

# KODAK Technical Pan Film



KODAK Technical Pan Film is Kodak's slowest and finest-grained black-and-white film for pictorial photography (when developed in KODAK TECHNIDOL Liquid Developer). It is a variable-contrast panchromatic film with extended red sensitivity; because of its extended red sensitivity, it yields prints with a gray-tone rendering slightly different from that produced by other panchromatic films. (This is most noticeable in portraits, in which it suppresses blemishes.)

Use this film for pictorial, scientific, technical, and reversal-processing applications. It is an excellent choice for making big enlargements or murals.

## APPLICATIONS

You can vary the contrast of KODAK Technical Pan Film by modifying development. The wide range of contrast levels, along with the spectral sensitization and combination of speed and image-structure properties, makes this film unusually versatile and suitable for many applications:

- Pictorial photography
- Photomicrography
- Microphotography (Microfilming)
- Solar photography
- Photographing electrophoretic gels
- Laser recording
- Other applications such as slide making, copying, and microfilming that require high or moderately high contrast combined with fine grain and high resolving power

## SIZES AVAILABLE

Sizes and CAT numbers may differ from country to country. See your dealer who supplies KODAK Professional Products.

### KODAK Technical Pan Film 2415

Size mm x ft	Film Code	Base	Sp No.	Letter Code	CAT No.
35 x 150	2415	ESTAR-AH	442	TP	129 9916

Size	Film Code	Base	Letter Code	CAT No.
135-36	2415	ESTAR-AH	TP	129 7563

### KODAK Technical Pan 4415

Sheets Per Package	Sizes (inches)	Film Code/Notch	Base	CAT No.
25	4 x 5	[Redacted]	ESTAR Thick	800 4640
25	8 x 10			818 2826

### KODAK Technical Pan Film 6415

Size	Film Code	Base	Letter Code	CAT No.
120	6415	3.6-mil acetate	TP	151 1054

Because 2415 Film has a thinner base than conventional 35 mm picture-taking films, 150-foot rolls finished to Sp 442 will fit in bulk-film loaders designed to accept 100-foot rolls.

Other sizes are available on a special-order basis, subject to manufacturing limitations and current minimum-order requirements. Minimum-order quantities for special-order sizes are generally 750 square feet (70 square metres) of film.

## SPECTRAL SENSITIVITY

Technical Pan Film has reasonably uniform spectral sensitivity at all visible wavelengths out to 690 nanometres (nm). Because of this extended red sensitivity, red areas and flesh tones may appear lighter than they would with conventional black-and-white films. This is often an advantage. For example, it helps conceal some skin blemishes and often adds a pleasing luminous quality to skin tones. (This effect is less evident in portraits made in the shade outdoors, because there is less red light present.)

To approximate the response of conventional panchromatic films more closely, make exposures through a color-compensating filter such as a KODAK Color Compensating Filter CC40C or CC50C (cyan). With this filter, no exposure compensation is necessary; however, there may be a slight loss in sharpness.

## STORAGE AND HANDLING

Load and unload your camera in total darkness. Do not use a safelight.

High temperatures or high humidity may produce unwanted quality changes. Store unexposed film at 75°F (24°C) or lower in the original package. Always store film (exposed or unexposed) in a cool, dry place. For best results, process film as soon as possible after exposure.

Protect processed film from strong light, and store it in a cool dry place. For more information on storing negatives, see KODAK Publication No. E-30, *Storage and Care of Photographic Materials—Before and After Processing*.

## EXPOSURE

The speed of this film depends on the application, the type and degree of development, and the level of contrast required. Therefore, no single speed value applies for all situations. (Speed ratings may range from a low of EI 16 for pictorial photography to a high EI 320 for microfilming. Use the exposure indexes in the following table with meters marked for ISO, ASA, or DIN speeds or exposure indexes. They are intended for trial exposures.

You can expose this film with daylight or tungsten light. Exposure to tungsten illumination produces a 10-percent increase in speed and a 5-percent increase in contrast.

## Exposure- and Contrast-Index Values for Various Development Conditions

Contrast Index		KODAK Developer	Development Time (minutes at 68°F [20°C])	Exposure Index
High	2.50	DEKTOL	3	200
2.40 to 2.70		D-19 (1:2)	4 to 7	100 to 160
2.25 to 2.55		D-19	2 to 8	100 to 200
1.20 to 2.10		HC-110 (Dil B)	4 to 12	100 to 250
1.25 to 1.75		HC-110 (Dil D)	4 to 8	80 to 125
1.10 to 2.10		D-76	6 to 12	64 to 125
1.00 to 1.50		MICRODOL-X	8 to 12	32 to 50
0.80 to 0.95		HC-110 (Dil F)	6 to 12	32 to 64
0.60		XTOL (1:2), (1:3), (1:4), (1:5)	6 to 16*	4 to 10
Low	0.50 to 0.70	TECHNIDOL Liquid	5 to 11	16 to 25

\* At 21°C (70°F)

For *pictorial applications*, use EI 25/15° and process the film in KODAK TECHNIDOL Liquid or KODAK XTOL Developer. (Refer to “PROCESSING.”)

For *high-contrast reversal-processing applications*, use EI 64/19° to produce slides from high-contrast subjects such as line art. Process the film with the KODAK T-MAX 100 Direct Positive Film Developing Outfit.

## Filter Factors

Multiply the normal exposure by the filter factor indicated below. If you use a through-the-lens meter, take the meter reading without the filter over the lens, and then calculate your exposure by using the filter factor. Where no filter factor is listed in the table, no test was made with that filter.

KODAK WRATTEN Gelatin Filter	Tungsten Filter Factor*	Daylight Filter Factor†
No. 8 (yellow)	1.2	1.5
No. 11 (yellowish green)	5	—
No. 12 (deep yellow)	1.2	—
No. 15 (deep yellow)	1.2	2
No. 25 (red)	2	3
No. 47 (blue)	25	12
No. 58 (green)	12	—

\* Based on a 1-second exposure and development in KODAK HC-110 Developer (Dilution D) for 8 minutes at 68°F (20°C).

† Based on a 1/25-second exposure and development in KODAK TECHNIDOL Liquid Developer for 9 minutes at 68°F (20°C).

