

KODAK TECHNICAL PAN FILMS

DESCRIPTION	1
APPLICATIONS	1
DARKROOM HANDLING	1
STORAGE AND HANDLING	1
SPECTRAL SENSITIVITY	2
FILM SPEED	2
EXPOSURE	2
SPECIFIC APPLICATIONS	3
PROCESSING	5
PRINTING	8
IMAGE-STRUCTURE CHARACTERISTICS	8
SPECTRAL-SENSITIVITY CURVE	9
MODULATION-TRANSFER FUNCTION	9
CHARACTERISTIC CURVES	9
QUICK REFERENCE TO DEVELOPERS	12
FILM SIZES AND ORDERING INFORMATION	12
MORE INFORMATION	12

DESCRIPTION

KODAK Technical Pan Film is a black-and-white panchromatic negative film with extended red sensitivity. The 2415 Film is available in 135 size and 35 mm long rolls;* it has a dimensionally stable 4-mil ESTAR-AH Base. The 4415 Film is available in 4 x 5-inch and 8 x 10-inch sheets with a dimensionally stable 7-mil ESTAR Thick Base. The 6415 Film is available in 120 size with a 3.6-mil acetate base. All three films have good latent-image keeping, a dyed-gel backing to suppress halation and curl, and a built-in 0.1-density dye that suppresses light piping.

*KODAK Technical Pan Film / 2415 is also available in various sheet sizes as a special-order item.

APPLICATIONS

By modifying development, you can vary the contrast of Technical Pan Films. The wide range of contrast levels, along with the spectral sensitization and combination of speed and image-structure properties, makes these films 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

DARKROOM HANDLING

Do not use a safelight. Handle unprocessed film in total darkness.

STORAGE AND HANDLING

Store unexposed film at 70°F (21°C) or lower in the original sealed package. You can lessen aging effects by storing the film at lower temperatures. If film has been refrigerated, allow the package to warm up to room temperature for 2 to 3 hours before opening it; if the film is frozen, allow 5 hours.

Load and unload the camera in subdued light, and rewind 135 film completely into the magazine before unloading. For best results, process the film as soon as possible after exposure.

Total darkness is required when you remove the film from the magazine or load and unload film holders.

Store processed film in a cool, dry place.



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, increase the exposure by one stop with tungsten light or two stops with daylight or electronic flash.

See the spectral-sensitivity curve on page 9.

FILM SPEED

These films have varied film-speed and contrast ratings; the speed depends on the application. Speed ratings range from a low of EI 16 for pictorial photography to a high of EI 320 for microfilming. Therefore, it is important to consider the contrast level you need before you determine the film speed.

EXPOSURE

Since you can use Technical Pan Film under a wide range of exposure conditions, we give recommendations only for the common applications. Note in the table that the exposure index is a function of the processing conditions and the contrast produced. Compare these values with the characteristic curves on pages 9, 10, and 11 to choose the appropriate contrast and exposure index. Exposure-index values given here are for use with meters marked for ISO (ASA/DIN) speeds or exposure indexes and are starting points for trial exposures.

You should bracket exposures by whole-stop increments for initial tests; use half-stop increments for critical applications.

**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
2.40-2.70	D-19 (1:2)	4-7	125-160
2.25-2.50	D-19	2-8	100-200
1.20-2.10	HC-110 (Dil B)	4-12	100-250
1.25-1.75	HC-110 (Dil D)	4-8	80-125
1.00-2.10	D-76	6-12	50-125
0.80-0.95	HC-110 (Dil F)	6-12	32-64
0.50-0.70	TECHNIDOL Liquid	5-11	16-25
Low 0.40-0.80	TECHNIDOL LC	7-18	25-32

Tests show that Technical Pan Film is approximately 10 percent more sensitive to tungsten light than to daylight. You may also find an increase in contrast of approximately 5 percent with tungsten light.

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

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

*Based on a 1/25-second daylight exposure

Filter Factors

Multiply your exposure by the following filter factors when you use filters. 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	1.2	1.5
No. 11	5	—
No. 12	1.2	—
No. 15	1.2	2.0
No. 25	2	3.0
No. 47	25	—
No. 58	12	—

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

†Based on a 1/25-second daylight exposure with development for 15 minutes at 68°F (20°C) in KODAK TECHNIDOL LC Developer or 9 minutes at 68°F (20°C) in KODAK TECHNIDOL Liquid Developer.

