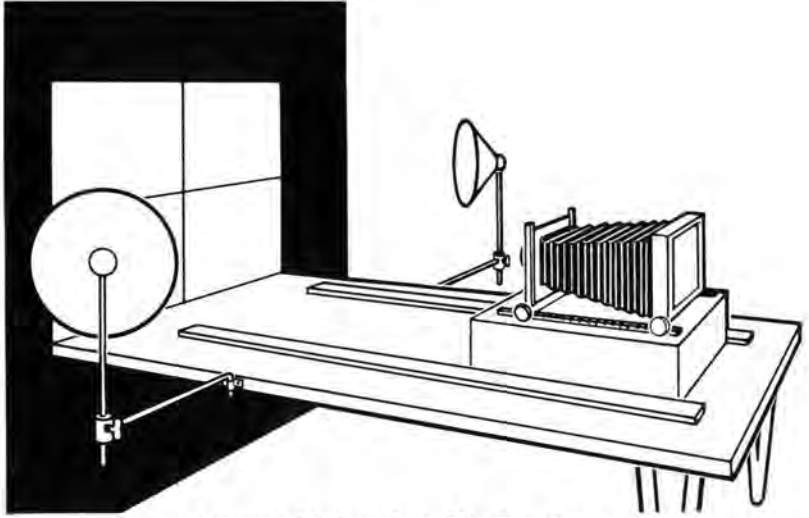
Inf	19½	9 x 13¼	10¼ x 14¾	13¼ x 13¼	10⅝ x 15⅝
50	19⅛	8¾ x 13	10 x 14¼	12⅞ x 12⅞	10¼ x 15
25	18½	8½ x 12½	9⅝ x 13¾	12½ x 12½	10 x 14¾
15	17¾	8⅛ x 12⅛	9¼ x 13¼	12 x 12	9½ x 14
10	16⅞	7¾ x 11½	8⅞ x 12⅝	11⅜ x 11⅜	9⅛ x 13⅜
8	16⅜	7½ x 11⅛	8½ x 12⅛	11 x 11	8¾ x 12⅞
6	15½	7⅛ x 10½	8⅛ x 11½	10½ x 10½	8⅜ x 12¼
5	14⅞	6¾ x 10	7¾ x 11	10 x 10	8 x 11¾
4	14	6⅜ x 9½	7⅜ x 10½	9½ x 9½	7½ x 11
3½	13⅜	6⅛ x 9	7 x 10	9 x 9	7¼ x 10⅝
3	12¾	5⅞ x 8¾	6⅝ x 9½	—	—
2½	11⅞	5½ x 7⅜	6¼ x 8⅞	—	—

+3

Inf	13	6 x 8⅞	6⅞ x 10⅛	8⅞ x 8⅞	7⅛ x 10½
50	12⅞	5⅞ x 8¾	6¾ x 9⅞	8⅝ x 8⅜	7 x 10¼
25	12½	5¾ x 8½	6⅝ x 9⅜	8⅛ x 8½	6¾ x 10
15	12¼	5⅝ x 8⅜	6⅜ x 9⅜	8¼ x 8¼	6⅝ x 9¾
10	11⅞	5⅜ x 8	6¼ x 9⅛	8 x 8	6⅜ x 9⅜
8	11½	5¼ x 7¾	6 x 8¾	7¾ x 7¾	6¼ x 9⅛
6	11⅛	5⅛ x 7⅝	5¾ x 8½	7½ x 7½	6 x 8¾
5	10¾	5 x 7⅜	5⅝ x 8¼	7¼ x 7¼	5¾ x 8½
4	10⅜	4¾ x 7	5⅜ x 7⅞	7 x 7	5½ x 8⅛
3½	10	4⅝ x 6¾	5¼ x 7⅝	6¾ x 6¾	5⅜ x 7⅞
3	9⅝	4⅜ x 6½	5 x 7⅜	—	—
2½	9⅛	4¼ x 6¼	4¾ x 7	—	—

*With the Kodak Signet Camera be sure to follow the tables in the camera manual.

In these tables the field sizes are based, not on the size of the camera back frame, but on the size of the picture area actually used. This area is the same as that of the Kodak Ready-Mount opening for the miniature films; for the two larger sizes, however, it is the same as the usual printing mask.



A suggested horizontal stand for view cameras

In the vertical outfit, the camera first should be adjusted so that the distance between the supplementary lens and the subject is that given in the table on page 10. The board which holds the subject should be made horizontal and checked with a spirit level, and the camera back should be leveled in a similar manner. A plumb bob, suspended below the center of the supplementary lens, will indicate the approximate center of the subject.

If desired, the exact area of the subject included may be seen (if the camera construction permits) by opening the camera back and observing the image on a piece of ground glass or tissue paper stretched across the picture aperture. If you tack a piece of paper to the copy board, you can define the exact field included in the picture by putting a pencil dot in each corner of the picture area as seen on the ground glass. Connect these four dots with lines to form a rectangle. Cut out the rectangle with a sharp knife. Now you can slide photographs or documents under the paper, and anything that appears in the rectangle you have just cut will appear in the picture.

Viewfinders on roll-film cameras are not intended for close-up copying and should be disregarded.

Field Sizes of Copying Cameras. When the copying camera is equipped with a ground-glass focusing back, the field size or the area of the original which will be included in the negative can be determined easily by observation of the image on the ground glass. In some cases it is desirable to be able to see the limit of the field directly on the subject; this can be done by placing a light back of the ground glass, so that an image of the illuminated ground glass is projected through the camera lens onto the subject.

The approximate field size can be calculated from the formula:

$$\text{Field size} = \text{Negative size} \times \frac{\text{Lens-to-subject distance}}{\text{Lens-to-film distance}}.$$

SPECIALIZED EQUIPMENT

The Kodak Verifax Copier is a self-contained office copier which reproduces letters, reports, charts, and other originals. The originals are copied on a light-sensitive matrix sheet from which one or several copies can be made. If a large number of copies is required, offset plates for duplicating machines can be made. Four models of the Kodak Verifax Copier are available – the Viscount, Regent, Signet, and Bantam, to copy originals up to 10 x 16 inches in size.

Kodagraph Micro-File machines for microfilming embody film units, built-in photoelectric exposure meters, lights, holders for originals, and control units. The table model pictured below is designed to meet the need for volume microfilming of diagrams, layouts, engineering drawings, books, and unbound documents which do not normally exceed 25 by 36 inches in size. A portable machine easily carried in two traveling cases is also available. Kodagraph Micro-File machines normally use 100-foot, 35mm, perforated or unperforated rolls of Kodak film, but can be adapted to take 16mm film. Details on Kodagraph Micro-File machines, Kodagraph Film Readers, and related equipment are available from the Business Photo Methods Division, Eastman Kodak Company, Rochester 4, N. Y.

Kodagraph Micro-File Machine, Model D

LIGHTING

IMPORTANT considerations in illuminating an original for copying are proper light distribution, control of reflections, and—in color photography—the color quality of the light source.

LIGHT SOURCES

REFLECTOR-TYPE photographic flood lamps, or No. 1 or No. 2 photoflood lamps in reflectors are suitable for both black-and-white copying and for copying with color films. The proper filters must be used with color films (see the Color Films Data Sheet). Fluorescent lamps, carbon arcs, and mercury arcs are suitable for black-and-white work.

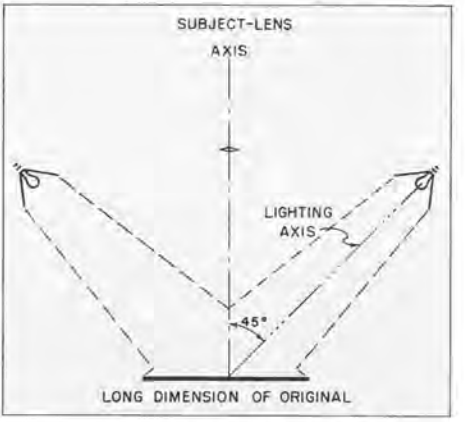
LAMP PLACEMENT

LIGHT distribution is much more critical in copying than in other photographic work. The illumination must be quite even *in the film plane in the camera.* In large, permanent copying setups, it is well to place the lamps so that all the corners of the largest original are equally lighted, and possibly 25 per cent brighter than the center. The need for higher illumination around the margin and corners of the original arises from the way in which light is distributed over the negative by the camera lens itself. The intensity in the film plane from a perfectly uniform subject is highest at the center and falls off gradually with increasing angle from the lens axis. To keep within a desirably small angle, the lens-to-film distance should never be less than the picture diagonal. This precludes wide-angle copying.

