KODAK PROFESSIONAL T-MAX Films

Kodak

TECHNICAL DATA / **BLACK-AND-WHITE FILM**

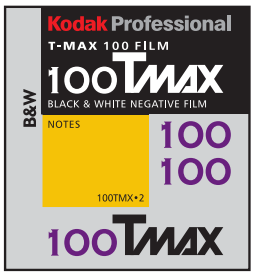
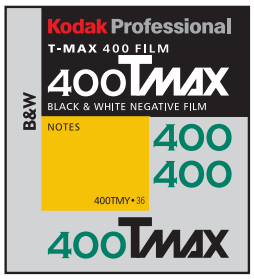
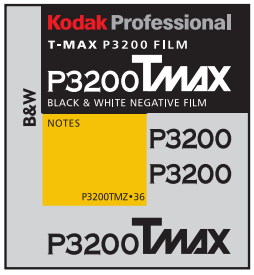
October 2007 • F-4016

—NOTICE—

To reflect our enduring commitment to black-and-white photography, Kodak moved black-and-white film production to an even more advanced film-coating facility in early 2002. New technology applied to these superior, time-tested emulsions resulted in slightly different processing times for the film family. But the same great films—those you've known and trusted for years—will still deliver the same breathtaking results.

The packaging examples below are the best way to determine which film you have. Refer to the corresponding publication for development times.

Note: T-MAX 400 Film was improved in October 2007. Some film characteristics, including processing times, have changed. Refer to Kodak publication F-4043 for packaging examples.

2002-9/2007 packaging, refer to this publication (F-4016)	**New (10/07) packaging, refer to Kodak publication F-4043:**
  	

See page 30 (back cover) for complete information on film identification.

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KODAK PROFESSIONAL T-MAX 100 Film/100TMX is a continuous-tone panchromatic black-and-white negative film for general outdoor and indoor photography. It is especially useful for detailed subjects when you need maximum image quality. It is also excellent for copying black-and-white photographs, for making black-and-white copies from color transparencies, and for photomicrography. This film features medium speed (ISO 100/21° in most developers), extremely high sharpness, extremely fine grain, and very high resolving power. It allows a very high degree of enlargement.

You can also use T-MAX 100 Film to produce high-quality black-and-white slides from camera-original exposures, continuous-tone photographs, drawings, artwork, and radiographs when you process it with the KODAK T-MAX 100 Direct Positive Film Developing Outfit. The T-MAX Outfit also lets you use this film to produce copy negatives from black-and-white or color negatives, to make duplicate black-and-white slides, or to make black-and-white slides from color slides.

KODAK PROFESSIONAL T-MAX 400 Film/400TMY is a continuous-tone panchromatic black-and-white negative film especially useful for photographing dimly lighted subjects or fast action, for extending flash distance range, and for photographing subjects that require good depth of field and fast shutter speeds with maximum image quality for the film speed. It is also useful for scientific and biomedical work, especially when fluorescence photography is required. It has high speed (ISO 400/27° in most developers), very high sharpness, extremely fine grain, and high resolving power; it allows a high degree of enlargement.

KODAK PROFESSIONAL T-MAX P3200 Film/P3200TMZ is a multi-speed continuous-tone panchromatic black-and-white negative film that combines high to ultra-high film speeds with finer grain than that of other fast black-and-white films. It is especially useful for very fast action; for dimly lighted scenes where you can't use flash; for subjects that require good depth of field combined with fast shutter speeds; and for handholding telephoto lenses for fast action or in dim light. It is an excellent choice for indoor or nighttime sports events and available-light press photography, as well as law-enforcement and general surveillance applications that require exposure indexes of 3200 to 25,000.

FEATURES	BENEFITS
• KODAK T-GRAIN Emulsion that reshapes pebble-like crystals into a tabular form with more surface to catch light	• Allows films with extremely fine grain to be made faster; high-speed films have finer grain. T-MAX Films offer the best of both worlds: high speed and fine grain.
• Improved sharpness	• Maintains subject detail in prints at higher degrees of magnification than conventional films.
• Expanded exposure latitude	• Greater "forgiveness" with overexposure errors; quality prints from moderately under- or overexposed negatives. • Better highlight separation.
• Improved reciprocity at long and short exposure times	• Less compensation required than with conventional films.
• 120-size film coated on a thicker (4.7-mil) base than other black-and-white roll films	• Improved dimensional stability; easier darkroom handling.
• Virtually no difference between the daylight and tungsten film speeds	• No need to adjust exposure for different light sources.
• More responsive to zone-system development changes	• Smaller time adjustments needed.
• No increase in processing time required for one-stop "push" with most developers	• No need to segregate one-stop-pushed film from normally exposed film. You can mix normal exposures and one-stop-pushed exposures on the same roll. (You may want to use paper one-half grade higher in contrast to print one-stop-pushed exposures.)
• Less development-time increase required for film pushed by two or more stops	• Saves processing time.
• Processed in standard developers, including KODAK PROFESSIONAL T-MAX Developer and KODAK KODAK PROFESSIONAL T-MAX RS Developer and Replenisher	• No need for a special developer. You can process T-MAX Films with other black-and-white films.
• T-MAX 100 Film—excellent for use in copy applications with normal exposure and processing	• No need for contrast adjustment or special processing.
• T-MAX 100 Film—high-quality black-and-white slides with processing in the KODAK T-MAX 100 Direct Positive Film Developing Outfit	• Reversal applications with shorter processing times.
• T-MAX 400 Film—a versatile film for all-around use	• Excellent for use under lighting conditions from bright sunlight to dim existing light.
• T-MAX P3200 Film—speeds ranging from high to ultra high	• Allows photography in situations where it was previously impossible.