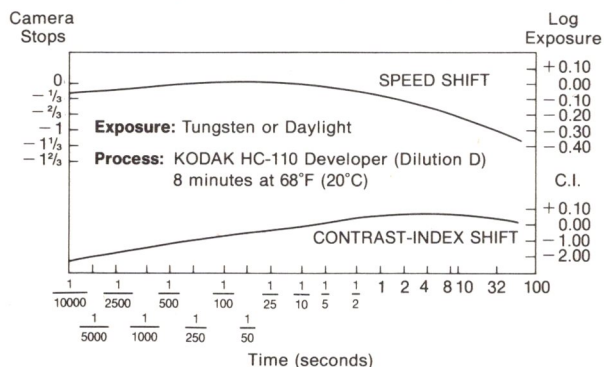
Adjustments for Long and Short Exposures

No exposure adjustments are required for exposures between 1/10,000 and 1 second. However, for exposures shorter than 1/500 second, you may want to increase development to compensate for the lower contrast that very short exposures can produce.

If indicated Exposure Time Is (seconds)	Use This Lens-Aperture Adjustment	OR This Exposure-Time Adjustment (seconds)	AND Use This Development Adjustment
1/10,000	None	None	+30%
1/1000	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 stop	NR	None

NR = Not recommended.

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



SPECIFIC APPLICATIONS

Pictorial Photography

These films produce high-quality pictorial negatives when processed in either of the two KODAK TECHNIDOL Developers. The 35 mm film yields very high image quality when processed in a compensating developer such as KODAK TECHNIDOL Liquid Developer or KODAK TECHNIDOL LC Developer, as do sheets and the 120 size when processed in KODAK TECHNIDOL Liquid Developer.

Developers for Pictorial Photography	
35 mm	TECHNIDOL LC or TECHNIDOL Liquid
120 and sheets	TECHNIDOL Liquid

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. Process the film according to the instructions on page 5.

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 don't 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.

Starting-Point Exposures for Copying Printed

Material: 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; for higher-contrast originals, use KODAK TECHNIDOL Liquid Developer for 9 minutes or KODAK TECHNIDOL LC Developer for 15 minutes (35 mm only).

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).

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). One of the TECHNIDOL Developers 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 & 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, and developed in HC-110 Developer (Dilution B) for 8 minutes at 68°F (20°C). Negatives should print easily and with good contrast on a normal-contrast paper. (If negatives are too dense, use a higher exposure index; if too thin, 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 Zeiss EM-109 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 5¹/₂ minutes in KODAK Developer D-19 (1:2) at 68°F (20°C), or for 4 minutes in KODAK Developer D-19 (full strength) at 68°F (20°C). For less contrast, process for 8 to 12 minutes in KODAK 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 KODAK 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 HeNe 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 completed, 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 KODAK Technical Pan Film, use either KODAK TECHNIDOL Liquid Developer or KODAK TECHNIDOL LC Developer. With KODAK Technical Pan Film / 4415 and 6415 (sheets and 120 size), use *only* KODAK TECHNIDOL Liquid Developer. Observe the precautionary information on the developer packaging.

Each of the developers requires a different agitation procedure. Follow the agitation instructions carefully.

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 by following the instructions below. Note that 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.

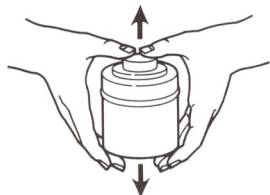
**Development Times for
KODAK TECHNIDOL Liquid Developer in
Stainless-Steel 8- or 16-oz or Plastic 10- or 20-oz Tanks**

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 reel smoothly and without hesitation into the tank of solution. Attach the top to the tank.
3. Promptly dislodge any air bubbles from the film by tapping the bottom of the tank on the work surface from a height of about 1 inch (2 cm). (You can then turn on the room lights.)
4. Immediately agitate by shaking the tank **vigorously** up-and-down 10 to 12 times for 2 seconds. *Do not rotate the tank.*

Liquid Developer Agitation Technique



5. Let the tank sit for 28 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.

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.

Bathe the film in KODAK Indicator Stop Bath, KODAK Stop Bath SB-1a, or KODAK Stop Bath SB-5 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 in KODAK Fixer 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 30 seconds 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. You can use heated forced air at 120 to 140°F (50 to 60°C) to reduce drying time.