Light distribution can be explored at the copy board with a flat-celled incident light meter, or with a reflected light meter aimed at and held close to a matte white surface considerably larger than the area to be used. Once the lamp positions have been adjusted for best results, it is very desirable to fix their positions for future use. The area of best light distribution with the usual two-lamp setup is wider than it is high; therefore, place the original so that its longer dimension is parallel with an imaginary line between the two lights.

The angle between lens and lamp axes should be about 45° for ordinary copy work (see diagram, page 14). If a 45° lighting angle shows up the surface texture, however, move the lamps closer to the lens axis. This may require the use of a lens of longer focal length, which permits the camera to be moved farther away from the original, thus preventing specular reflections from entering the lens.

The lighting can be tested by photographing a matte white card equal in size to the largest likely subject, on the largest film of the highest contrast that will be used. Inspection of the developed negative will indicate any changes needed.



Standard setup of camera and lamps for copying originals.

REFLECTION CONTROL

Reflections which degrade quality, and in severe cases obliterate areas in the copy, arise in two ways:

1. Light from the lamps is specularly reflected into the lens by the original, especially if it has a rough, creased, or curved surface.
2. Light reflected by the original or its surroundings strikes the front of the camera, an image of which can be seen reflected by a glossy or glass-covered original. A glossy print on a large white background will show such an image in its shadow areas.

Reflections of the first type can sometimes be avoided by careful lamp placement or by treating the surface of the original in various ways. Complete control is offered by the Pola-Screen technique, described below. Reflections of the second type should be eliminated by painting the copy board black, by masking with black paper any white areas surrounding the original, and if necessary, by covering the camera front, except for the lens, with black card. The copyboard surroundings should be dark.

Kodak Pola-Screens must be placed over the camera lens and over each light. When the plane of polarization of each lamp Pola-Screen is at 90° to that of the Pola-Screen placed over the lens, practically all specular reflections are stopped, and only diffused reflections from the original are photographed. By rotating the Pola-Screen over the lens, varying amounts of specular reflections are permitted to pass through the lens, and the effect can be observed on the ground glass of the camera or by viewing it directly through the lens Pola-Screen. This control is valuable in reproducing oil paintings, pencil sketches, and other art work, where elimination of all reflections might result in a rendition completely different from what the artist intended.

Kodak Pola-Lights are especially designed for copying and other studio photography requiring reflection control. The main parts of a Kodak Pola-Light are a circular Kodak Pola-Screen mounted in a light baffle, and an adjustable mounting bracket with a rigid gooseneck and socket which holds a reflector-type flood lamp in the proper position behind the Pola-Screen. Pola-Lights are used in pairs. They can be obtained as complete units with stands or without stands; or just the two Kodak Baffles with Pola-Screens can be purchased for use with existing copying lights.

Detailed instructions for their use are included with Kodak Pola-Lights. Exposure can best be determined by test or by exposure-meter readings of a white matte card on the easel with the lens Pola-Screen held over the meter window at the angle at which it will be used for the actual exposure.

FLARE REDUCTION

FLARE light in the camera reduces shadow contrast in the copy negative. It can be reduced by the measures recommended for eliminating the second type of reflections described above; that is, by painting the copy board black, and surrounding the lens with a black card. Furthermore, dirty lenses are all too frequently the cause of flare. A copying camera lens is often neglected and films over in time. Smoke from arc lamps veils a lens surface quite rapidly. The lens of a vertical camera collects dust on its upper surface. Periodic checks and the use of Kodak Lens Cleaner are recommended. Lumenized lenses are desirable for copying, but this feature can be more than offset by the conditions just described.

If the copy negative is enlarged, flare in the enlarger can reduce highlight contrast. Dirty lenses and failure to mask the negative carrier down to the negative size are the usual causes of flare.

Copying setup with two Kodak Pola-Lights.

PROCEDURE FOR MAKING COPIES

With the original centered on the easel, the copy lights are turned on, the image is adjusted to the desired size on the ground glass, and the camera focused. If a roll-film camera is being used, reference to the table on page 10 will show the correct lens-to-subject distance for the size of the original being copied and the supplementary lens being used. This distance must be measured exactly.

The lights are adjusted to give even illumination in the film plane in the camera. The original should be viewed from a point close to the lens to detect any reflections that might reach the lens.

The camera is loaded with the proper negative material for the subject. The lens should be stopped down to about *f*/16 to provide a depth-of-field leeway for correcting slight inaccuracies of focus.

OBTAINING CORRECT EXPOSURE

Exposure is best determined by developing a trial film which has been given a series of exposures. Such a film shows the proper time and aperture for a given lighting setup, and as long as conditions and materials are unchanged no further trials are necessary. This applies to all line work—whether black on white or white on black.

USE OF PHOTOELECTRIC EXPOSURE METERS

When a photoelectric exposure meter is used for determining exposures for copying, the most consistently reliable results are obtained by measuring the illumination on the original, either directly with an incident light meter, or indirectly with a reflection type meter by making a reading on a card of known reflectance.

With both continuous-tone and line copying materials the recommended exposure indexes can be used directly with incident light meters held in the plane of the original being copied. The hemisphere light collector on certain incident light meters should be replaced by the disc collector for copy exposure determination. The indexes also apply directly to reflected light meters when the reading is taken from a surface having a reflectance of 18 per cent, such as the gray side of the Kodak Neutral Test Card. In the absence of the proper gray card, a reflected light reading can be made on a matte white surface of approximately 90 per cent 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.

The indexes for the high contrast materials for line work are intended merely for trial exposure. This is because these materials have inherently short exposure latitude, and also because the exposure should be adjusted to the maximum that can be given without causing filling in or veiling of the lines.

RELATIVE APERTURE CHANGE

THE distance from the lens to the film is increased for short subject distances so that the indicated relative aperture is no longer effective.

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

For example, a 10-inch lens racked out 5 inches from the infinity setting (to 15 inches from the film), and set at $f/8$, would have an effective f-value of $f/12$, and exposure should be computed at this value. The following table indicates the amount by which the calculated exposure must be multiplied for a few typical situations.

Reproduction size (percent of original size)	25%	50%	100% (same-size)	150%	200%	300%
Multiply calculated exposure by—	1.6	2.2	4.0	6.5	9.0	16.0

This correction applies to cameras with bellows focusing. It is not needed for small cameras plus Kodak Portra Lenses.

The Kodak Master Photoguide contains an Effective Aperture Computer for use in modifying exposures for subjects closer than 8 times the focal length of the camera lens.

JUDGING COPY NEGATIVES

COPY negatives of continuous-tone originals should be exposed and developed so that most of the detail of the shadow areas is retained. The negative should have slightly more over-all density than an original negative of the subject. The contrast should be normal.

Good copy negatives of line originals are characterized by dense backgrounds and clear lines. Fine lines should be clear and easily distinguishable by reflected light from a sheet of white paper (rather than strong transmitted light), and not obscured, or "closed up." When the original is in poor condition and has lines that are weak or faded, high contrast and background density in the copy negative sometimes must be sacrificed by using a film having less contrast to preserve the weak lines. Prints from copy negatives of black, coarse line originals should be made on a very high-contrast paper.

Copying Requirements —Typical Originals

CONTINUOUS-TONE ORIGINALS

THE IDEAL copy negative of a photographic print or painting retains all the gradations of the original within a density range which can be printed. In the average copy negative of a full-scale photographic print, the maximum density of the negatives should not exceed 1.5 to 1.6. The detail of both highlights and shadows should be apparent.

Photographic Prints, even though of good viewing quality, usually have some loss of detail in the highlights and in the shadows when copied. The highlight loss is minimized by exposing for thin shadow detail on Kodak Commercial Film or Kodak Gravure Copy Film.

Prints Made Especially for Copying should differ from ordinary prints to avoid objectionable loss of highlight detail or, less serious, of shadow detail. A print to be copied should be on glossy paper, should have strongly modeled highlights but no clear whites, and should not have the deepest possible black. The best way of making such prints is to use paper of a grade suitable for a normal print, but to dodge so that the highlight areas are printed rather heavily. Alternatively, make a print on a paper having a grade number one or two steps lower than normal. Expose for normal shadows and "heavy" highlights. In either case, the reflection density range should not exceed 1.4. Retouching should be neutral in color. The copy negative should have fully exposed shadows and be developed slightly more than an original negative.

While it is not generally realized, the same type of glossy print with a short density range can yield a better photomechanical reproduction. If such a print is submitted, it should be accompanied by a full-scale viewing print to serve as a guide to the desired appearance.