SIZES AVAILABLE

Catalog numbers and packaging may differ from country to country. See your dealer who supplies KODAK PROFESSIONAL Products.

KODAK PROFESSIONAL T-MAX 100 Plate

The KODAK PROFESSIONAL T-MAX 100 Plate is a continuous-tone panchromatic plate that has the same sensitometric characteristics as KODAK PROFESSIONAL T-MAX 100 Film / 100TMX. It is especially useful for photomicrography, electron micrography, and laser recording, as well as solar and astronomical photography. It provides maximum image quality for detailed subjects. You can process this plate in KODAK PROFESSIONAL T-MAX RS Developer and Replenisher, KODAK XTOL Developer, KODAK HC-110 Developer Replenisher (Dilution B), or KODAK PROFESSIONAL Developer D-76. For ordering information, see a dealer who sells KODAK PROFESSIONAL Products.

DARKROOM RECOMMENDATIONS

Do not use a safelight. Handle unprocessed film in total darkness. *Do not* develop these films by inspection.

Note: The afterglow from fluorescent lights may fog these films. Make sure your darkroom is *completely* dark before you handle unprocessed film.

STORAGE AND HANDLING

Store unexposed film at 75°F (24°C), or lower, in the original sealed package. For protection from heat in areas with temperatures consistently higher than 75°F (24°C), you can store the film in a refrigerator. If film has been refrigerated, allow the package to warm up to room temperature for 2 to 3 hours before opening it.

Load and unload roll-film cameras in subdued light, and rewind the film completely before unloading the camera. Total darkness is required when you remove film from the magazine or load and unload film holders.

Store exposed film in a cool, dry place, and process it promptly.

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

EXPOSURE

The nominal speed of KODAK PROFESSIONAL T-MAX 100 Film is EI 100. It was determined in a manner published in ISO standards. Exposing the film at EI 100 should usually lead to the minimum exposure required to produce negatives of very high quality (see the following table). This film has good latitude and responds well to changes in development time. For consistent results, use the rated speed or make tests to determine a speed rating that meets your needs. For information on methods of determining your best exposure and developer combination, see KODAK Publication No. F-5, *KODAK Professional Black-and-White Films*.

When you use T-MAX 100 Film for reversal applications, expose it at EI 50. For more information on reversal processing, see KODAK Publication No. J-87, *KODAK T-MAX 100 Direct Positive Film Developing Outfit*.

The nominal speed of KODAK PROFESSIONAL T-MAX 400 Film is EI 400. It was determined in a manner published in ISO standards. Because of its great latitude, you can underexpose this film by one stop (at EI 800) and still obtain high quality with normal development in most developers. There will be no change in the grain in the final print, but there will be a slight loss of shadow detail and a reduction in printing contrast of about one-half paper grade.

When you need very high speed, you can expose T-MAX 400 Film at EI 1600 and increase the development time. With the longer development time, there will be an increase in contrast and graininess with additional loss of shadow detail, but negatives will still produce good prints. You can even expose this film at EI 3200 with a longer development time. Underexposing by three stops and using three-stop push-processing produces a further increase in contrast and graininess, and additional loss of shadow detail, but the results will be acceptable for some applications.

The speed numbers for these films are expressed as Exposure Indexes (EI). Use these exposure indexes with meters or cameras marked for ISO/ASA or ISO/DIN speeds in daylight or artificial light.

The developer you use to process these films affects the exposure index. Set your camera or meter (marked for ISO/ASA or ISO/DIN speeds) at the speed for your developer given in the table.

Use This Exposure Index		
KODAK Developer or Developer and Replenisher	T-MAX 100 Film	T-MAX 400 Film
T-MAX	**100 / 21°**	**400 / 27°**
T-MAX RS	**100 / 21°**	**400 / 27°**
XTOL **XTOL (1:1)**	**100 / 21°** **100 / 21°**	**400 / 27°** **400 / 27°**
D-76 **D-76 (1:1)**	**100 / 21°** **100 / 21°**	**400 / 27°** **400 / 27°**
HC-110 (B)	100 / 21°	320 / 26°
MICRODOL-X MICRODOL-X (1:3)	50 / 18° 100 / 21°	200 / 24° 320 / 26°
DURAFLO RT	**80 / 20°**	**400 / 27°**

Note: The developers and exposure indexes in bold type are the primary recommendations.

Under most conditions, you'll obtain highest quality with normal exposure at the rated exposure index and normal development. For high-contrast scenes, you'll obtain highest quality if you increase exposure by one or two stops and process the film normally.

If normal development produces negatives that are consistently too low in contrast, increase the development time slightly (10 to 15 percent). If negatives are too contrasty, decrease the development time slightly (10 to 15 percent). See "Adjusting Film Contrast."