Tray Processing (sheets)

Mix 1 quart (32 fl oz [946 mL]) of TECHNIDOL Liquid Developer at one-half the working strength you'd use for roll films. That is, use 1 bottle or 2 foil 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. Use the following agitation procedure for the best processing uniformity:

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

Bathe the film at 65 to 70°F (18 to 21°C) in KODAK Indicator Stop Bath, KODAK Stop Bath SB-1a, or KODAK Stop Bath SB-5 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 Rapid Fixer or KODAK Fixer 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 squeeze.

KODAK TECHNIDOL LC Developer (35 mm only)

Preparing a Working Solution: For a 16-oz small tank, start with 14 fl oz (400 mL) of warm water at 125°F (52°C). Use 17 fl oz (500 mL) for a 20-oz small tank. Slowly pour the contents of one packet of the developer powder into the water, and stir with enough agitation to keep the chemicals suspended until they completely dissolve. Add water to bring the total volume to the capacity of the tank, i.e., 16 fl oz (473 mL) or 20 fl oz (591 mL). Stir until the solution is completely mixed. Cool the developer to the correct temperature, and use it within 24 hours.

Processing with TECHNIDOL LC Developer:

Over-agitation of this developer caused by vigorous shaking within the first 30 seconds of development usually causes nonuniform development, especially adjacent to sprocket holes. On the other hand, insufficient agitation during this critical film-wetting period will also cause nonuniform development because of uneven initial development.

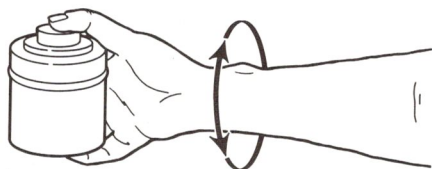
Develop roll film for one of the times in the table below, according to the developer temperature you choose.

**Development Times for
KODAK TECHNIDOL LC 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	15 minutes	11 minutes	8 minutes

1. Fill the tank with developer adjusted to one of the temperatures in the tables.
2. In total darkness, drop the loaded reel into the solution smoothly and without hesitation. Attach the top to the tank.
3. Dislodge any air bubbles from the film by promptly tapping the bottom of the tank on the work surface from a height of approximately 1 inch (2 cm). (You can then turn on the room lights.)
4. Use initial agitation of up to four inversion cycles, i.e., extend your arm and twist your wrist 180° as shown, with no lateral arm movement. (Steps 2 to 4 will take from 7 to 10 seconds, depending on your type of tank.)

**Powder-
Developer
Agitation
Technique**



5. Let the tank sit for the remainder of the first 30 seconds.
6. After 30 seconds, start agitating for 5 seconds at 30-second intervals for the remainder of the development time, using 2 to 5 inversion cycles each time.

This technique has produced acceptable results with 35 mm Technical Pan Film in a variety of tests performed in our laboratories. Other variations are possible; some people have had success with agitation every minute. Tank size and design affect agitation and therefore affect film contrast and development. Experiment to find the best technique for your tank. If your negatives are consistently too dense or contrasty, use a shorter time; if they are too thin or flat, use more agitation or more time. Limited testing with rolling-tank agitation produced higher densities near the edges of the film.

Bathe, fix, wash, and dry as described on page 6 for small-tank processing with TECHNIDOL Liquid Developer.

Other KODAK Developers

To process these films in the other developers listed in the table on page 2, 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" (page 2) and the characteristic curves (pages 9 to 11). 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 ± 1/2°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 ± 1/2°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	2	8 ft (2.4 m)	80 ± 1/2°F (26.5 ± 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

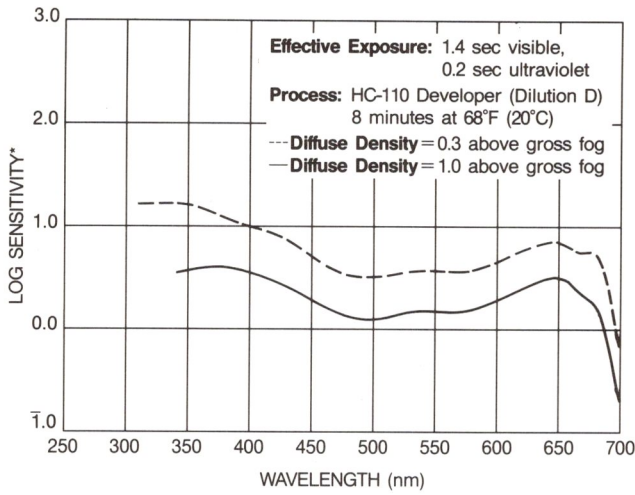
The data in this section are based on development at 68°F (20°C) in KODAK HC-110 Developer (Dilution D) for 8 minutes, KODAK TECHNIDOL Liquid Developer for 9 minutes, or KODAK TECHNIDOL LC Developer for 15 minutes.