Rough-Surfaced, Creased, or Wrinkled Prints usually show troublesome reflections which can be avoided by using Kodak Pola-Screens at the lights and camera lens. In some cases, reflections from surface scratches or slight wrinkles can be avoided if the print is flattened in a printing frame and copied through the glass. When the materials involved can withstand such treatment, extremely rough or wrinkled samples can be copied under water or glycerine.

Small Prints, if on other than glossy paper, give trouble because of surface texture, which reproduces as a coarse graininess. Such trouble can be avoided by using Pola-Screens at the lens and lights.

Caution in Preparation of Old Photographs for Copying. Since old photographs cannot be replaced, it is wise to make the best possible negative *before* attempting any cleaning or other preparation of the original. Then if the original should be damaged, it may be possible to prepare an acceptable print from this first copy negative.

Old photographs of all types sometimes are so badly damaged that the only procedure for obtaining a clean reproduction is first to make the best possible copy, then to build up the resulting print with spotting medium, or airbrush, and finally to recopy the retouched print.

Soiled Prints can often be cleaned by careful use of an art-gum eraser, or by swabbing with cotton dampened with a mixture of half water and half denatured alcohol. Before being cleaned, the print should be examined for any evidence of pencil work, spotting, or retouching which would be removed by cleaning. The cleaning treatment should first be tried on a small area at one corner of the print.

Prints with Colored Stains or Spots, having an image which is black and not faded, should be copied on a panchromatic film with a filter similar to but deeper in color than the stains.

Faded Prints usually have yellowed images of low contrast.

Moderately faded prints with fair detail in highlights and shadows should be copied on non-color-sensitive film such as Kodak Commercial Film or on Kodak Commercial Ortho Film through a blue filter.

Prints badly faded throughout shadows and highlights are best copied on Kodak Contrast Process Ortho Film with a blue filter, developed by inspection to the desired contrast in a high-contrast developer. *In cases of extreme fading*, where these methods fail, the best possible copy negative should first be made; then, before proceeding further, permission should be obtained from the owner for you to attempt restoration of the original with Kodak Stain Remover S-6. If this attempt is successful, the original can then be copied.

Daguerreotypes (mercury image on a silvered copper plate). The photographic image on a daguerreotype is extremely delicate and must be treated with great care. *If the surface is touched, a permanent mark will result.*

Daguerreotypes commonly show a great deal of dirt and stain. In many cases, most of the dirt is on the glass cover and the daguerreotype itself is in fairly good condition. If necessary, however, the daguerreotype can be cleaned. See the reference at the back of the book.

The reflections characteristic of daguerreotypes can be controlled by using over the camera a black-velvet screen with a hole in the center to fit over the camera lens.

Copies of a badly faded photograph, low in contrast and yellowed by age: Left, made on a portrait film; right, made as recommended on page 19.

The copy negative can usually be made on one of the films recommended for continuous-tone copying (see page 22). Because the lightness scale of daguerreotypes is very limited, it is helpful to increase the development time fifty percent.

Ambrotypes (whitish silver image on a glass plate with a black backing) may be disfigured by discoloration of the backing. If the backing can be separated, it can be cleaned or replaced with a piece of glossy developing paper which has been exposed to light and developed to a jet black. Films and development recommended for copying continuous-tone prints are also suitable for copying ambrotypes. When higher contrast is needed, it can be obtained by increasing the development time, or, in extreme cases, by using line copying materials as listed on page 25. In some cases, the silver image of the ambrotype will be of sufficiently good quality to be used as a negative in the normal manner.

Tintypes (whitish silver image on a black-lacquered metal plate) often show scratches, dents, and other blemishes. Fine scratches can usually be eliminated by rubbing the surface with a little Vaseline or mineral oil and wiping it off with a soft lintless cloth. Pola-Screens over both the lens and lights will further reduce the effect of blemishes. Another method for overcoming imperfections involves placing the tintype in a shallow tray of water and then copying it from above. The tintype should always be placed so that the worst scratches are

parallel with an imaginary line connecting the copying lights.

Photoengravings and Photolithographs. If the pattern of the halftone screen is resolved in the copy negative, these originals should be treated as line copy. Overexposure of the negatives must be avoided.

If the halftone-screen pattern is *not* resolved in the copy negative, originals of this type should be treated as continuous-tone copy.

Photogravures require the same technique as photographs.

Posters and Lithographs are usually continuous-tone in character, and can be copied in the same manner as paintings, discussed below.

Paintings and other colored continuous-tone originals can be copied in color with Kodak Ektachrome or Kodachrome Film. High-key pastels may require ½ stop less exposure than average paintings; rich, low-key old masters may require ½ stop more than average. The best results in making black-and-white copies of paintings are obtained by using a suitable filter in combination with one of the panchromatic materials recommended for continuous-tone copying. The Kodak Master Photoguide, on sale at Kodak dealers, is a valuable aid in selecting the proper films and filters for this purpose.

In the copying of oil paintings, the artist's brush marks often cause undesirable reflections. These may be reduced by changing the lighting angle. They can be controlled most effectively through the use of Kodak Pola-Screens at both the lens and lights.

Tapestry Figures and Textile Weaves are copied in much the same way as paintings. The method of lighting depends on whether emphasis is to be placed on the colored figures or on the weave and texture. A strong light from one side of the camera will accentuate the surface texture. Standard copying illumination, that is, equal light from both sides of the camera, is best when figures are to be reproduced without showing the texture of the material.

Pencil, Charcoal, and Crayon Sketches require essentially the same technique as black-and-white photographic prints, but crayon sketches in color, like paintings, may require filters to secure maximum color differentiation.

Etchings and some pencil drawings appear, at first glance, to be line subjects. Actually, however, the lines differ in depth or tone as well as in width, and the different tones must be reproduced to obtain a satisfactory copy. Originals of this type should therefore be copied on continuous-tone copying materials; slightly longer than normal development may be desirable. If an etching shows a color wash, it may be possible to tone the copy print to reproduce this effect.

CONTINUOUS-TONE COPYING MATERIALS

KODAK SENSITIZED MATERIAL	EXPOSURE INDEXES* Incident Light or Light Reflected from 18% Gray Card		Meter Settings for Reflected Light from White Card†	Kodak Developer	Recommended Development in Minutes at 68 F (20 C)		Kodak Safelight Filter, Wratten Series
	Daylight	Tungsten	Tungsten		Continuous Agitation	Intermittent Agitation	
SHEET FILMS							
Commercial (also Matte)	20	6	1.2	DK-50	2½	3	1
				DK-50 (1:1)	4	5	
Commercial Ortho	32	10	2	DK-50	3½	4¼	2
				DK-50 (1:1)	4½	6	
Gravure Copy Film	—	2	0.4	D-11	6	7½	1
Panatomic-X	32	25	5	DK-50	3½	4¼	TD‡
Infrared (Kodak Wratten Filter No. 25)	—	10	2	DK-50	7	9	7
ROLL FILMS, FILM PACKS							
Panatomic-X	25	20	4	D-76	6	7	TD‡
Verichrome Pan	80	64	12	D-76	11	12	TD‡
35MM FILMS							
Fine Grain Positive	1.2	0.3	0.06	D-76	3	—	1A
Plus-X	80	64	12	D-76	7	8	TD‡
PLATES							
33	20	5	1.0	DK-50	5	6	1
Panchromatic	16	10	2.0	D-76	7	9	TD‡
				DK-50	3	4	
COLOR FILMS							
Ektacolor, Type B	—	8§		See instructions packed with film.			Total Darkness
Ektachrome, Type B	—	10§					
Ektachrome, Type F	—	16**					
Kodachrome, Type F	—	12**					
Kodacolor or Ektacolor S	32	20**					
Kodachrome A	—	16**					

*These exposure indexes are recommended for meters marked for American Standard Exposure Indexes. For copying, these indexes can be used directly with incident-light meters held in the plane of the original being copied, or with reflected-light meters when the reading is taken from the gray side of the Kodak Neutral Test Card.

When the camera lens is extended to focus on subjects closer than eight times its focal length, which is usual in copying, exposure computation must allow for the change in effective *f*-number. Apply the exposure factors given on the Effective Aperture Computer in the Kodak Master Photoguide.

†For reflected-light readings taken from a matte white surface substituted for the original being copied. These correspond to the regular Exposure Indexes divided by 5.

‡Total Darkness. A Kodak Safelight Filter, Wratten Series 3, can be used for a few seconds only after development is half completed.

§For 3200 K lamps.