If your negatives are too thin, increase exposure by using a lower exposure index; if too dense, reduce exposure by using a higher exposure index.

Pushing Exposure* with KODAK PROFESSIONAL T-MAX Developer and KODAK PROFESSIONAL T-MAX RS Developer and Replenisher			
KODAK PROFESSIONAL Film	1-Stop Push	2-Stop Push	3-Stop Push†
T-MAX 100 Film	EI 200/24° Normal Processing	EI 400/27° 2-Stop Push Processing	EI 800/30° 3-Stop Push Processing
T-MAX 400 Film	EI 800/30° Normal Processing	EI 1600/33° 2-Stop Push Processing	EI 3200/36° 3-Stop Push Processing

* Pushing exposure results in slight losses of quality compared with normal exposure and normal processing. You can also use other Kodak developers for pushing these films; however, T-MAX Developer and T-MAX RS Developer and Replenisher produce higher-quality tone reproduction (better shadow detail) under these conditions.
For high-contrast scenes, such as spotlighted performers under harsh lighting, expose and process as indicated in the table. However, when detail in the deep-shadow areas is important to the scene, increase exposure by 2 stops and process your film normally.

† Pushing exposure and processing by 3 stops increases contrast and graininess and decreases shadow detail further. Expose and process a test roll to determine if the results are acceptable for your needs.

Adjustments for Long and Short Exposures

At the exposure times in the table below, compensate for the reciprocity characteristics of these films by increasing the exposure as shown.

T-MAX 100 Film			
If Indicated Exposure Time Is (Seconds)	Use This Lens-Aperture Adjustment	OR	This Adjusted Exposure Time (Seconds)
1/10,000	+1/3 stop		Change Aperture
1/1,000	None		None
1/100	None		None
1/10	None		None
1	+1/3 stop		Change Aperture
10	+1/2 stop		15
100	+1 stop		200

T-MAX 400 Film			
If Indicated Exposure Time Is (Seconds)	Use This Lens-Aperture Adjustment	OR	This Adjusted Exposure Time (Seconds)
1/10,000	None		None
1/1,000	None		None
1/100	None		None
1/10	None		None
1	+1/3 stop		Change Aperture
10	+1/2 stop		15
100	+1 1/2 stops		300

Filter Corrections

The filter corrections for T-MAX 100 and T-MAX 400 Films are the same.

Increase exposure by the filter factor or the number of stops indicated when you use filters. For greatest exposure accuracy with a through-the-lens meter, take the meter reading without the filter over the lens, and then increase your exposure as shown in the table.

KODAK WRATTEN Gelatin Filter	Daylight			Tungsten		
	Increase Lens Aperture By (f-stops)	OR	Increase Exposure By (Filter Factor)	Increase Lens Aperture By (f-stops)	OR	Increase Exposure By (Filter Factor)
No. 8 (yellow)	2/3		1.5	1/3		1.2
No. 11 (yellowish green)	1 2/3		3	1 2/3		3
No 12 (deep yellow)	1		2	1/3		1.2
No. 15 (deep yellow)	1		2	2/3		1.5
No. 25 (red)	3		8	2		4
No. 47 (blue)	3		8	4 2/3		25
No. 58 (green)	2 2/3		6	2 2/3		6
Polarizing Filter	1 2/3		2.5	1 1/3		2.5

Note: Filter factors for other Kodak black-and-white films are different.

PROCESSING

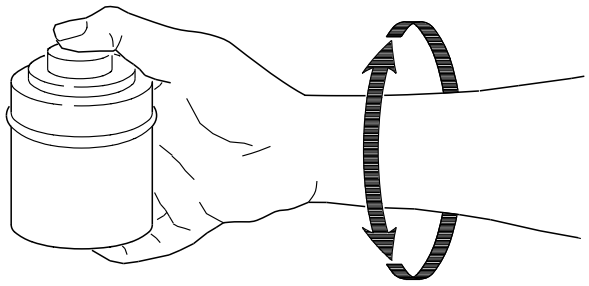
These starting-point recommendations are intended to produce negatives with a contrast appropriate for printing with a diffusion enlarger. To print negatives with a condenser enlarger, you may need to adjust the contrast by reducing your development time; see "Adjusting Film Contrast." Tank development times shorter than 5 minutes may produce unsatisfactory uniformity.

MANUAL PROCESSING

Small-Tank Processing (8- or 16-ounce tank)—Rolls

With small single- or double-reel tanks, drop the loaded film reel into the developer and attach the top to the tank. Firmly tap the tank on the top of the work surface to dislodge any air bubbles. Provide initial agitation of 5 to 7 inversion cycles in 5 seconds, i.e., extend your arm and vigorously twist your wrist 180 degrees.

Then repeat this agitation procedure at 30-second intervals for the rest of the development time.