	KODAK Developer		
	HC-110 (Dilution D)	TECHNIDOL Liquid	TECHNIDOL LC
Diffuse RMS Granularity*	8 (extremely fine)	5 (micro-fine)	7 (extremely fine)
Resolving Power† (lines per mm)			
TOC 1.6:1	125	100	100
TOC 1000:1	320	320	320

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

†Determined according to a method similar to the one described in ISO 6328-1982, *Method for Determining the Resolving Power of Photographic Materials*. The values given for this film represent extremely high resolving power.

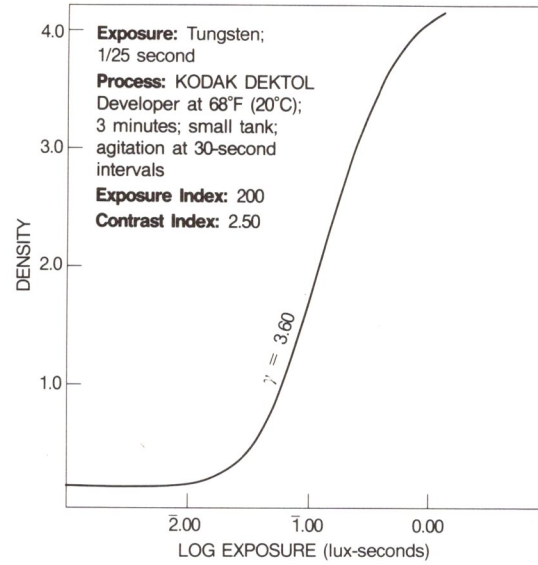
SPECTRAL-SENSITIVITY CURVE



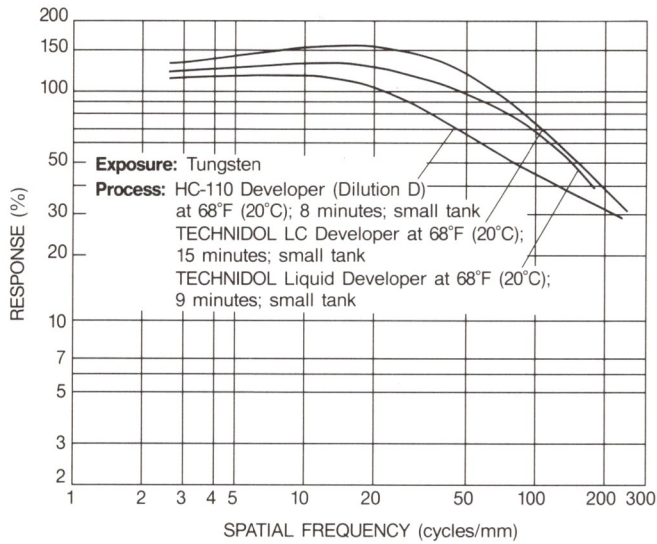
*Sensitivity = reciprocal of exposure (ergs/cm²) required to produce specified density

CHARACTERISTIC CURVES*

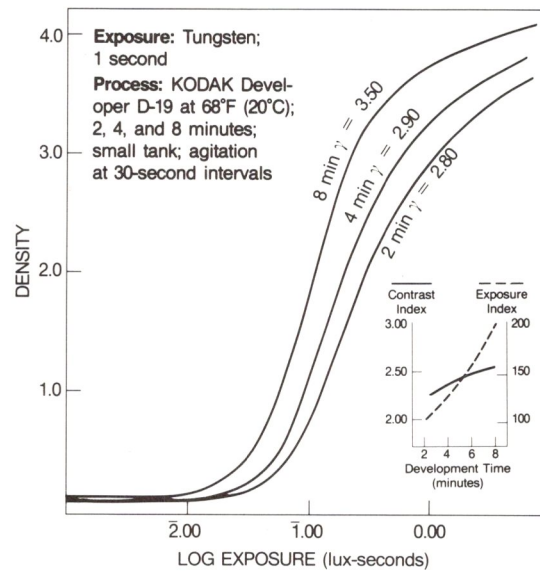
*Densitometry: American Standard diffuse visual density