**For photoflood, with Kodak Light Balancing Filter No. 82A.

LINE ORIGINALS

Black-and-White Line Original. A black-and-white negative of a line original, such as a line drawing or typewritten page, must show high contrast between the two tones reproduced. For example, a copy negative of black lettering on a white background has high density in the background area and clear lettering. The required contrast is obtained by using a negative material of extreme contrast and giving it high-contrast development. See the table on page 25. Such materials have limited exposure latitude and must be exposed correctly.

Line originals, such as maps or pencil drawings, which have been handled a great deal, may show variation in the density of lines. If legibility rather than maximum contrast is the primary consideration, these originals can be copied on a continuous-tone material. The negative should be developed in a vigorous developer, such as Kodak Developer D-11 or D-8. Use of a continuous-tone material may also be advisable when copying line originals with varying background density, if it is desired to preserve this detail. High-contrast line-copying materials do not reproduce satisfactorily both fine, light lines and broad, dark lines at the same exposure level.

Drawings and Typed or Printed Matter. These can be copied with any of the materials recommended for line copying. The focus must be critically sharp to avoid filling in of fine lines, and the negative should be fully exposed but not overexposed.

In making copies of drawings, letters, or other originals which are printed on one side only, it is desirable to back up the material with white cardboard or several thicknesses of white paper in order to increase the effective whiteness of the paper and give greater contrast. This is especially helpful with letters on thin paper.

If the sheet to be copied is printed on both sides, it should be backed up with black paper or a black card to keep the lines or lettering on the back from showing through.

Clearest typewritten originals are produced by typing through a carbon paper ribbon or unused carbon paper on white bond paper (the ordinary ribbon should not be used). The paper should be backed up with a second sheet of carbon paper, reversed to print on the rear surface. This technique usually is used for contact printing, but can be used in ordinary copying. The contrast of these originals is increased if they are backed up with a white card while being copied.

When making copies for the purpose of slide projection, typewrit-

ten material should not be crowded on a slide; the readable limit is about half of an 8½ x 11-inch page of double-spaced typing.

Colored Line Original. In making black-and-white copies of colored line originals, the problem is to secure contrast between the subject and the background. This can usually be accomplished by means of high-contrast panchromatic film and a filter. If the subject is to be rendered *light* against a *dark* background, the filter should transmit the color of the subject and absorb the color of the background. If the subject is to be rendered *dark* against a *light* background, the filter should absorb the subject color and transmit the background color.

Blueprints are best copied on a panchromatic film through a red filter, Wratten No. 25 or 29. The red filter absorbs blue light so that the blue background records as black, while the lines remain white.

Printed or Written Matter in Colored Inks usually requires a high-contrast panchromatic film and a contrast filter which *does not* transmit the color of the ink used, but which freely transmits the color of the paper stock. Filter recommendations are given in the table below.

FILTERS FOR COPYING COLORED LETTERING ON WHITE OR COLORED PAPER ON PANCHROMATIC FILM*

PAPER COLOR	INK COLOR	WRATTEN FILTER NO.
White or Yellow	Blue	25(A)
White	Red	47
White or Yellow	Blue or Red	58
White or Yellow	Purple	58
Green	Black, Blue or Red	58
Blue	Black or Red	47
Pink	Black or Blue	25(A)

*For filter factors, see *Data Sheets*.

Checks can be copied on Contrast Process Panchromatic Film. The ink is usually dark enough to record properly without a filter.

Documents on Yellowed Paper with black or gray ink require a high-contrast orthochromatic or panchromatic film and a deep yellow contrast filter such as the Wratten No. 15. The No. 15 filter freely transmits the yellow light reflected from the yellowed paper so that the paper records as white, the ink as black.

Manuscripts and Documents on which the ink has faded to yellow or brown ordinarily yield best contrast on a non-color-sensitive film. With panchromatic film, a blue filter should be used.

LINE COPYING MATERIALS

KODAK SENSITIZED MATERIAL	EXPOSURE INDEXES* Incident Light or Light Reflected from 18% Gray Card**: Daylight	Tungsten	Meter Settings for Reflected Light from White Card†: Tungsten	Kodak Developer	Recommended Development in Minutes at 68 F (20 C): Continuous Agitation	Intermittent Agitation	Kodak Safelight Filter, Wratten Series
SHEET FILMS							
Contrast Process Ortho	—	50	10	D-8(2:1)	2	—	1
				D-11	4	5	
Contrast Process Panchromatic	—	80	16	D-8(2:1)	2	—	TD‡
				D-11	4	5	
Kodalith Ortho, Type 2	—	5	1	Kodalith	2½	—	1A
				D-85	2¼	—	
Kodalith Pan	—	12	2.5	Kodalith	2¼	—	3
				D-85	2	—	
Kodalith Ortho, Type 3	—	6	1.2	Kodalith	2½	—	
				D-85	2¼	—	
Kodalith Super Ortho	—	4	0.8	Kodalith	2½	—	
				D-85	2¼	—	
ROLL FILM							
Verichrome Pan	80	64	12	D-11	4	5	TD‡
35MM FILMS							
				Dektol			
Micro-File	—	32	6	(1:1)	4½	6	TD‡
Fine Grain Positive	40	10	2	D-11	7	9	1A
PLATES							
Process	—	12	2.5	D-8(2:1)	2	—	1
				D-11	4	5	

*These indexes are recommended for meters marked for American Standard Exposure Indexes. The indexes for line copying are for determining a trial exposure only.

When the camera lens is extended to focus on subjects closer than eight times its focal length, which is usual in copying, exposure computation must allow for the change in effective *f*-number. Apply the exposure factors given on the Effective Aperture Computer in the Kodak Master Photoguide.

**For copying, these indexes can be used directly with incident-light meters held in the plane of the original being copied, or with reflected-light meters when the reading is taken from the gray side of the Kodak Neutral Test Card.

†For reflected-light readings taken from a matte white surface substituted for the original being copied. These correspond to the regular Exposure Indexes divided by 5.

‡Total Darkness. A Kodak Safelight Filter, Wratten Series 3, can be used for a few seconds only after development is half completed.

COMBINED LINE AND CONTINUOUS-TONE ORIGINALS

WHEN line and continuous-tone materials are combined, separate negatives of the two subjects should be made and combined in printing. Kodak Commercial Film or Gravure Copy Film may be used for the continuous-tone negatives and Kodalith Ortho Film, Type 2, Kodalith Super Ortho, Kodalith Ortho, Type 3, or Kodak Contrast Process Ortho Film for the line negatives. The negatives may be cut and spliced together or printed separately with suitable masks.

If both subjects must be copied on one film, some loss of quality is inevitable. Kodak Commercial Film should be exposed and developed for good continuous-tone reproduction. This portion of the dry negative can be blocked out with Kodak Lantern Slide Varnish. When dry, the line image can be reduced slightly, then intensified.

SPECIAL COPYING PROCEDURES

FULL-COLOR COPIES

Copying with Kodak color films involves the same basic procedure as with black-and-white materials. For correct color rendering and exposure, however, certain precautions are needed.

Kodak Ektacolor Film, Type B, or Kodak Ektachrome Film, Type B, sheet film, are color balanced for use with 3200 K lamps operating at their rated voltage. Stock voltage ratings of 115, 120, and 125 are available. Kodacolor Film, Kodak Ektacolor Film, Type S, Kodak Ektachrome Film, Type F, and Kodachrome Film, Type F, are balanced for Class M clear flash lamps. Any one of these films may be used with an 82C filter for 3200 K lamps or an 82A filter for photoflood lamps. Kodachrome Professional Film, Type A, is designed for use with photoflood lamps without a filter.

Correct exposure is essential. Exposure can be estimated by the use of exposure meters or tables, or by making a range of test exposures varying by half a lens opening. An incident light exposure meter can be used in the plane of the original being copied. The hemisphere light collector on certain incident light meters should be replaced by the disc collector for copy exposure determination. Alternatively, a reflected light meter reading can be made from the gray side of a Kodak Neutral Test Card substituted for the original. The usual exposure indexes apply to both situations. If you have a reflected light meter, but no Neutral Test Card, use a white card such as the back of a double-weight print. Divide the usual exposure index by 5. The lens settings indicated by any of these techniques need modifying for dark or light subjects and for bellows extension. Dark subjects usually require ½ stop more exposure; very light subjects, ½ stop less. In copying colored line originals with Kodak color films, the same method and the same modified exposure indexes are required as are used for colored continuous-tone originals.