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Small Tank Processing, (8- or 16-ounce tank)—Rolls

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes					Development Time in Minutes				
	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX (1:4)*	NR	7½	7	6½	6¼	NR	7	6½	6½	6
T-MAX (1:7)†	—	—	—	—	9½	—	—	—	—	10
T-MAX (1:9)†	—	—	—	—	13½	—	—	—	—	15
T-MAX RS*	NR	8	7½	7	6¼	NR	7	6	6	5
T-MAX RS (1:7)†	—	—	—	—	8½	—	—	—	—	7
T-MAX RS (1:9)†	—	—	—	—	12½	—	—	—	—	13
XTOL	8½	7½	6½	6	5	7½	6½	5¾	5¼	4½‡
XTOL (1:1)†	11½	9½	8½	—	6½	135: — 120: —	135: 8¾ 120: 9¼	135: 8 120: 8½	135: 7½ 120: 8	135: 7 120: 7
D-76	7½	6½	5½	5	4¼‡	9	8	7	6½	5½
D-76 (1:1)	11	9½	8½	7½	6¼	14½	12½	11	10	9
HC-110 (B)	6½	6	5½	5	4‡	6½	6	5½	5	4½‡
MICRODOL-X	13½	11½	10½	9½	8	12	10½	9	8½	7½
MICRODOL-X (1:3)	NR	17	15½	14½	12½	NR	NR	20	18½	16

* The recommended standard dilution is 1:4.
† We do not recommend using more dilute solutions of these developers than indicated in the table. Dilute developers require longer development times; they give slightly higher film speed and a slight increase in graininess.
‡ Development times shorter than 5 minutes may produce unsatisfactory uniformity.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Large-Tank Processing (1/2- to 3 1/2-gallon tank)—Rolls and Sheets

Agitate continuously for the first 15 to 30 seconds by raising and lowering the basket, rack, or spindle 1/2 inch. *Do not* agitate the basket, rack, or spindle for the remainder of the first minute. Then agitate once per minute by lifting the basket, rack, or spindle out of the developer, tilting it approximately 30 degrees, draining it for 5 to 10 seconds, and reimmersing it. Alternate the direction of tilting the basket, rack, or spindle.

Large-Tank Processing, (1/2- to 3 1/2-gallon tank)—Rolls

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes					Development Time in Minutes				
	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX	NR	8½	8	7½	7	NR	7	6½	6½	6
T-MAX RS	NR	8¾	8¼	7¾	7	NR	8½	8	7½	7
XTOL	9½	8¼	7¼	6½	5½	135: 9 120: 9¼	135: 7¾ 120: 7¾	135: 7 120: 6¾	135: 6½ 120: 6¼	135: 5½ 120: 5¼
D-76	8¼	7¼	6½	5¾	4¾	10	9	8	7½	6½
HC-110 (B)	7½	6½	6	5¼	4½	8	7	6½	6	5
MICRODOL-X	15	13	11¾	10¾	8¾	13	11½	10	9	8

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Large-Tank Processing, (1/2- to 3 1/2-gallon tank)—Sheets

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes					Development Time in Minutes				
	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX RS	NR	8¾	8¼	7¾	7	NR	10	8	7½	6
XTOL	9½	8¼	7¼	6½	5½	10	8½	7¼	6¾	5¾
D-76	8¼	7¼	6½	5¾	4¾	11	10	9	8	7
HC-110 (B)	7½	6½	6	5¼	4½	10	8½	7½	7	6½

Note: Do not use KODAK T-MAX Developer to process sheet films.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Tray Processing—Sheets

Provide continuous agitation; rotate the sheets 90 degrees as you interleave them. Prewetting sheet film may improve tray process uniformity.

Tray Processing—Sheets

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes					Development Time in Minutes				
	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX RS	NR	7¼	6¾	6¼	5¾	NR	8	7½	7	6
XTOL	8	6¾	6	5¼	4½	8½	7¼	6¼	—	5
XTOL 1:1	10½	9	8	7	6	—	10½	9½	—	7¼
D-76	6¾	5¾	5¼	4¾	4	9½	7	6½	6	5½
HC-110 (B)	6¼	5½	4¾	4½	3¾	9	7½	7	6½	6

Note: Do not use KODAK T-MAX Developer to process sheet films.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Rotary-Tube Processing—Rolls and Sheets

Rotary-Tube Processing—Rolls

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film			
	Development Time in Minutes					Development Time in Minutes			
	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX (1:4)*	—	7¾	7¼	6¾	6¼	6½	6½	6	5½
T-MAX (1:7)†	—	—	—	—	9½	—	—	—	10
T-MAX (1:9)†	—	—	—	—	13½	—	—	—	11
T-MAX RS*	—	7¾	7¼	6¾	6¼	6½	6	5½	5½
T-MAX RS (1:7)†	—	—	—	—	8½	—	—	—	7½
T-MAX RS (1:9)†	—	—	—	—	12½	—	—	—	8½
XTOL	8¾	7¼	6½	5¾	5	135: 5½ 120: 5¼	135: 5 120: 4¾‡	135: 4½‡ 120: 4¼‡	135: 4‡ 120: 3¾‡
XTOL (1:1)†	11¾	9¾	8¾	7¾	6¾	135: 7¾ 120: 7	135: 7 120: 6½	135: 6½ 120: 6	135: 5½ 120: 5¼
D-76	7½	6¼	5¾	5¼	4¼‡	7	6½	6	5½
HC-110 (B)	7	5¾	5¼	4¾‡	4‡	6	5½	5	5

* The recommended standard dilution is 1:4.
† We do not recommend using more dilute solutions of these developers than indicated in the table. Dilute developers require longer development times; they give slightly higher film speed and a slight increase in graininess.
‡ Development times shorter than 5 minutes may produce unsatisfactory uniformity.