## Adjustments for Long and Short Exposures

Compensate for the reciprocity characteristics of this film by increasing exposure and adjusting the development as shown.

If Indicated Exposure Time Is (seconds)	Use This Lens-Aperture Adjustment	OR	This Adjusted Exposure Time (seconds)	AND Use This Development Adjustment
1/10,000	None		None	+30%
1/1,000	None		None	+20%
1/100	None		None	None
1/10	None		None	None
1	None		None	-10%
10	+1/2 stop		15	-10%
100	+1 1/2 stops		Adjust aperture	None

## DARKROOM RECOMMENDATIONS

Handle unprocessed film in total darkness. After development is half completed, you can use a KODAK 3 Safelight Filter (dark green) in a suitable safelight lamp with a 15-watt bulb. Keep the safelight at least 4 feet (1.2 metres) from the film.

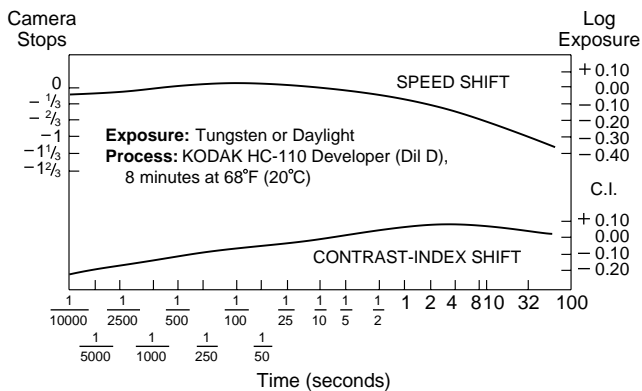
For information on safelight testing, see KODAK Publication K-4, *How Safe Is Your Safelight?*

## Exposure- and Contrast-Index Values for Processing in the KODAK VERSAMAT Film Processor, Model 11

Contrast Index	KODAK Developer	Development Temperature °F (°C)	Machine Speed (ft/min)	Developer Racks	Exposure Index ISO/DIN*
2.20	VERSAMAT 885	85 (29.4)	10	1	160/23°
1.40	VERSAMAT 641	85 (29.4)	10	1	125/22°
1.40	DURAFLO RT	80 (26.5)	10	2	160/23°

\* Based on a 1/25-second daylight exposure

## Changes in Speed and Contrast Due to Long- and Short-Exposure Adjustments



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## SPECIFIC APPLICATIONS

### Pictorial Photography

These films produce high-quality pictorial negatives when processed in KODAK TECHNIDOL Liquid or KODAK XTOL Developer. (See “PROCESSING.”) Conventional developers generally produce contrast too high for normal pictorial photography. Process the film according to the instructions for KODAK TECHNIDOL Liquid Developer.

In pictorial applications, the fine grain permits enlargements at magnifications of 25X or more with little perceptible grain. The extended red sensitivity has a haze-cutting effect in photographs of distant landscapes and in aerial shots.

Use an exposure index of 25 for trial exposures.

### Copy Applications

You can use these films for copying printed material, making reverse-text title slides, and copying continuous-tone photographs.

Use two lamps. Place one on each side of the copy material so that each light strikes the material at about a 45-degree angle. For originals larger than 16 x 20 inches (40 x 50 cm), you may need four lamps (two on each side) for uniform illumination. Determine the exposure with a meter.

If you use a camera with a through-the-lens meter, take the reading from a gray card in the copy position. The meter could give you an incorrect reading from the copy itself, depending on the amount of text.

If you do not use an exposure meter, try these starting points: With two No. 2 photolamps in matte-surface reflectors at about 4 feet (1.2 metres) from the copyboard, use 1/60 second at *f*/8. With two No. 1 photolamps, increase the exposure by one stop.

With meters marked for ISO (ASA/DIN) speeds or exposure indexes, use these film-speed values:

#### Starting-Point Exposures for Copying Printed

**Materials:** With meters marked for ISO (ASA/DIN) speeds or exposure indexes, use these film-speed values:

- Tungsten 320/26°—for incident-light readings or for reflected-light readings from a *gray* card (18-percent reflectance) at the copyboard.
- Tungsten 64/19°—for reflected-light readings from a *matte white* card (90-percent reflectance) at the copyboard.

**Note:** These values are based on small-tank development in KODAK Developer D-19 for 4 minutes at 68°F (20°C) with agitation at 30-second intervals.

The exposure index is based on the formula  $EI = 36/H$ , where H is the 1-second exposure in lux-seconds required to produce a density of 1.20 above minimum density with the indicated development.

#### Starting-Point Exposures for Making Reverse-Text

**Slides:** With exposure meters marked for ISO (ASA/DIN) speeds or exposure indexes, use these film-speed values:

- Tungsten 200/24°—for incident-light readings or for reflected-light readings from a *gray* card (18-percent reflectance) at the copyboard.
- Tungsten 40/17°—for reflected-light readings from a *matte white* card (90-percent reflectance) at the copyboard.

**Note:** These values for reverse-text slides are based on development in KODAK DEKTOL Developer for 3 minutes at 68°F (20°C).

The exposure index is based on the formula  $EI = 10/H$ , where H is the 1-second exposure in lux-seconds required to produce a density of 0.60 above minimum density with the indicated development.

**Copying Continuous-Tone Photographs:** To copy continuous-tone photographs, use an exposure-index value to achieve a gamma value between 0.6 and 1.0, depending on the contrast of the original. For low-contrast originals, you can try KODAK HC-110 Developer (Dilution B) for 6 minutes (EI 160); for higher-contrast originals, use KODAK TECHNIDOL Liquid Developer for 9 minutes (EI 25).

### Microphotography (Microfilming)

The resolving power of Technical Pan Film allows microfilming of most documents at reductions of up to 20X, assuming that the copying lens is of high quality and is carefully focused. The film plane and the plane of the copyboard must be parallel to provide sharp focus over the whole image area. When you photograph black-and-white originals, use a green filter such as a KODAK WRATTEN Gelatin Filter No. 58 or 61. This will help suppress the chromatic aberrations found in most lenses that would be emphasized by the extended red sensitivity of the film.

For optimum image quality, adjust the exposure to achieve a negative density of 1.20 in the areas that correspond to the white or light-colored areas of the original. Process the film to a gamma of 2.0 in KODAK HC-110 Developer (Dilution D) for 8 minutes at 68° F (20°C) (EI 125).