When Kodak Pola-Screens are used for reflection control, as described on page 14, there may be a tendency toward excessive contrast and color saturation in color copies of paintings and color prints. The results can often be improved considerably by the use of a "flash" exposure to give a uniform fogging exposure over the whole film. The flash exposure is produced by placing a sheet of white paper or cardboard over the original, and giving an exposure equivalent to about 2 per cent of the normal exposure.

ILLEGIBLE DOCUMENTS AND QUESTIONED PAINTINGS

Copying by Infrared Radiation. Infrared photography may be useful in copying charred, deteriorated, altered, or overprinted documents, and in examining paintings.

Filters and Lighting for Infrared Photography: Infrared-sensitive films or plates, ordinary tungsten or photographic flood lamps, and a Wratten A Filter (red) are required for taking pictures by infrared light. The Wratten Filter No. 87 is desirable in some cases.

Infrared Materials Available: Kodak Infrared Films (miniature and sheet) and Kodak Infrared Sensitive Plates. For the high contrast required in documentary examination, these materials should be developed in Kodak Developer D-19 for about 9 minutes at 68°F. Development recommendations for continuous-tone copying are given in the table, *Continuous-Tone Copying Materials*, page 22.

The technique is explained in detail in the book, "Photography by Infrared," by Dr. Walter Clark, published by John Wiley & Sons, New York. General information on infrared photography is given in the Kodak Data Book *Infrared and Ultraviolet Photography.*

Copying by Ultraviolet Radiation. Ultraviolet photography can often be used to detect faded or vanished writing, chemical erasures, and restoration in works of art.

When ultraviolet radiation strikes an object, some ultraviolet light is reflected; furthermore, many substances glow, or "fluoresce." Photographs can be taken in total darkness with an ordinary camera (no filter) by reflected ultraviolet radiation obtained by illumination with ultraviolet only. A General Electric Uviarc, or other ultraviolet source, in a lighttight box with a window of Corning Glass Filter No. 5860 (Violet Ultra), 10mm thick, is suitable. The fluorescence observed visually with this lighting can be photographed by adding a Wratten Filter No. 2B to the camera lens to absorb the reflected ultraviolet, which is stronger photographically than the fluoresced light. The exposures required in photographing reflected ultraviolet are usually less than a minute at *f*/16 on Contrast Process Ortho Film. Exposures of fluorescence made on Portrait Panchromatic Film through a Wratten Filter No. 2B may be as long as one hour at *f*/4.5.

Certain commercial ultraviolet lamps, in which the glass itself is an ultraviolet-transmitting filter, transmit too much visible light to permit the faint fluorescence of documentary subjects to be photographed. Additional information about ultraviolet photography appears in the Data Book *Infrared and Ultraviolet Photography.*

NEGATIVES AND TRANSPARENCIES

NEGATIVES (and other transparencies) can be copied by (a) contact printing, (b) enlarging on film or plates, or (c) transilluminating the negative in front of a copying camera. In the case of (c) care must be exercised to be certain that no light is reflected from the front surface of the illuminated negative. If any light is reflected from the front of the negative, it will interfere with the rendering of highlight details. A lighttight tunnel from the negative being copied to the lens can be used to avoid any possibility of troublesome reflections.

Duplicate Negatives from Intermediate Positives. Duplicate negatives can be made by means of an intermediate positive. A film positive is made from the original negative, and is then printed on another piece of film to produce the duplicate. Kodak Commercial Film is recommended for both steps.

The intermediate positive and the copy negative can be printed by contact, or one or both can be printed by projection, to produce a copy which is larger or smaller than the original. For contact printing, it is convenient to use a printing frame placed on the enlarger easel, and to use the enlarger as the light source. The enlarger lens can be stopped down to give exposures of convenient length. A sheet of black paper should be used in contact with the back to the film to avoid reflections from the easel or the back of the printing frame.

The exposure for the intermediate positive should be sufficient to give a slight density in even the brightest highlights, and development should be adjusted to give a soft positive flatter than would be desirable for a transparency intended for viewing. Any necessary dodging can be done during the printing of the positive. A mask should be used to block stray light coming around the sides of negatives. Films with antihalation backing should be used in both cases.

COPYING FOR EXACT SIZE

THE dimensions of film base tend to change only slightly. There is both a temporary change during processing and a permanent change with age. The dimensions are also affected by temperature and humidity. Kodalith Ortho PB Film, Type 3, and Kodak Commercial PB Film have excellent dimensional stability. Dimensional changes may differ slightly along the length and width of the film. The dimensions of glass plates do not change at all. The differences in dimensional changes in paper are even greater. Ordinary photographic paper changes much more as a result of processing than film does, and the

change is likely to be permanent. Belt drying or ferrotyping changes print proportions considerably. Dimensional changes in film can be held to a minimum by holding both the temperature and the humidity at fixed values, preferably near 70 F and 50 per cent, respectively, while storing, exposing, drying, and printing. The same conditions should be observed for paper. In addition, the paper should be used for its end purpose at the same temperature and humidity conditions. The use of Kodak Resisto paper, when processed as recommended, greatly reduces the dimensional changes in the print. The following table rates various negatives and printing material combinations in the order of increasing dimensional changes.

Negative Material	Printing Material
1. Glass Plates	Sensitized Metal or Glass
2. Film	Film
3. Film	Resisto Paper
4. Film	Ordinary Paper
5. Ordinary Paper	Ordinary Paper

Kodak Resisto N and Resisto Rapid N Papers have a base which resists the penetration of water during the 7 to 8 minutes' processing time. Drying is very rapid and dimensional changes are less than those of ordinary paper, since very little water is absorbed by the base.

REFLEX COPYING

Copies of printed pages, line drawings, coarse-screen halftone illustrations, etc., can be made by the *reflex method*, using high-contrast, light-weight or single-weight, contact printing paper such as those described in the section on Kodak Contact Printing Papers, page 6.

The reflex technique applies if the original has printing on both sides. The photographic paper is placed so that the emulsion is in contact with the side to be copied. The reverse side of the original is covered with a sheet of black paper. Exposure is made by directing light through the back of the sensitive paper. With correct exposure, the light passing through the sensitive paper barely affects it, but the light reflected back by the white areas of the original gives sufficient additional exposure to result in a satisfactory negative. The negative image is laterally reversed; it can be read by transmitted light or printed by contact to obtain a positive print.

To copy originals which have printing, typewriting, drawing, etc., on one side only, the sensitive paper sometimes can be exposed

through the back of the original in the same manner as a print is made from a negative. If the thickness or texture of the original renders this method impractical, the exposure should be made by directing the light through the back of the sensitive paper. In this case, the original should be backed with a sheet of white paper.

Exposure Time for reflex copying is considerably longer with a given printer or light source than is required for printing from ordinary film negatives. For example: using a large printing frame and a No. 1 photographic flood lamp at about 2 feet, an exposure of a few seconds is required to produce a reflex negative on Azo F-5, Single Weight, from a white original having printing on both sides. Exact exposure should be determined by test. Develop in Kodak Developer D-72 or Kodak Dektol, diluted 1:2.

Optimum-quality reflex copies and faster reproduction are possible with Kodagraph Papers. Information as to source of supply and other details may be obtained by writing to the Graphic Reproduction Sales Division, Eastman Kodak Company, Rochester 4, N. Y.

RESTRICTIONS ON COPYING

COPYRIGHTED MATERIAL

It is unlawful to reproduce without written permission of the copyright owner material bearing a notice of copyright. Each reproduction of such material must carry a copyright notice.

GOVERNMENT OBLIGATIONS

The law prohibits the copying of: U. S. and foreign government obligations such as: currency, bonds, notes, or the like; canceled and uncanceled U. S. stamps; U. S. Government departmental identification cards, badges, or insignia; military or naval documents, etc., marked Secret, Confidential, or Restricted; certificates of citizenship, naturalization, or arrival, etc., or duplicates of same.

The only exceptions to the above are the following:

U. S. stamps can be copied for philatelic purposes, and in black-and-white only, provided that the reproductions are less than ¾ or more than 1½ times the size of the original.

Coins, U. S. and foreign, now can be photographed.

This is only a brief summary of existing photographic restrictions, and the Eastman Kodak Company assumes no responsibility therefor. Legal advice should be obtained before reproducing any of the above-mentioned or similar material.

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	—	1¾ 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 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.

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.

Sensitometric Data

Color Sensitivity:
Blue sensitive only.