Note: Do not use KODAK T-MAX Developer to process sheet films.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Rotary-Tube Processing—Sheets

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film			
	Development Time in Minutes					Development Time in Minutes			
	65°F (18°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX RS*	—	7¾	7¼	6¾	6¼	6½	6	5½	5½
T-MAX RS (1:7)†	—	—	—	—	8½	—	—	—	7½
T-MAX RS (1:9)†	—	—	—	—	12½	—	—	—	8½
XTOL	8¾	7¼	6½	5¾	5	6¼	5½	5	4‡
XTOL (1:1)†	11¾	9¾	9	8½	7¾	8¼	7¼	6¾	5¾
D-76	7½	6¼	5¾	5¼	4¼‡	7	6½	6	5½
HC-110 (B)	7	5¾	5¼	4¾‡	4‡	6	5½	5	5

* The recommended standard dilution is 1:4.
† We do not recommend using more dilute solutions of these developers than indicated in the table. Dilute developers require longer development times; they give slightly higher film speed and a slight increase in graininess.
‡ Development times shorter than 5 minutes may produce unsatisfactory uniformity.

Note: Do not use KODAK T-MAX Developer to process sheet films.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

FINAL STEPS

Rinse at 65 to 75°F (18 to 24°C) with agitation in KODAK Indicator Stop Bath or running water for 30 seconds.

Fix at 65 to 75°F (18 to 24°C) for 3 to 5 minutes with vigorous agitation in KODAK Rapid Fixer. Be sure to agitate the film frequently during fixing.

Note: To keep fixing times as short as possible, we strongly recommend using KODAK Rapid Fixer. If you use another fixer, such as KODAK Fixer or KODAFIX Solution, fix for 5 to 10 minutes or twice the time it takes for the film to clear. You can check the film for clearing after 3 minutes in KODAK Rapid Fixer or 5 minutes in KODAK Fixer or KODAFIX Solution.

Important

Your fixer will be exhausted more rapidly with these films than with other films. If your negatives show a magenta (pink) stain after fixing, your fixer may be near exhaustion, or you may not have used a long enough time. If the stain is slight, it will not affect image stability, negative contrast, or printing times. You can remove a slight pink stain with KODAK Hypo Clearing Agent. However, if the stain is pronounced and irregular over the film surface, refix the film in fresh fixer.

Wash for 20 to 30 minutes in running water at 65 to 75°F (18 to 24°C) with a flow rate that provides at least one complete change of water in 5 minutes. You can wash long rolls on the processing reel. To save time and conserve water, use KODAK Hypo Clearing Agent.

Dry 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 a soft viscose sponge.

PUSH PROCESSING

Push processing allows film to be exposed at higher speeds, however, push processing will not produce optimum quality. There will be some loss in shadow detail, an increase in graininess, and an increase in contrast. The degree of these effects varies from slight to very significant depending on the amount of underexposure and push processing. The results are usually excellent with 1-stop and 2-stop push, and acceptable with 3-stop push depending on the lighting and the scene contrast.

Small Tank Processing, (8- or 16-ounce tank)—Rolls

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film					KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes					Development Time in Minutes				
	EI 200		EI 400		EI 800	EI 800		EI 1600		EI 3200
	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	75°F (24°C)
T-MAX	7½	6¼	12¼	10	11¾	7	6	10	8	9½
T-MAX RS	8	6¼	12¼	10	11¾	7	5	10	7	9½
XTOL	7½	5	9½	6½	7¼	135: 7¼ 120: 7¼	135: 5 120: 5¼	135: 8½ 120: 8½	135: 6 120: 6	135: 6¾ 120: 7
XTOL (1:1)	9½	6½	12¼	8¼	9	135: 9½ 120: 10¾	135: 7¾ 120: 8	135: 10¾ 120: 12½	135: 8½ 120: 9¼	135: 9¼ 120: 10½
D-76	6½	4¼*	8¼	5½	NR	8	5½	10½	7	NR
HC-110 (B)	6	4*	11½	7¾	NR	6	4½*	8½	6	NR

* Development times shorter than 5 minutes may produce unsatisfactory uniformity.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Large-Tank Processing, (1/2- to 3 1/2-gallon tank)—Rolls

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film				KODAK PROFESSIONAL T-MAX 400 Film					
	Development Time in Minutes				Development Time in Minutes					
	EI 200		EI 400		EI 800		EI 1600		EI 3200	
	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)
T-MAX RS	8¾	7	—	11¼	8½	7	12	9	NR	12
XTOL	—	—	—	7¼	135: 9 120: 8½	135: 6 120: 6	135: 10 120: 10	135: 7 120: 6¾	135: 11½ 120: 11¼	135: 8 120: 7¾

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Large-Tank Processing, (1/2- to 3 1/2-gallon tank)—Sheets

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film				KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes				Development Time in Minutes				
	EI 200		EI 400		EI 800				EI 1600
	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	75°F (24°C)
T-MAX RS	8¾	7	—	11¼	10	8	7½	6	9
XTOL	—	—	—	7¼	9½	8¼	7½	6½	7¾

Note: Do not use KODAK T-MAX Developer to process sheet films.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Rotary-Tube Processing—Rolls