### Photographing Electrophoretic Gels

Electrophoretic gels are often photographed to produce prints for information storage, analysis, display, and publication. KODAK Technical Pan Films yield high-quality black-and-white negatives from which you can make high-quality prints of these gels. Adjust exposure carefully to minimize the appearance of the gel background tint in the prints.

Make tests to determine exposures for your lighting conditions. Develop the film for 4 minutes in KODAK HC-110 Developer (Dilution D) at 68°F (20°C) (EI 80). TECHNIDOL Liquid Developer may also work with your setup.

## Photomicrography

The low contrast of most microscopic subjects often requires a contrast-enhancing film-and-developer combination and (with stained specimens) a contrast-enhancing filter. For routine photomicrography of H and E-stained tissue, try a broad-band yellow-green filter (e.g., a KODAK WRATTEN Gelatin Filter No. 11) at a tungsten exposure index of 50, developed in HC-110 Developer (Dilution B) for 8 minutes at 68°F (20°C). Negatives should print easily and with good contrast on normal-contrast paper. (If negatives are too dense, use a higher exposure index; if too thin, use a lower one. If contrast is too low, increase the development time; if too high, decrease the time.)

For phase-contrast and differential-contrast techniques, try a tungsten exposure index of 100, and develop in HC-110 Developer (Dilution D) for 6 minutes at 68°F (20°C). (If necessary, adjust the exposure index or development as described above.) This method may also be suitable for banding techniques in chromosome photomicrography. When you want maximum contrast, as in older karyotyping methods, use a tungsten exposure index of about 125, and develop in Developer D-19 for 4 minutes at 68°F (20°C). (Because of the differing spectral sensitivities of microscope photocells and the special characteristics of Technical Pan Films, these exposure index recommendations cannot be exact.)

Metallographers can easily select development conditions from the characteristic curves shown in this pamphlet, based on the contrast index they have used successfully with other materials.

## Electron Micrography

Use Technical Pan Film to record the output of the fiber-optic faceplate in transmission electron microscopes and to provide optimum contrast and resolution for biological specimens.

Make tests to determine exposures for the accelerating voltage and magnification. Develop for 5½ minutes in Developer D-19 (1:2) at 68°F (20°C) or for 4 minutes in Developer D-19 (full strength) at 68°F (20°C). For less contrast, process for 8 to 12 minutes in HC-110 Developer (Dilution B) at 68°F (20°C).

## Astronomical Photography

The extended red sensitivity of Technical Pan Films makes them especially suited to solar photography at the H-alpha line (656 nm), and their reasonably uniform spectral sensitivity over the visible region of the spectrum makes them most useful for solar filtergrams. They are also useful for lunar and planetary photography. The extremely fine grain and high resolving power, coupled with high-contrast development (with Developer D-19, for example) permits reproduction of very fine detail on objects in the solar system.

You can use these films for stellar photography, but first hypersensitize them with forming gas or silver nitrate to improve the film response with the long exposures required. (For information on hypersensitization of Technical Pan Films, see the *American Astronomical Society Photo-Bulletin*, Issue No. 24, 1980, No. 2.)

## Laser Photography

The extended red sensitivity of these films makes them very useful in applications in which the exposing radiation is from helium-neon lasers (633 nm) or red-light-emitting diodes (typically 640 to 650 nm).

For example, Technical Pan Films are frequently recommended for photographing holograms reconstructed with the helium-neon lasers. Since the range of scene brightnesses that can be recorded and reconstructed holographically is inherently great, it is sometimes appropriate to process the film to a low contrast (contrast index of 0.5 to 0.6). However, in holographic interferometry, processing the film to a contrast index of 1.5 or more will enhance the visibility of the interferometric fringe by increasing its modulation. Try HC-110 Developer (Dilution B).

In image-recording or plotting applications, you can control the film contrast during processing to convert the modulation range of the recorder to the density range you want on the film.

## PROCESSING

Handle unprocessed film in total darkness. After development is half complete, you can use a suitable safelight lamp equipped with a KODAK 3 Safelight Filter (dark green) and a 15-watt bulb *for a few seconds*. Keep the safelight at least 4 feet (1.2 metres) from the film.

When you use these films for pictorial applications, you must select a film-and-developer combination carefully. With 35 mm Technical Pan Film, use TECHNIDOL Liquid Developer. With Technical Pan Film / 4415 and 6415 (sheets and 120 size), use *only* TECHNIDOL Liquid Developer. Observe the precautionary information on the developer packaging.

### KODAK XTOL Developer Small-Tank Processing (135 rolls)

You can use the following recommendations to produce negatives of pictorial contrast using diluted KODAK XTOL Developer. We recommend testing to confirm proper speed, contrast, and development. The recommendations are for 135-36 film only. Processing 120 film in dilute XTOL Developer is not recommended because of the potential for uneven development. Use your normal agitation technique. Use diluted XTOL Developer **only once**.

#### Processing KODAK Technical Pan Film / 2415 in Small Tanks with Fresh, Dilute KODAK XTOL Developer and Normal Agitation (Development Time in minutes)

Roll Film	Format	EI	CI	Developer Dilution			
				1:2	1:3	1:4	1:5
				70°F (21°C)	70°F (21°C)	70°F (21°C)	70°F (21°C)
KODAK Technical Pan / 2415	135	4	0.60	6.00			
		6	0.60		9.00		
		8	0.60			12.00	
		10	0.60				15* 16†

\* Using 16 fluidounces (473 mL) of developer per roll

† Using 8 fluidounces (237 mL) of developer per roll

### KODAK TECHNIDOL Liquid Developer Small-Tank Processing (rolls)

You can process roll film in small 8- or 16-ounce stainless-steel or 10- or 20-ounce plastic tanks with spiral reels using the following instructions. With some spiral reels, the 35 mm film may be susceptible to nonuniform processing effects if agitation is not carefully controlled. Pouring the developer on dry film through the light trap in the tank top can also produce nonuniformity. To avoid processing problems, pour the developer into the tank before you insert the loaded reel, and follow the agitation recommendations below.

**Preparing a Working Solution:** Mix your liquid developer according to the instructions packaged with the developer. Use water at 68 to 86°F (20 to 30°C).