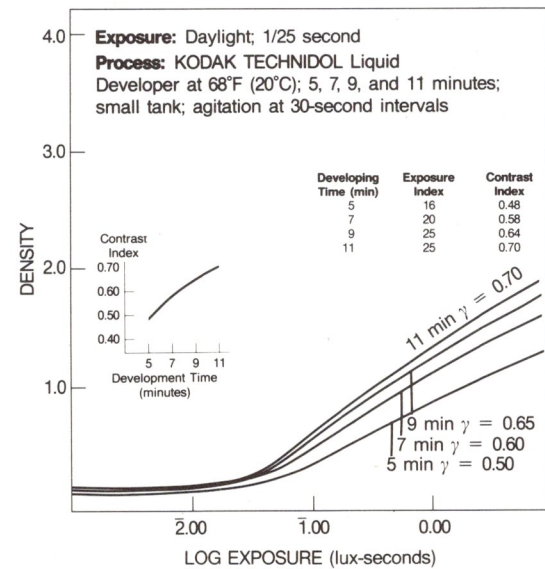
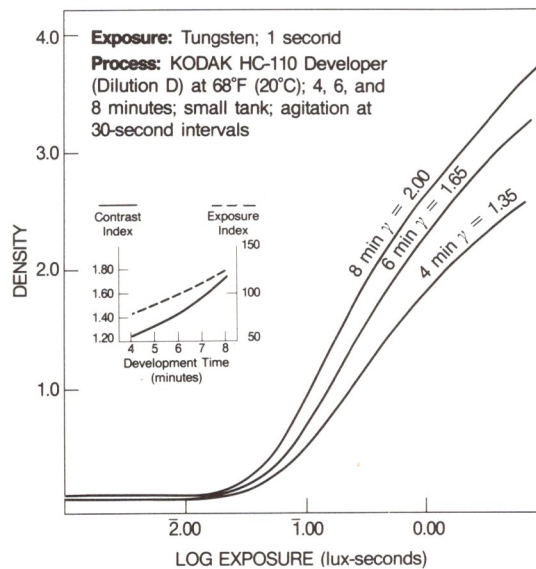
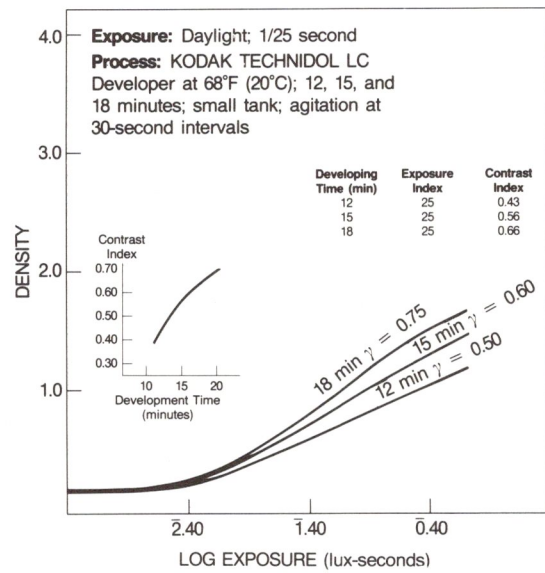
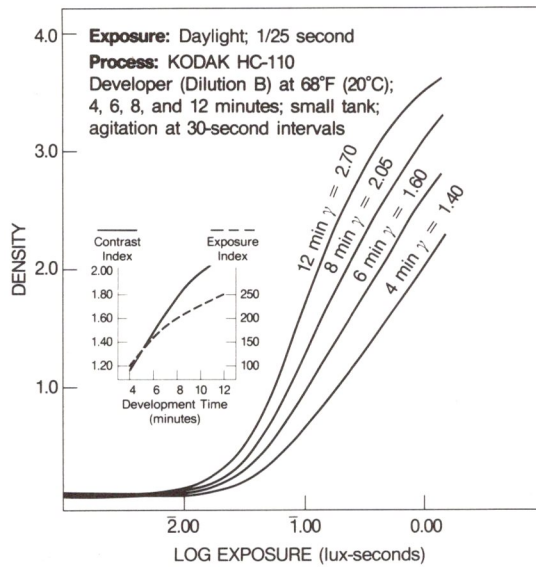
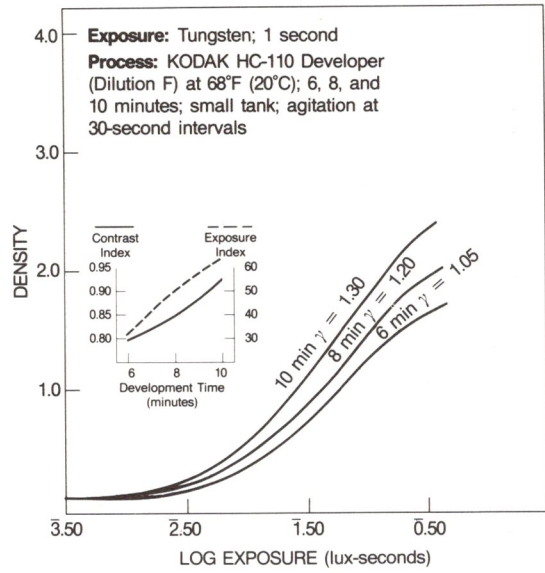
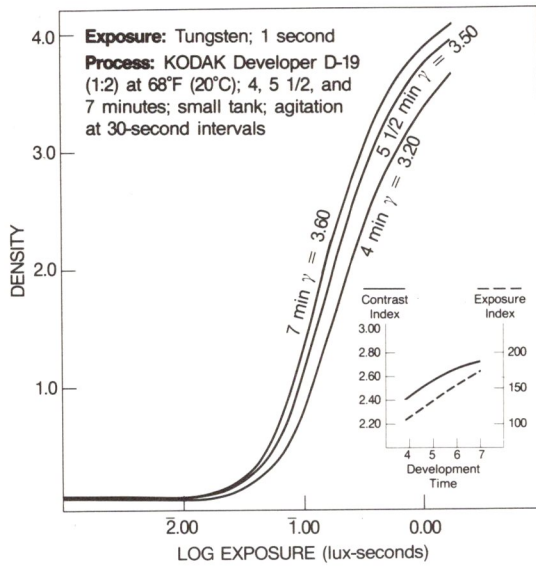