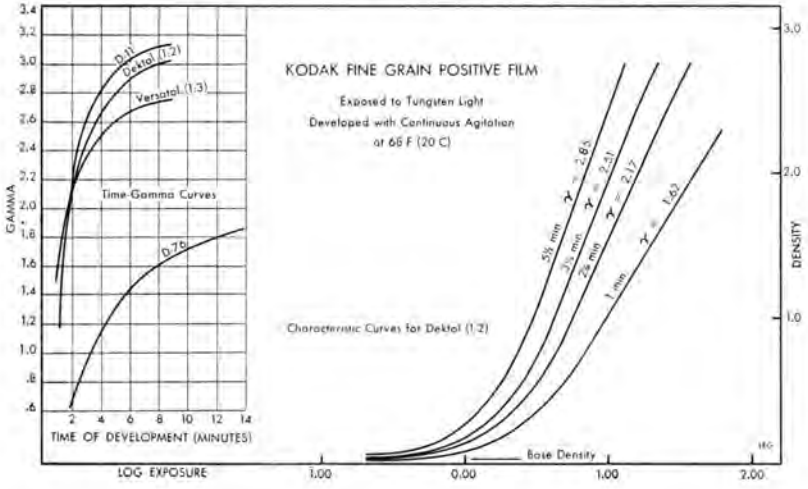
Spectrogram to Tungsten Light

Definition:

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

*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 MICRO-FILE FILM (35mm)

This film has a very high-contrast, special panchromatic emulsion, with extremely low graininess and extremely high resolving power. It is especially designed for making greatly reduced copies of books, newspapers, manuscripts, line drawings, letters, etc. It should be used in all cases where the copy negatives represent more than a tenfold linear reduction in size.

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 at not less than 4 feet.

Exposure

Exposure Index for meters marked for American Standard Exposure Indexes (based on ½ second exposure time and recommended development):

Tungsten—**32**

This setting is recommended for trial exposures in copying. It applies 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 the marked figure nearest one-fifth the above value, e.g., 6 as the tungsten value.

Allow for the increase in effective *f*-number caused by the extension of the lens.

Illumination: It is recommended that two light sources be used, one on either side of the copy material. Arrange them so that the light strikes the material at about a 45° angle. A sheet of plate glass is often used to hold the copy flat.

Exposure Examples: With two No. 1 Photoflood Lamps in matte-surfaced reflectors at about 24 inches from the copy, the exposure will be about ½ second at *f*/22. The use of No. 2 Photoflood Lamps will permit shorter exposures. To obtain an image of sufficient size, it may be necessary to use a supplementary lens, such as the Kodak Portra 1+, 2+, or 3+ Lens on the camera. Care should be taken in centering the copy and focusing the camera.

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

KODAK WRATTEN FILTERS	No. 8 (K2)	No. 15 (G)	No. 25 (A)
Photoflood or high-efficiency tungsten	1.5	2	8

For copying badly aged, faded manuscripts or books with yellowed paper, use the Kodak Wratten Filter No. 8 (K2) or No. 15 (G) to secure added contrast. For copying blueprints, the Kodak Wratten Filter No. 25 (A) is recommended.

Processing

Develop at 68 F for approximate times given below:

KODAK DEVELOPER*	Intermittent Agitation† (Tank)
Dektol (1:1)	6 minutes

*This developer is available in prepared powder form in several package sizes.
†Agitation at 30-second intervals during development.

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

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 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.

Archival Processing: The special precautions that should be followed in producing records of archival quality are discussed in the sections on Processing for Permanence in the Kodak Data Books, *Microfilming with Kodagraph Micro-File Equipment and Materials*, and *Processing Chemicals and Formulas*.

Dry in a dust-free place.

Sensitometric Data

Color Sensitivity:
Special Panchromatic.

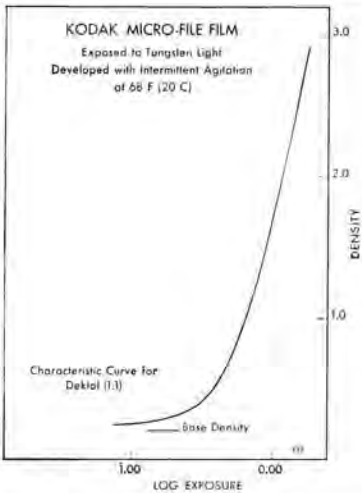
Spectrogram to Tungsten Light

Definition:

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

*The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curve:
For recommended processing.



Rolls Available: *35mm*—M135 magazine (36 exposures), and bulk rolls, *35mm, perforated, frame-numbered*, M402 (100 ft), also in *35mm, perforated, not frame-numbered*, M417 (100 ft) on No. 10 spools.

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.

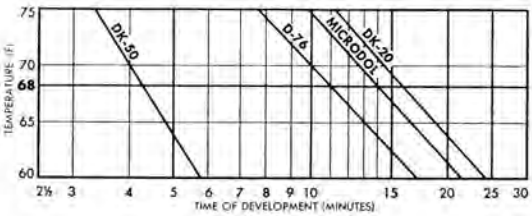
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently.*

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

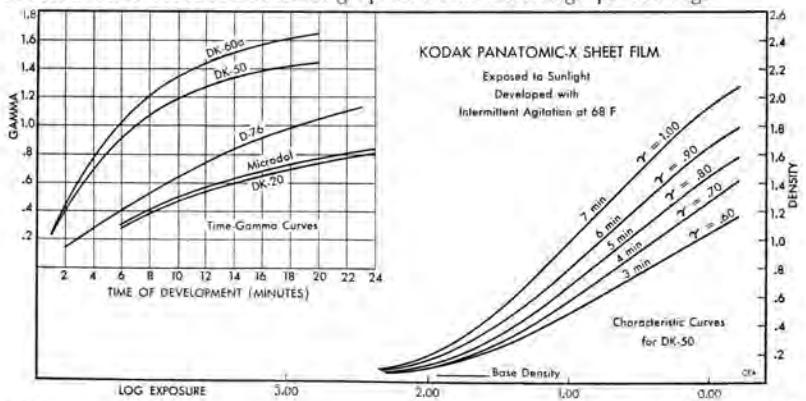
Spectrogram to Tungsten Light

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 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.

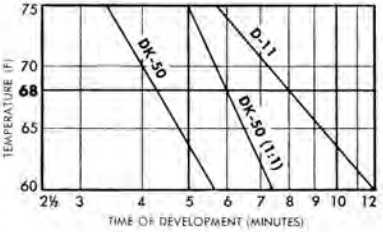
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

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:

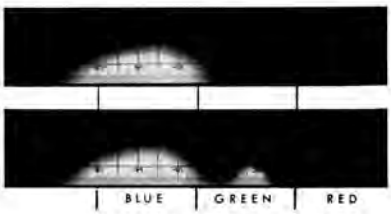
Commercial | Commercial Matte | Commercial Ortho

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 42.

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	4	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.

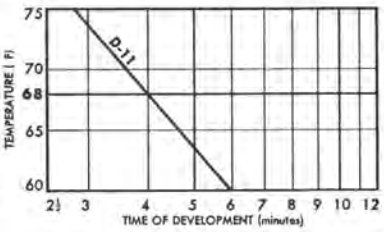
Fix 5 to 10 minutes at 65 to 70 F with Kodak Acid Fixer or Kodak Fixing Bath F-5, or 2 to 4 minutes with Kodak Rapid Fixer. *Agitate films frequently during fixing.*

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

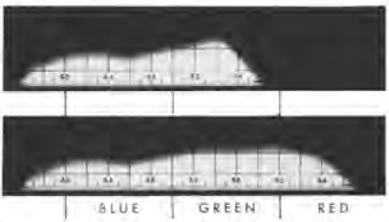
Contrast Process Panchromatic

Sensitometric Data

Color Sensitivity:

CONTRAST PROCESS ORTHO
Orthochromatic

CONTRAST PROCESS PANCHROMATIC
Panchromatic, Type B



Spectrograms to Tungsten Light

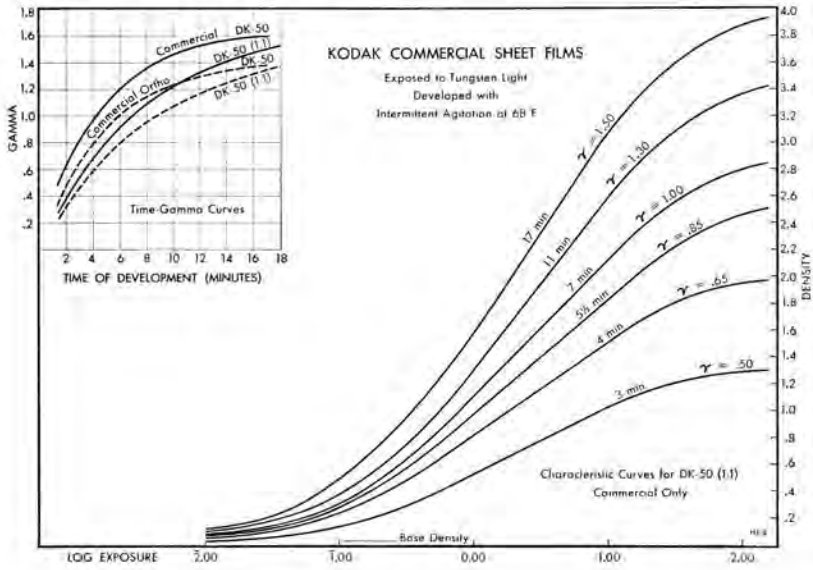
Definition:

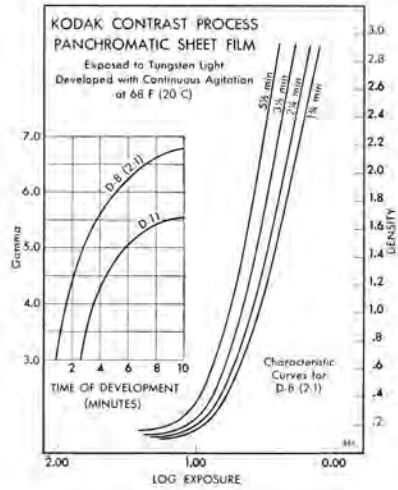
Graininess	Resolving Power	Sharpness (Acutance)	Degree of Enlargement Allowed*
Fine	Very High	Extremely High	Extremely Great

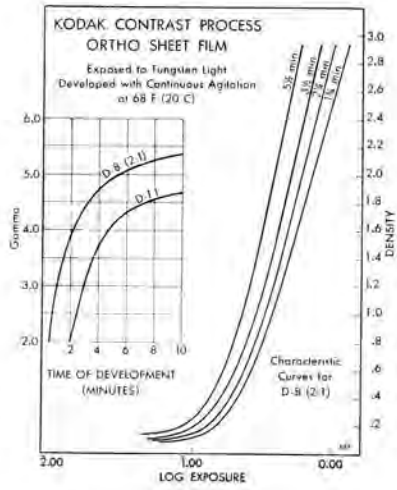
*For good quality negatives of suitable subjects. The degree of enlargement allowed usually will be limited by the camera and subject conditions rather than by the film characteristics.

Sensitometric Curves: See page 42.

Sensitometric Curves: For average product and average processing.







KODAK GRAVURE COPY FILM — Code Notch

An orthochromatic film especially suited for making continuous-tone copy negatives. It provides increased highlight contrast, which is particularly useful in photogravure reproduction and photocopying. It can also be used for making continuous-tone positives with improved shadow contrast.

Safelight: This film should be handled and developed by the light of a Kodak Safelight Filter, Wratten Series 1 (red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet.

Exposure

Caution: To prevent pinholes and spots, be sure the film and copy-board glass are clean and free of dust. Also, because of the increase in highlight contrast, uneven illumination of the copy board will be more noticeable. The uniformity of illumination should be checked with a meter.

Exposure Indexes

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

White-Flame Arc—**4** *Tungsten*—**2**

These settings are 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 percent gray side) at the copy board. A matte white card will serve, in which case expose for 5 times the calculated exposure time.

Allow for the change in exposure times necessary when making enlarged or reduced images. To find the correct exposure for close copying work, which is common in photomechanical reproduction, apply the appropriate exposure factors based on the percentage of reduction or enlargement of the original copy. A few typical factors are given below.

Reproduction Size (percent of original size)	25%	50%	100% (same-size)	150%	200%	300%
Multiply calculated exposure by	1.6	2.2	4.0	6.5	9.0	16.0

The exposure level determines the over-all contrast and particularly the highlight contrast of the reproduction. If the negative is underexposed, no improvement in highlight contrast will result; if it is overexposed, the middle tones will be too dark in a reproduction with correct highlight tones. The exposure required to obtain the proper highlight contrast is fairly critical. See the comments under the table of development times.

To determine more accurately the optimum exposure level for your particular conditions, select a typical original and mount it on the copy board along with a suitable reflection gray scale. Make a series of test exposures and carry through your regular reproduction process with each negative. Select the reproduction which shows the best tone rendering and measure the highlight density of the negative from which it was made. As a guide for future work, plot the negative densities against the densities of the original gray scale. For critical work, it may be necessary to readjust the exposure level to compensate for uncontrolled variations in the process.

Examples of Exposure: Under average shop conditions, with a same-size reproduction, the exposure is as follows:

Light Source	Aperture	Exposure
Two 35-ampere arc lamps, one on each side, 48 inches from the center of the copy	*f*/22	12 sec
Two No. R-2 Reflectorflood Lamps, or two 500-watt 3200 K lamps in reflectors, at 36 inches from the center of the copy	*f*/22	35 sec
Two blue fluorescent lamps with eight 40-watt "blue" tubes in each, 36 inches from the center of the copy	*f*/22	35 sec*

*Daylight fluorescent lamps require more than 2 times this exposure. Green fluorescent lamps require about the same exposure but will give slightly higher middle-tone contrast.

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

Light Source	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
*White-Flame Arc	3	5	6	12	15	4	5	2.5
†Tungsten	2	2.5	4	6	5	6	8	2.5

*For ac or dc. With direct-current arc lamps, the positive carbon should be in the lower position.
†Photoflood or other high-efficiency tungsten.

Processing

Develop at 68 F (20 C) for approximate times given below:

Kodak Developer*	Development Times (minutes)	
	Tray (Continuous Agitation)	Tank† (Intermittent Agitation)
D-11	6	8
DK-60a‡	5	7
Dektol (1:1)‡	5	7

*These developers are available in prepared powder form in several package sizes.
†Agitation at one-minute intervals during development.
‡These developers result in slightly lower contrast than that produced by Kodak Developer D-11.

These development times will produce a slight increase in highlight contrast when the exposure is adjusted to give a maximum density of 1.8 in the negative, and are recommended when the aim is to produce whiter highlights in the copy. However, when most accurate reproduction of all tones in the original is desired, the development time in Kodak D-11 Developer should be reduced to 4 minutes in a tray or 5 minutes in a tank at 68 F (20 C), and the exposure adjusted to produce a maximum density of about 1.5 to 1.6.

Rinse in Kodak Stop Bath SB-1a for about 10 seconds, with agitation, at 65 to 70 F (18 to 21 C).

Fix at 65 to 70 F for approximate times below or twice the time for film to clear. Agitate film frequently during fixing.

Kodak Fixer	Fixing Times (minutes)
*Kodak Acid Fixer	5 to 10
*Kodalith Fixer	5 to 10
Kodak Fixing Bath F-5	5 to 10
*Kodak Rapid Fixer	2 to 4

*Available in prepared form in several package sizes.

Wash for 20 to 30 minutes in running water at 65 to 70 F (18 to 21 C). To minimize drying marks, treat in Kodak Photo-Flo Solution after washing

or wipe surfaces carefully with a Kodak Photo Chamois, a soft viscose sponge, a Kodak Rubber Squeegee, or other soft squeegee.

Dry in a dust-free place.

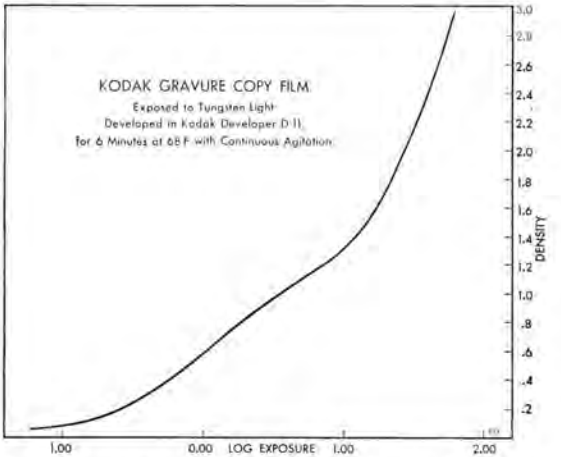
Sensitometric Data

Color Sensitivity: Orthochromatic.