To process one roll of 135-36 film, make 8 fl oz (237 mL) of developer solution. Stir until the solution is completely mixed. To process one 120-size roll or two 135-36 rolls of film in the same process, prepare one pint (16 fl oz [473 mL]) of developer.

You can reuse the developer if you increase the development time of the second process by 1 minute. Store the developer in an air-tight bottle, and use it within a week.

**Processing with TECHNIDOL Liquid Developer in a Small Tank:** The following procedure may vary from the instructions provided with your tank, but you must follow it to obtain good results.

**Develop** roll film for the amount of time in the table below, according to the developer temperature you choose.

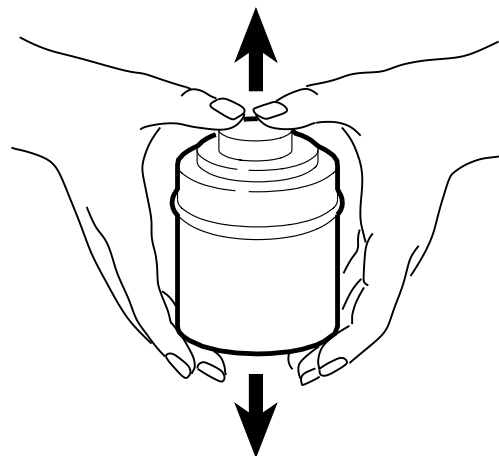
#### Development Times for KODAK TECHNIDOL Liquid Developer in Stainless-Steel 8- or 16- oz or Plastic 10- or 20-oz Tanks

Temperature	68°F (20°C)	77°F (25°C)	86°F (30°C)*
Time	9 minutes	7½ minutes	6½ minutes

\* With 35 mm film only

1. Fill the tank with developer adjusted to one of the temperatures in the table.
2. In total darkness, drop the loaded reels into the tank of solution and attach the top to the tank.
3. Firmly tap the bottom of the tank on the top of the work surface to dislodge any air bubbles. (You can then turn on the room lights.)
4. Provide immediate agitation by shaking the tank **vigorously** up and down 10 to 12 times for 2 seconds. *Do not rotate the tank.*

#### Liquid Developer Agitation Technique



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5. Let the tank sit for 30 seconds, and then start the next 2-second agitation.
6. Repeat steps 4 and 5 every 30 seconds for the remainder of the development time.

**Final Steps in Tank Processing—**  
68 to 86°F (20 to 30°C)

Step/Solution	Time (min:sec)
<b>Rinse</b> — with agitation:	
KODAK Indicator Stop Bath	0:15 to 0:30
KODAK EKTAFL0 Stop Bath	0:15 to 0:30
<b>Fix</b> — with frequent agitation:	
KODAK Fixer	2:00 to 4:00
KODAK Rapid Fixer	1:30 to 3:00
KODAFIX Solution	2:00 to 4:00
<b>Wash:</b>	
Running water —OR—	5:00 to 15:00
Rinse with water	0:15
KODAK Hypo Clearing Agent	1:30
Running water	5:00
<b>Final rinse:</b>	
KODAK PHOTO-FLO Solution	0:30
<b>Dry</b> — in a dust-free place	

**Note:** Keep the rinse and fix temperatures within 3°F (1.7°C) of the developer temperature, and the wash temperature within 5°F (3°C) of the developer temperature.

**Rinse** the film in KODAK Indicator Stop Bath or KODAK EKTAFL0 Stop Bath for 15 to 30 seconds. Use running water for 30 seconds if you don't use a stop bath.

**Fix** the film with frequent agitation in KODAK Rapid Fixer for 1½ to 3 minutes. Or use KODAK Fixer or KODAFIX Solution for 2 to 4 minutes.

**Wash** the film in clean running water for 5 to 15 minutes.

To save time and conserve water, use KODAK Hypo Clearing Agent. Rinse the fixed film in running water for 15 seconds. Bathe the film in KODAK Hypo Clearing Agent for 1 to 2 minutes with agitation. Then wash the film for 5 minutes in running water, providing at least one change of water during the 5 minutes.

**Dry** the film in a dust-free place. To minimize drying marks, treat the film with KODAK PHOTO-FLO Solution after washing, or wipe the surface carefully with a KODAK Photo Chamois or soft viscose sponge.

You can use heated forced air at 10°F (38°C) to reduce drying time.

**Tray Processing (sheets)**

Mix 1 quart (32 fl oz [946]) of TECHNIDOL Liquid Developer at one-half the working strength you'd use for roll films. That is, use 2 packets of developer concentrate and add enough water at 68°F (20°C) to make 1 quart. Stir until the developer is completely mixed.

You can develop the equivalent of twelve 4 x 5-inch sheets of film in this amount of solution. Do not reuse this solution for a second batch even if your first batch consisted of fewer than twelve sheets.

**Processing with TECHNIDOL Liquid Developer in a Tray:** Use the special agitation procedure described below for best processing uniformity in a tray.

**Presoak** the film in water at 68°F (20°C) for approximately 2½ minutes.

1. Locate the code notch and identify the emulsion side of the film. Turn the first sheet so that the emulsion side faces up and the code notch is in the *lower left-hand corner*; place the sheet in the water presoak.
2. Agitate the film for 5 seconds. Place the next sheet of film on top with the emulsion side up and the code notch in the *upper right-hand corner*. (This will help you identify the first sheet of film later.) Repeat this step for the remaining sheets.
3. When all the sheets are in the presoak, begin timing for 2½ minutes. Agitate carefully by pulling the bottom sheet out every 5 seconds and placing it on top. Be sure to keep the film emulsion side up and to keep the stack immersed.
4. After 2½ minutes, locate the first sheet, remove it, and allow it to drain. Using the same code-notch orientation, quickly place the sheet in the developer and agitate for about 10 seconds. Move the remaining sheets to the developer one at a time, agitating each for 10 seconds. Be careful that they don't scratch each other.