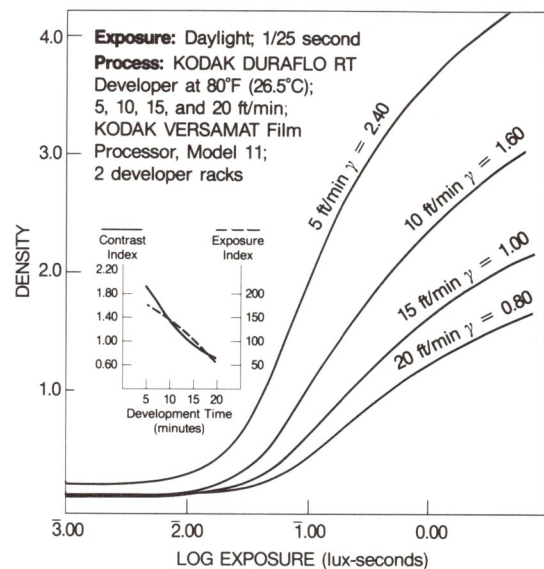
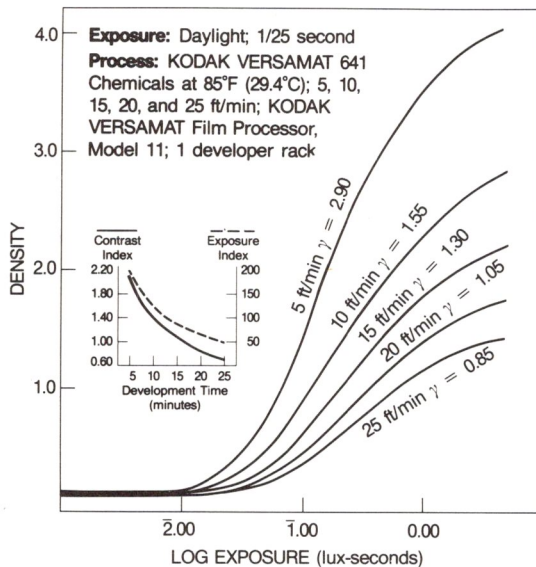
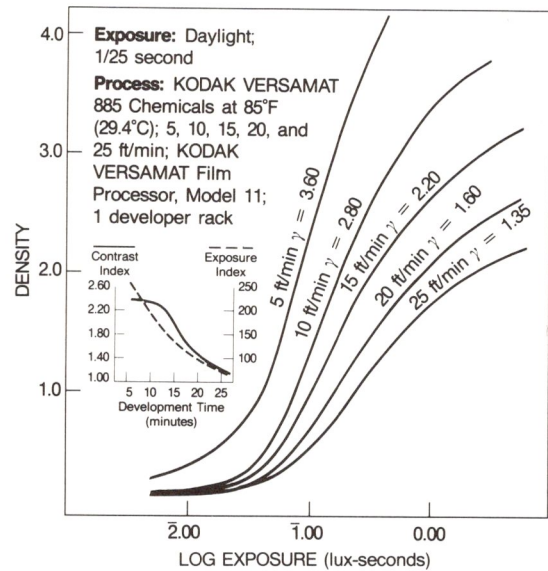
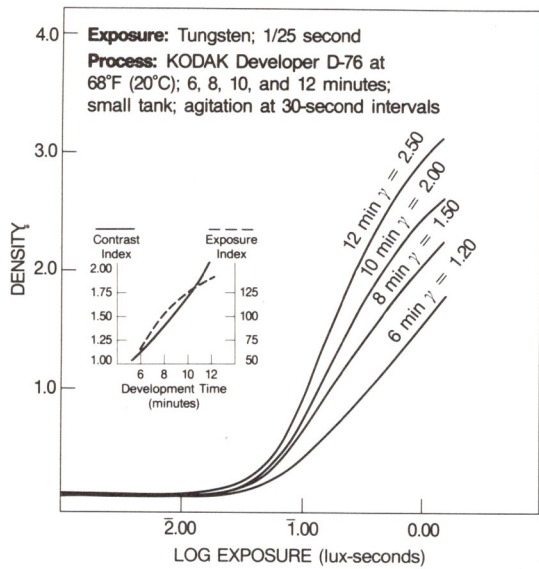
MODULATION-TRANSFER FUNCTION