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film							KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes							Development Time in Minutes				
	EI 200		EI 400				EI 800	EI 800		EI 1600		EI 3200
	68°F (20°C)	75°F (24°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	75°F (24°C)
T-MAX	7¾	6¼	12¼	11½	10¾	10	11¾	6½	5½	8½	7	9
T-MAX RS	7¾	6¼	12¼	11½	10¾	10	11¾	6½	5	10	8	12
XTOL	7¼	5	9½	8½	7½	6½	7¼	135: 6½ 120: 6¼	135: 4½ 120: 4¼	135: 7½ 120: 7¼	135: 5 120: 5	135: 5¾ 120: 5¾
XTOL (1:1)	9¾	7¾	12¼	—	—	8¼	9	135: 8¾ 120: 8¼	135: 6¼ 120: 6	135: 10 120: 9¾	135: 7¼ 120: 7	135: 8½ 120: 8¼
D-76	6¼	4¼*	8¼	7½	6¾	5½	—	7	5½	9	7	NR
HC-110 (B)	5¾	4*	11½	10¼	9¼	7¾	—	6	5	8½	7	NR

* Development times shorter than 5 minutes may produce unsatisfactory uniformity.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

Rotary-Tube Processing—Sheets

KODAK Developer or Developer and Replenisher	KODAK PROFESSIONAL T-MAX 100 Film							KODAK PROFESSIONAL T-MAX 400 Film				
	Development Time in Minutes							Development Time in Minutes				
	EI 200		EI 400				EI 800	EI 800		EI 1600		EI 3200
	68°F (20°C)	75°F (24°C)	68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	68°F (20°C)	75°F (24°C)	75°F (24°C)
T-MAX RS	7¾	6¼	12¼	11½	10¾	10	11¾	6½	5½	10	8	12
XTOL	7¼	5	9½	8½	7½	6½	7¼	7	4½	8	5¼	6
XTOL (1:1)	9¾	7¾	12¼	—	—	8¼	9	9¼	6¾	10¾	7¾	9
D-76	6¼	4¼*	8¼	7½	6¾	5½	—	7	5½	9	7	NR
HC-110 (B)	5¾	4*	11½	10¼	9¼	7¾	—	6	5	8½	7	NR

* Development times shorter than 5 minutes may produce unsatisfactory uniformity.

NR = Not Recommended

Note: The development times in the table are suggested starting points.

MACHINE PROCESSING

Roller-Transport Processors

KODAK VERSAMAT Film Processors

You can process these films in roller-transport processors, such as the KODAK VERSAMAT Film Processor, Model 5, 11, or 411, with KODAK DURAFLO RT Developer Starter, KODAK DURAFLO RT Developer Replenisher, and KODAK Rapid Fixer.

Processing Steps and Conditions for KODAK VERSAMAT Film Processors

KODAK PROFESSIONAL T-MAX 100 and 400 Films				
Step	No. of Racks	Path Length		Temperature
		Model 11	Models 5 and 411	
Develop	2	8.5 ft (2.6 m)	4 ft (1.2 m)	80 ± 0.5°F (26.5 ± 0.3°C)
Fix	3	12 ft (3.8 m)	6 ft (1.9 m)	80°F (26.5) nominal
Wash	2	8 ft (2.4 m)	4 ft (1.2 m)	70 to 75°F (21 to 24°C)
Dry		8 ft (2.4 m)	4 ft (1.2 m)	105 to 140°F (40.5 to 60°C)

The recommended machine speeds for processing KODAK PROFESSIONAL T-MAX 100 and 400 Films are as follows:

Processor	T-MAX 100 Film	T-MAX 400 Film
KODAK VERSAMAT Film Processor, Models 5 and 411	2.5 ft (0.8 m) per minute	2.6 ft (0.8 m) per minute
KODAK VERSAMAT Film Processor, Model 11	5.3 ft (1.6 m) per minute	5.5 ft (1.7 m) per minute

You may need to use higher dryer temperatures (135 to 140°F [57 to 60°C]) to dry several sheet films processed in succession. If you are processing only roll films, a lower temperature will be adequate.

Processing Conditions for Other Roller-Transport Processors

Adjust the machine speed so that the development time for normally exposed film is approximately 97 seconds for T-MAX 100 Film and 85 seconds for T-MAX 400 Film. The development time is measured from the time the film enters the developer to the time it enters the fixer. Differences in machine design that affect agitation and crossover times from one tank to the next may require development-time adjustments.

Replenishment Rates

Developer—Because most film loads will consist of a variety of film types, use an average replenishment rate of 0.20 mL per square inch of film processed.

Fixer—Use 0.55 mL per square inch.

Note: T-MAX Films require a higher-than-normal fixer replenishment rate.

Large Tank Rack-and-Tank Processors

The development times for large-tank rack-and-tank processors are based on a machine speed that transfers the film every 2 minutes. The times given below are starting-point recommendations for T-MAX RS Developer and Replenisher and XTOL Developer. Make tests to determine if results are acceptable for your needs.