**Develop** at 68°F (20°C) for 8 minutes. Be sure the developer is at 68°F (20°C). Agitate the film in the developer as you did in the presoak. However, increase the rate of the initial agitation by going through the stack of film four times in the first minute of development. After 1 minute, take the entire stack of film and turn it 180 degrees. Continue the agitation at the normal rate of going through the stack twice per minute for the rest of the development time. Continue rotating the film as follows:

After this many minutes	Rotate the stack	To the
2	90°	left
3	180°	left
4	90°	right
5	180°	right
6	90°	left
7	180°	left

**Final Steps in Tray Processing—**  
65 to 70°F (18 to 21°C)

Step/Solution	Time (min:sec)
<b>Rinse</b> — with agitation:	
KODAK Indicator Stop Bath	0:15 to 0:30
KODAK EKTAFL0 Stop Bath	0:15 to 0:30
<b>Fix</b> — with frequent agitation:	
KODAK Fixer	2:00 to 4:00
KODAK Rapid Fixer	2:00 to 4:00
KODAFIX Solution	2:00 to 4:00
<b>Wash:</b>	
Running water —OR—	5:00 to 15:00
Rinse with water	0:15
KODAK Hypo Clearing Agent	1:30
Running water	5:00
<b>Final rinse:</b>	
KODAK PHOTO-FLO Solution	0:30
<b>Dry</b> — in a dust-free place	

**Rinse** the film at 65 to 70°F (18 to 21°C) in KODAK Indicator Stop Bath or KODAK EKTAFL0 Stop Bath for 15 to 30 seconds. Use running water for 30 seconds if no stop bath is available.

Put the first sheet into the stop bath and agitate vigorously. Put the remaining sheets into the stop bath one at a time, and agitate each vigorously for about 5 seconds. Go through the stack at the normal pace.

**Fix** the film at 65 to 70°F (18 to 21°C) in KODAK Fixer, KODAK Rapid Fixer, or KODAFIX Solution for 2 to 4 minutes. Move the sheets to the fixer one at a time. Continue the agitation.

**Wash** the film in running water at 65 to 70°F (18 to 21°C) for 5 to 15 minutes. To save time and conserve water, you can use KODAK Hypo Clearing Agent. First rinse the film in running water for 15 seconds. Transfer the stack of film to the hypo clearing agent solution and agitate for 1½ minutes. Then wash the film for 5 minutes in running water, providing at least one change of water during this time. Treat the film with KODAK PHOTO-FLO Solution and hang it up to dry; do not squeegee.

**Other KODAK Developers**

To process these films in the other developers listed in the table Exposure- and Contrast-Index Values for Various Development Conditions or the Quick Reference Guide to Developers, follow the instructions for your tank.

Before using any developer, make sure that the solution is free of small air bubbles. If bubbles adhere to the emulsion, they may cause small undeveloped clear spots on the film (dark spots on the print). Bubbles may form more easily if you mix cold and hot water. If bubbles do form, let the

developer stand until they dissipate. Attaching an aerator to the water supply will help eliminate small bubbles.

Develop to the contrast index for your application; see “Exposure” and the characteristic curves. The contrast index depends primarily on the developer, temperature, dilution, and processing technique. It is affected less by exposure time and normal product variability.

**KODAK VERSAMAT 641 Developer Replenisher  
KODAK VERSAMAT 641 Developer Starter  
KODAK VERSAMAT 641 Fixer and Replenisher**

**Processing Sequence**

Step	No. of Racks	Path Length	Temperature
Develop	1	4 ft (1.2 m)	85 ±0.5°F (29.4 ±0.3°C)
Fix	3	12 ft (3.8 m)	85°F (29°C) nominal
Wash	2	8 ft (2.4 m)	75 to 80°F (24 to 27°C)
Dry	—	8 ft (2.4 m)	135 to 140°F (57 to 60°C)

To produce a contrast index of about 1.4, start with a machine speed of 10 feet per minute (3.05 m/min).

**KODAK VERSAMAT 885 Developer Replenisher  
KODAK VERSAMAT 885 Developer Starter  
KODAK VERSAMAT 885 Fixer and Replenisher**

**Processing Sequence**

Step	No. of Racks	Path Length	Temperature
Develop	1	4 ft (1.2 m)	85 ±0.5°F (29.4 ±0.3°C)
Fix	3	12 ft (3.8 m)	85°F (29°C) nominal
Wash	2	8 ft (2.4 m)	75 to 80°F (24 to 27°C)
Dry	—	8 ft (2.4 m)	135 to 140°F (57 to 60°C)

To produce a contrast index of about 2.2, start with a machine speed of 10 feet per minute (3.05 m/min). You will obtain adequate washing at speeds up to 15 feet per minute (4.5 m/min).



**KODAK DURAFLO RT Developer Replenisher**  
**KODAK DURAFLO RT Developer Starter**  
**KODAK Rapid Fixer**

**Processing Sequence**

Step	No. of Racks	Path Length	Temperature
Develop	1	8 ft (2.4 m)	80 ±0.5°F (27 ±0.3°C)
Fix	3	12 ft (3.8 m)	80°F (27°C) nominal
Wash	2	8 ft (2.4 m)	70 to 75°F (21 to 24°C)
Dry	—	8 ft (2.4 m)	135 to 140°F* (57 to 60°C)

To produce a contrast index of about 1.4, start with a machine speed of 8 feet per minute (2.4 m/min). Washing at this speed will not provide archival quality, but it should be adequate for many scientific recording applications.

\* Use a lower dryer temperature (95 to 110°F or 35 to 44°C) with 2415 Film if spots form due to rapid drying. Lower temperatures may also be adequate if you are drying only roll film.

**PRINTING**

The 0.1 neutral density built into the ESTAR-AH Base is one-half to one-third that found in conventional 35 mm picture-taking films. Correctly exposed and processed pictorial negatives may appear to be “thinner” than normal. It is important to take this into account when you judge the printability of negatives.

The micro-fine grain of Technical Pan Film makes possible printing at higher magnifications than are usually acceptable with conventional picture-taking films. Enlargements made at magnifications greater than 25X with highly specular (point-source) enlargers may show a random distribution of poorly defined white specks in otherwise dense areas. The specks are caused by tiny matte particles coated on the back surface of the film. You can mask the specks, with little loss in the overall sharpness of the image, by using an enlarger with a diffuse or semi-diffuse light source.