These photographic modulation-transfer values were determined using a method similar to that described in ANSI Standard PH-2.39-1977(R1984). The film was exposed with the specified illuminant to spatially varying sinusoidal test patterns with an aerial image modulation of a nominal 35 percent at the image plane, with processing as indicated. In most cases, these photographic modulation-transfer values are influenced by development adjacency effects, and are not equivalent to the true optical modulation-transfer function of the emulsion layer in the particular photographic product.







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.

KODAK Technical Pan Films

QUICK REFERENCE TO DEVELOPERS

KODAK Technical Pan Film (and 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 or TECHNIDOL LC	DEKTOL	D-19	HC-110 (Dil B), TECHNIDOL Liquid, or TECHNIDOL LC	HC-110 (Dil D)	HC-110 (Dil D), TECHNIDOL Liquid, or TECHNIDOL LC	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 8x10-inch)	TECHNIDOL Liquid			HC-110 (Dil B) or TECHNIDOL Liquid		HC-110 (Dil D) or TECHNIDOL Liquid				
6415 (120)										

FILM SIZES AND ORDERING INFORMATION

KODAK Technical Pan Film is available through dealers who regularly supply Kodak products to professional photographers. The 135-36 size is also available through dealers who carry Kodak products for general picture-taking. If the film size you want isn't in stock, your dealer can order it for you.

Size and Specification	CAT No.
135-36 magazine	129 7563
35 mm x 150 ft TP651 (type AA core, KS perf)	129 9916
120 size	151 1054
4 x 5-inch, 25 sheets per pkg	800 4640
8 x 10-inch, 25 sheets per pkg	818 2826

Because 2415 Film has a thinner base than conventional 35 mm picture-taking films, 150-foot rolls finished to Sp 651 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.

MORE INFORMATION

For more information on KODAK Technical Pan Film, its availability in special-order sizes, and its specific applications (e.g., photomicrography, astrophotography, copying, pictorial photography), please write to this address:

Photo Information, Dept. 841S
Eastman Kodak Company
343 State Street
Rochester, New York 14650

Photographic Products Group

EASTMAN KODAK COMPANY • ROCHESTER, NY 14650