Large-Tank Rack-and-Tank Processing			
KODAK PROFESSIONAL Film	EI	KODAK Developer or Developer and Replenisher	Time (min) at 72°F (22°C)
T-MAX 100	100/21° 200/24°	T-MAX RS or XTOL	6 to 8
T-MAX 400	400/27° 800/30°		

Replenishment Rates

T-MAX RS Developer and Replenisher—Add 45 mL (1.5 ounces) of replenisher solution for each 135-36 or 120 roll or 8 x 10-inch sheet of film processed. Stir or recirculate the solution after each addition of replenisher solution.

Note: Do not use T-MAX RS Developer and Replenisher to replenish T-MAX Developer. They are not designed to work together.

XTOL Developer—Add 70 mL (2.4 ounces) of replenisher solution for each 135-36 or 120 roll or 8 x 10-inch sheet of film processed. Stir or recirculate the solution after each addition of replenisher solution.

Push Processing: Roller Transport Processors

To process pushed T-MAX 100 or 400 Film in a machine with DURAFLO RT Developer, use a normal machine process with the machine speed shown in the appropriate table below.

KODAK Film	EI	Machine Speed
KODAK VERSAMAT Film Processor, Models 5 and 411		
T-MAX 100	200/24°	2.5 ft (0.8 m)/min (normal)
	400/27°	1.9 ft (0.6 m)/min
T-MAX 400	800/30°	2.6 ft (0.8 m)/min (normal)
	1600/33°	2.2 ft (0.7 m)/min
KODAK VERSAMAT Film Processor, Model 11		
T-MAX 100	200/24°	5.3 ft (1.6 m)/min (normal)
	400/27°	4 ft (1.2 m)/min
T-MAX 400	800/30°	5.5 ft (1.7 m)/min (normal)
	1600/33°	4.5 ft (1.4 m)/min

Other Roller-Transport Processors		
KODAK Film	EI	Development Time
T-MAX 100	200/24°	97 seconds (normal)
T-MAX 400	800/30°	85 seconds (normal)
T-MAX 100	400/27°	128 seconds
T-MAX 400	1600/33°	115 seconds

Push Processing: Large Tank Rack-and-Tank Processors

The development times for these processors are based on a machine speed that transfers the film every 2 minutes. The times given below are starting-point recommendations. Make tests to determine if results are acceptable for your needs.

KODAK PROFESSIONAL Film	EI	KODAK Developer or Developer and Replenisher	Time* (min) at 72°F (22°C)
T-MAX 100	200/24°	T-MAX RS	6 to 8
T-MAX 400	800/30°		
T-MAX 100	200/24°	XTOL	6 to 8
T-MAX 400	800/30°		
T-MAX 100	400/27°	T-MAX RS	8 to 10
T-MAX 400	1600/33°		
T-MAX 100	400/27°	XTOL	8 to 10
T-MAX 400	1600/33°		

* Development time depends on agitation and tank size.

CONTRAST ADJUSTMENT

If you want to increase or decrease film contrast from its normal value, you can adjust your standard development time. Your standard development time is the time that produces normal negative contrast based on your processing equipment and conditions, agitation, and processing technique.

The table below provides adjustment factors for several developers. The factors are based on a developer temperature of 75°F (24°C) for KODAK T-MAX Developers and a temperature of 68°F (20°C) for the others. The "standard" for each developer is indicated by 1.0. To increase or decrease film contrast or to use a different developer temperature, find the adjustment factor in the table. Multiply the standard development time by this factor to find the development time to use for a different contrast or developer temperature (or both).

For detailed processing instructions for KODAK XTOL Developer, see *KODAK XTOL Developer*, KODAK Publication No. J-109.

Note: These tables apply to negatives you will print with a diffusion enlarger. If you use a condenser enlarger, shift your selection one column to the left.

Development-Time Adjustment Factors				
Temperature	20% Less Contrast	Normal Contrast	20% More Contrast	40% More Contrast
KODAK PROFESSIONAL T-MAX Developer and KODAK PROFESSIONAL T-MAX RS Developer and Replenisher				
68°F (20°C)	0.9*	1.2	1.4	NR
72°F (22°C)	0.8*	1.1	1.3	1.7
75°F (24°C)	0.7*	**1.0**	1.2	1.5
KODAK PROFESSIONAL Developer D-76 and KODAK MICRODOL-X Developer				
65°F (18°C)	1.0*	1.2	1.4	1.6
68°F (20°C)	0.8*	**1.0**	1.2	1.4
70°F (21°C)	0.7*	0.9	1.1	1.3
72°F (22°C)	0.7*	0.8	1.0	1.2
75°F (24°C)	0.6*	0.7	0.9	1.0
KODAK HC-110 Developer Replenisher (Dilution B)				
65°F (18°C)	0.7*	1.2	1.6	2.1
68°F (20°C)	0.6*	**1.0**	1.4	1.8
70°F (21°C)	0.6*	0.9	1.3	1.6
72°F (22°C)	0.5*	0.8	1.2	1.5
75°F (24°C)	0.4*	0.7	1.0	1.3
KODAK MICRODOL-X Developer (1:3)				
75°F (24°C)	0.8*	**1.0**	1.3	1.5

* If you select one of these factors, add one stop to your camera exposure.

NR = Not recommended

RETOUCHING

You can retouch KODAK PROFESSIONAL T-MAX Film in 120 and sheet sizes by applying liquid dyes to the base or emulsion side. You can also use retouching pencil on the base side after applying KODAK Retouching Fluid.