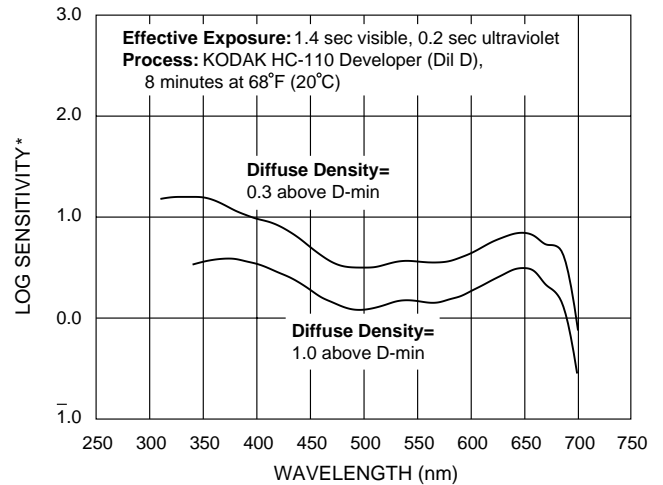
**IMAGE-STRUCTURE CHARACTERISTICS**

The data in this section are based on development at 68°F (20°C) in KODAK HC-110 Developer (Dilution D) for 8 minutes or KODAK TECHNIDOL Liquid Developer for 9 minutes.

Diffuse rms Granularity*	KODAK Developer	
	HC-110 (Dilution D)	TECHNIDOL Liquid
	8 Extremely fine	5 Micro fine

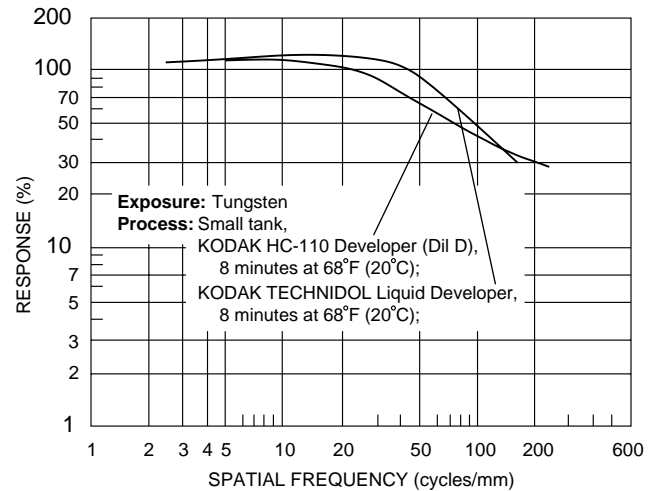
\* Read at a net diffuse density of 1.0 using a 48-micrometre aperture and 12X magnification.