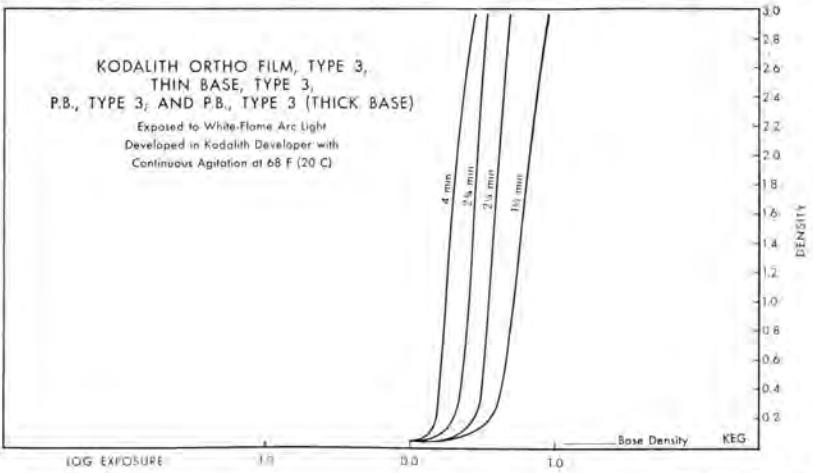
Spectrogram to White-Flame Arc

Spectrogram to Tungsten Light

Sensitometric Curve:



Sizes Available: Most popular sheet-film sizes from 4 x 5 to 20 x 24 inches.



KODALITH ORTHO FILM, TYPE 3; THIN BASE, TYPE 3; P.B., TYPE 3; AND P.B., TYPE 3 (THICK BASE)

An extremely high-contrast orthochromatic film designed primarily for making line and halftone negatives and positives for photomechanical reproduction. This film has wide development latitude and will produce sharp halftone dots suitable for dot etching. It is available in both sheets and rolls.

With Kodalith Ortho Thin Base Film, Type 3, the negatives can be printed with the image toward the light source for lateral image reversal. There is no appreciable loss of detail because the .0035-inch antihalation base is thin and clear. It is useful in both photolithography and photoengraving work.

Kodalith Ortho P.B. Film, Type 3, has a polystyrene base which offers unusual advantages where size-holding is of critical importance. The dimensional stability of regular film base has been surpassed by this new, clear plastic which is practically unaffected by changes in humidity. Use this new film for those jobs where a film with the best possible dimensional stability is needed. It is available in two thicknesses, .005 inch (P.B., Type 3) and .010 inch [P.B., Type 3 (Thick Base)].

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.

Exposure

Caution: To prevent pinholes and spots, be sure the film and copy-board glass are clean and free of dust.

Exposure Indexes

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

White-Flame Arc—**10** *Tungsten*—**6**

Example of Exposure: Under average shop conditions for linework, with a same-size reproduction, expose about 10 seconds at *f*/32 with two 35-ampere arc lamps placed 48 inches from the center of the copy, one on each side, at an angle of 45°.

Filter Factors: When a filter is used, multiply the unfiltered exposure by the filter factor for that particular Kodak Wratten Filter shown below. Since lighting conditions vary, these factors are only approximate.

Light Source	No. 8 (K2)	No. 15 (G)	No. 47B
*White-Flame Arc	2.5	5	12
†Tungsten	1.5	2.5	25

*For ac or dc. With direct-current arc lamps, the positive carbon should be in the lower position.
†Photoflood or other high-efficiency tungsten.

Processing

Develop at 68 F (20 C) for approximate times given below:

Kodak Developer	Development Times (minutes)		
	Halftone Negative	Agitation	Line Negative
‡Kodalith	2¾	Continuous	2½
‡Kodalith Super Line	—	Continuous	2¾
‡Kodalith Fine Line	—	§See note below	2¼
D-85	2	Continuous	2¼

‡Available in prepared powder form in several package sizes.
§2¼ minutes' total time (about 30 seconds' continuous agitation plus 1¾ minutes with no agitation). Full instructions with developer.
This developer is for those who prefer to mix a developer by formula. It is not furnished in a packaged form, but the formula is published in the booklet "Kodak Formulas for the Graphic Arts," available on request from the Graphic Reproduction Sales Division, Eastman Kodak Company, Rochester 4, N.Y.

Rinse films in Kodak Stop Bath SB-1a for about 10 seconds, with agitation, at 65 to 70 F (18–21 C). This bath checks development, tends to prevent any spots or streaks, and prolongs the life of the fixing bath.

Fix at 65 to 70 F (18–21 C) for approximate times below or twice the time for film to clear. *Agitate films frequently during fixing.*

Kodak Fixer	Fixing Times (minutes)
**Kodalith Fixer	2 to 3
Kodak Fixing Bath F-5	2 to 3
**Kodak Rapid Fixer	1 to 2

**Available in prepared form in several package sizes.

Wash about 10 minutes in an adequate supply of running water. To minimize drying marks, treat in Kodak Photo-Flo Solution after washing, or wipe surfaces carefully with a Kodak Photo Chamois, a soft viscose sponge, a Kodak Rubber Squeegee, or other soft squeegee (such as a windshield wiper blade).

Dry in a dust-free place.

Reduction and Dot Etching by conventional techniques can be used with this film. Kodak Nonstaining Reducer R-14 is ideal for this work. Other standard formulas, such as Kodak Farmer's Reducer or iodine-cyanide, can also be used.

Staging or Cleaning P.B. Films: When the film emulsion is scratched or otherwise removed, certain staging-paint solvents and film cleaners will be found to attack the polystyrene base. It is recommended that asphaltum be used when staging is necessary. Asphaltum can be removed with naphtha without adversely affecting the film base. Naphtha, which is free of residual oil, is also satisfactory for cleaning polystyrene base films.

Sensitometric Data

Color Sensitivity: Orthochromatic

Sensitometric Curves: See page 45.

Spectrogram to WFA

Copying Data—Kodak Ektachrome and Kodachrome Films for Artificial Light

Exposure Indexes for meters marked for American Standard Exposure Indexes:

KODACHROME PROF. FILM, TYPE A	*Tungsten* (Photoflood)—**16**
KODAK EKTACHROME FILM, TYPE F	*Tungsten* (Photoflood)—**16***
KODACHROME FILM, TYPE F	*Tungsten* (Photoflood)—**12***
KODAK EKTACHROME FILM, TYPE B	*Tungsten* (3200K)—**10**

*With Kodak Light Balancing Filter No. 82A

These values are for trial exposures in the copying of continuous-tone and line originals, using tungsten light of appropriate color quality. They apply to *incident light* meter readings at the copy board and to reflected-light readings from a gray card of 18% reflectance† at the copy board. If the reading is taken from a white card of 90% reflectance, use approximately one-fifth the above values, e.g. 3, 2, and 2 respectively.

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

Effect of Extended Bellows: Whenever the subject is closer than 8 times the focal length of the lens, allowance must be made for the decrease in effective lens aperture due to the bellows extension (see page 17).

Suggested Lamp-and-Filter Combinations

In general, best color rendering is obtained with the light source for which each film is designed. Other light sources may not give equally good results, even with the most appropriate filters. The filters listed below are suggested for trial.

LAMPS	KODACHROME AND KODAK EKTACHROME *Type F*	EKTACHROME *Type B*
Photoflood	No. 82A	No. 81A
3200 K	No. 82C	No Filter
Standard Warm* White Fluorescent	CC-10C + CC-30M	CC-20R
Standard Cool White Fluorescent	CC-30M + CC-20Y	CC-50Y + CC-40M
Daylight Fluorescent	Not recommended	Not recommended
White-Flame Carbon Arc	Not recommended	Not recommended

*G. E. only

Trial Exposures for Copying: These recommendations are suggested as a starting point for a series of tests with art work and flat copy of average reflectance. For art work with a light background, the lens opening should be decreased slightly. Use four No. 2 reflector-type flood lamps at 45° to camera-copy axis and at 44 inches from copy. They should provide 900 foot-candles incident light or 50 candles per square foot read with a reflected-light meter from a Kodak Neutral Test Card (gray side).

Film	Filter	Camera Settings	
		Shutter Speed	*Aperture*
Kodachrome, Type F	No. 82A	1/25 sec.	*f*/4
Kodak Ektachrome, Type F	No. 82A	1/25 sec.	Between *f*/4.0 and *f*/5.6
Kodak Ektachrome, Type B	No. 81A	1 sec.	*f*/16
Kodacolor & Ektacolor, Type S	No. 82A	1/25 sec.	*f*/5.6

Kodak Ektacolor Film, Type B, is balanced for exposure with 3200 K lamps. Filter recommendations for other commonly used light sources are given on the instruction sheet packed in each box of film.

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authoritative reference books

THE KODAK MASTER PHOTOGUIDE: A 32-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.

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