**Spectral-Sensitivity Curves**



\*Sensitivity = reciprocal of exposure (erg/cm<sup>2</sup>) required to produce specified density  
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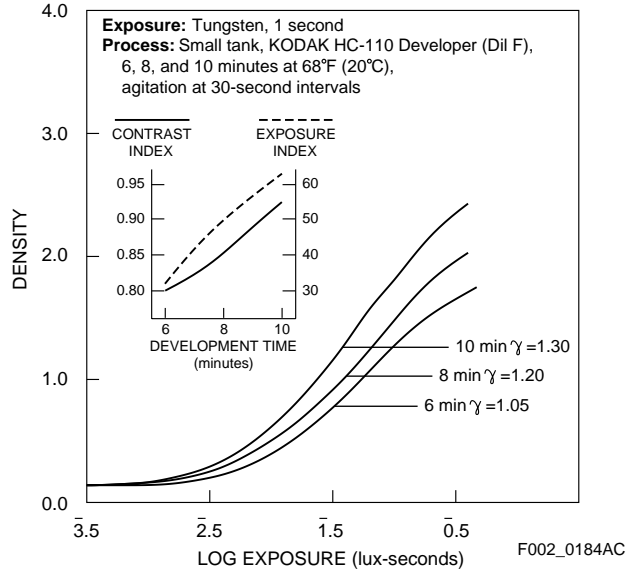
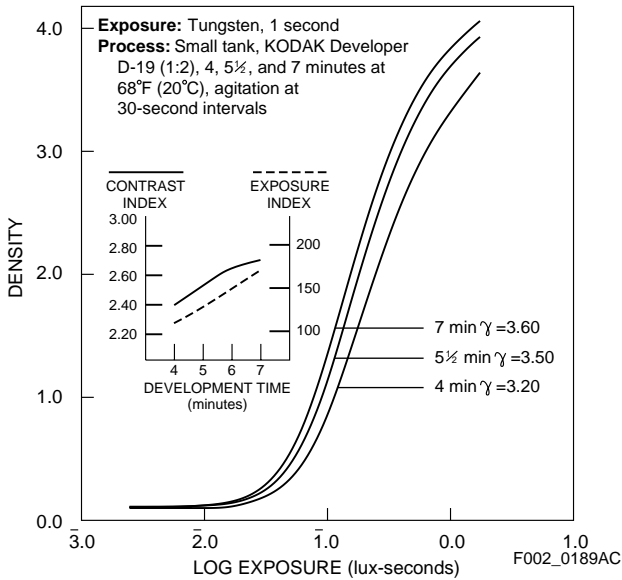
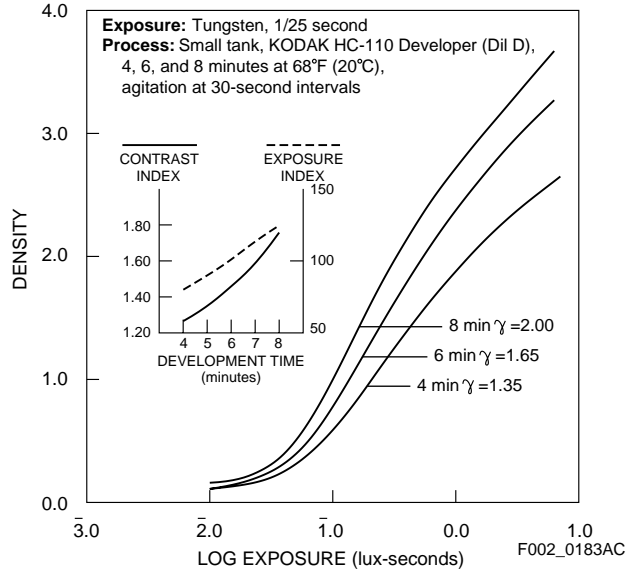
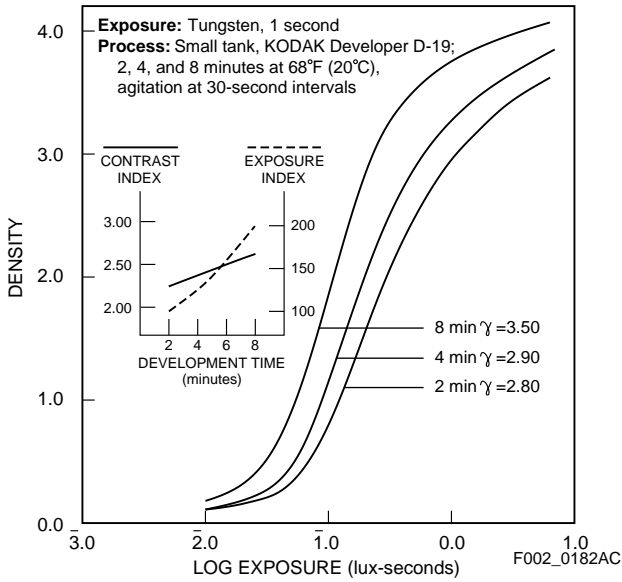
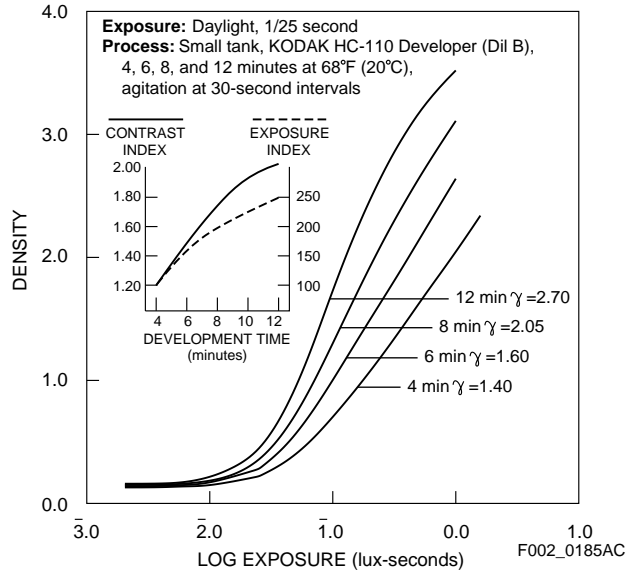
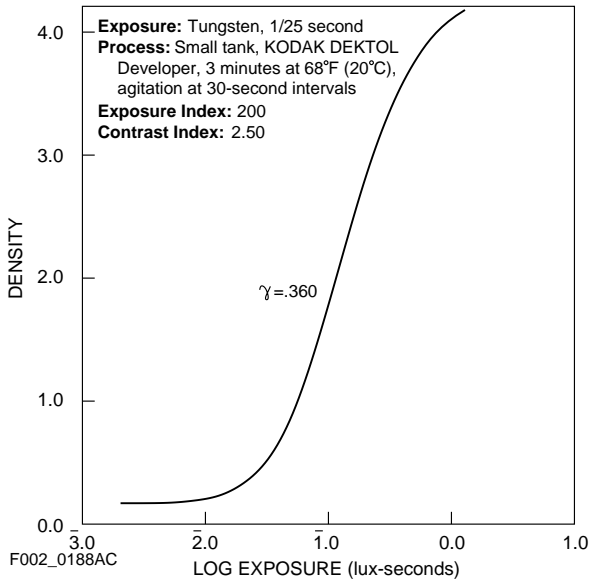
**Modulation-Transfer Curves**

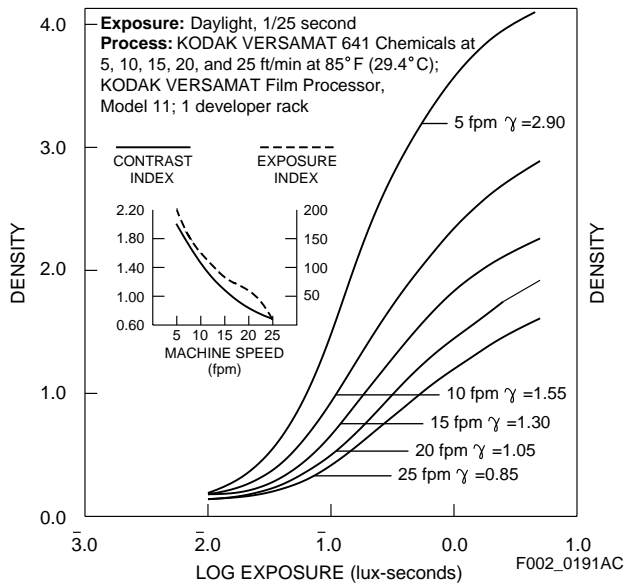
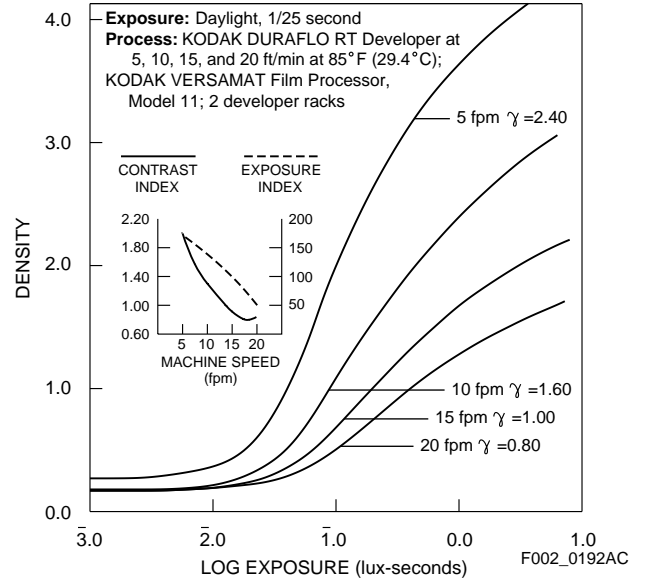
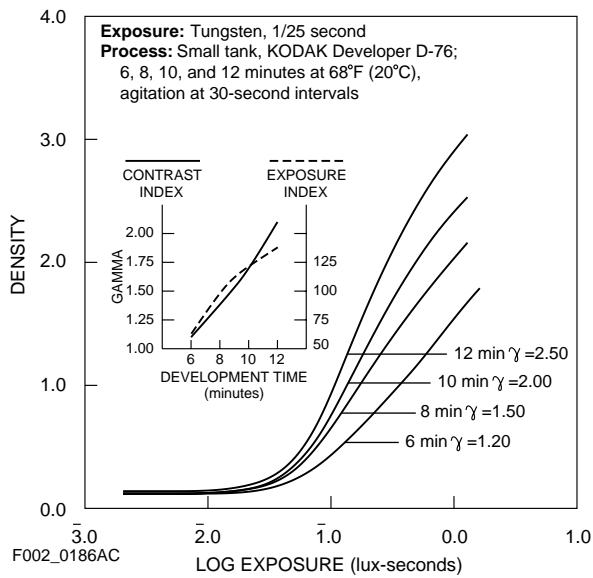
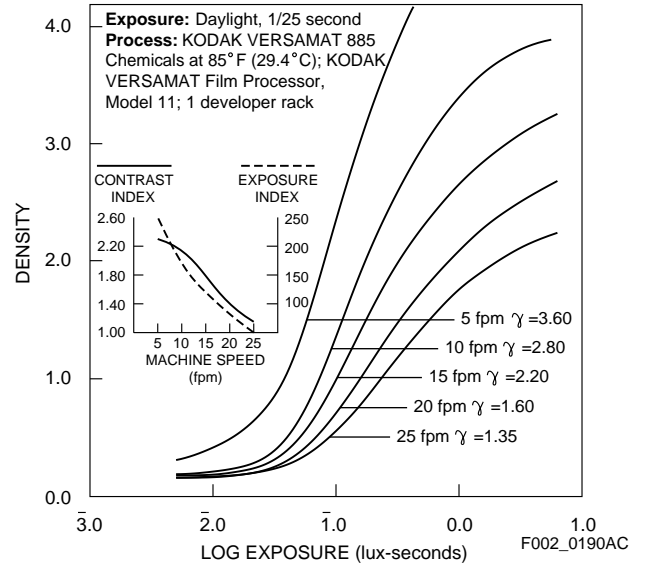
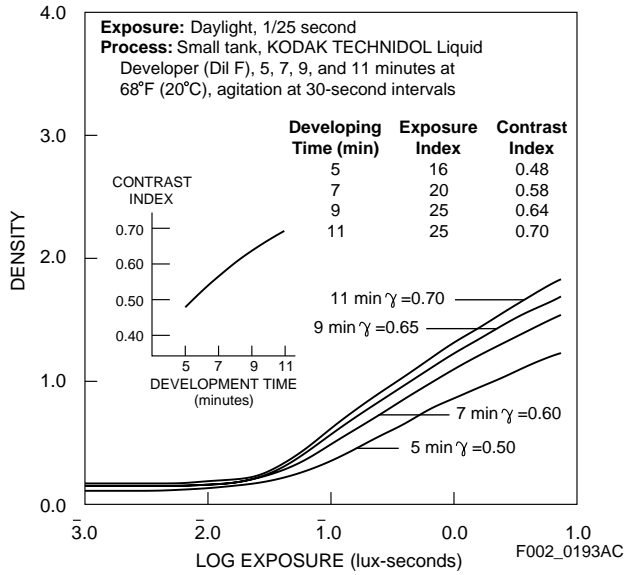


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**NOTICE:** The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent standards or specifications that must be met by Eastman Kodak Company. The company reserves the right to change and improve product characteristics at any time.

# Characteristic Curves





## QUICK REFERENCE GUIDE TO DEVELOPERS

KODAK Technical Pan Film (sizes)	KODAK Developer to Use for—									
	Pictorial	Reverse-Text Slides	Copying Printed Material	Copying Continuous-Tone Photos	Micro-photography	Electro-phoretic Gels	Photo-micrography	Electron Micrography	Astro-nomical	Laser
2415 (135 and long rolls)	TECHNIDOL Liquid, XTOL (1:2), XTOL (1:3), XTOL (1:4), XTOL (1:5)	DEKTOL	D-19	HC-110 (Dil B), TECHNIDOL Liquid	HC-110 (Dil D)	TECHNIDOL Liquid	HC-110 (Dil B), D-19, or HC-110 (Dil D)	D-19, D-19 (1:2), or HC-110 (Dil B)	D-19	HC-110 (Dil B)
4415 (4 x 5- and 8 x 10-inch)			HC-110 (Dil B) or TECHNIDOL Liquid		HC-110 (Dil D) or TECHNIDOL Liquid					
6415 (120)			TECHNIDOL Liquid		TECHNIDOL Liquid					

### MORE INFORMATION

Kodak has many publications to assist you with information on Kodak products, equipment, and materials.

Additional information is available on the Kodak website and through the U.S.A./Canada faxback system.

The following publications are available from dealers who sell Kodak products, or you can contact Kodak in your country for more information.

- E-30 *Storage and Care of KODAK Photographic Materials—Before and After Processing*
- F-2 *Pathways to Black and White*
- E-71 *Retouching Color Negatives*

For the latest version of technical support publications for KODAK PROFESSIONAL Products, visit Kodak on-line at:  
<http://www.kodak.com/go/professional>

Many technical support publications for KODAK PROFESSIONAL Products can be sent to your fax machine from the Kodak Information Center. Call:  
**U.S. 1-800-242-2424, Ext. 33 / Canada 1-800-295-5531**  
 —Available 24 hours a day, 7 days a week—

If you have questions about KODAK PROFESSIONAL Products, call Kodak.

In the U.S.A.:

1-800-242-2424, Ext. 19, Monday–Friday  
 9 a.m.–7 p.m. (Eastern time)

In Canada:

1-800-465-6325, Monday–Friday  
 8 a.m.–5 p.m. (Eastern time)

**Note:** The Kodak materials described in this publication for use with KODAK Technical Pan Film are available from dealers who supply KODAK PROFESSIONAL Products. You can use other materials, but you may not obtain similar results.

## Kodak Professional