IMAGE STRUCTURE

The data in this section are based on development in KODAK Developer D-76, at 68°F (20°C).

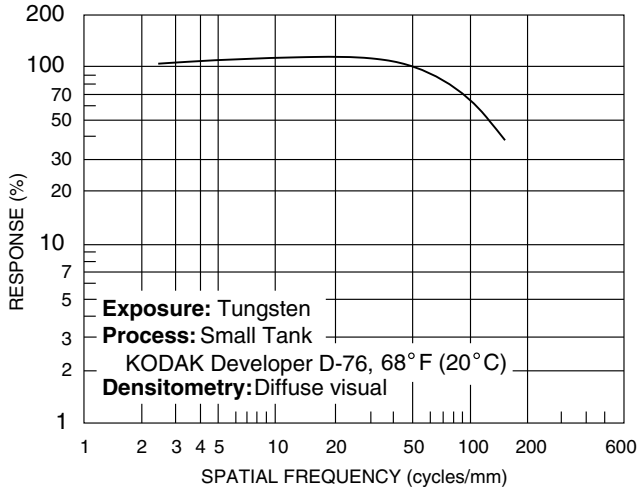
KODAK PROFESSIONAL Film	Resolving Power*	Diffuse rms Granularity†
T-MAX 100	63 lines/mm (TOC 1.6:1)	8
	200 lines/mm (TOC 1000:1)	
T-MAX 400	50 lines/mm (TOC 1.6:1)	11
	125 lines/mm (TOC 1000:1)	

* Determined according to a method similar to the one described in ISO 6328, *Photography—Determination of ISO Resolving Power*.
† Read at a net diffuse density of 1.00, using a 48-micrometre aperture, 12X magnification.

CURVES

KODAK PROFESSIONAL T-MAX 100 Film

Modulation Transfer Curves



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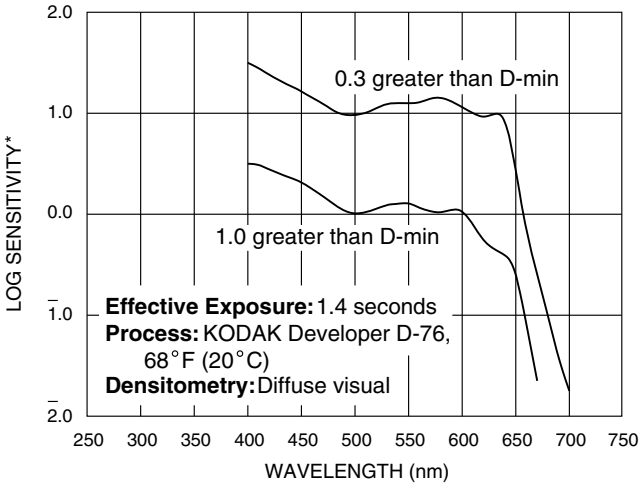
Spectral Sensitivity Curves*



*Sensitivity = reciprocal of exposure (ergs/cm^2) required to produce specified density

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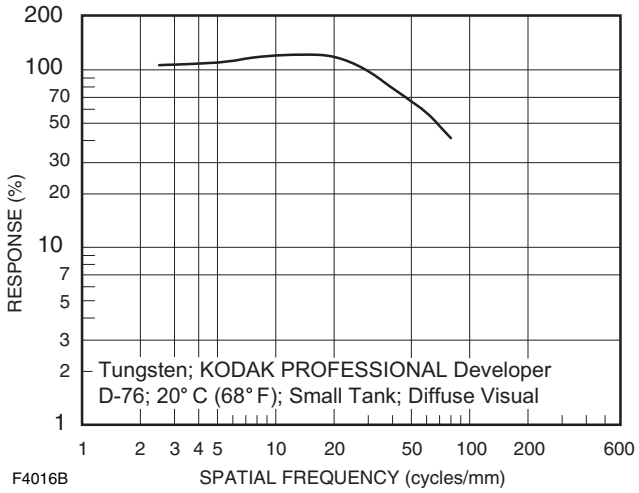
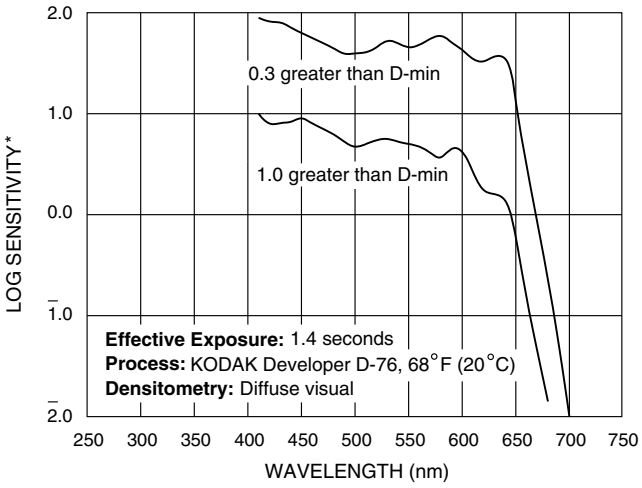
KODAK PROFESSIONAL T-MAX 400 Film

Modulation Transfer Curves



F4016B

Spectral-Sensitivity Curves*

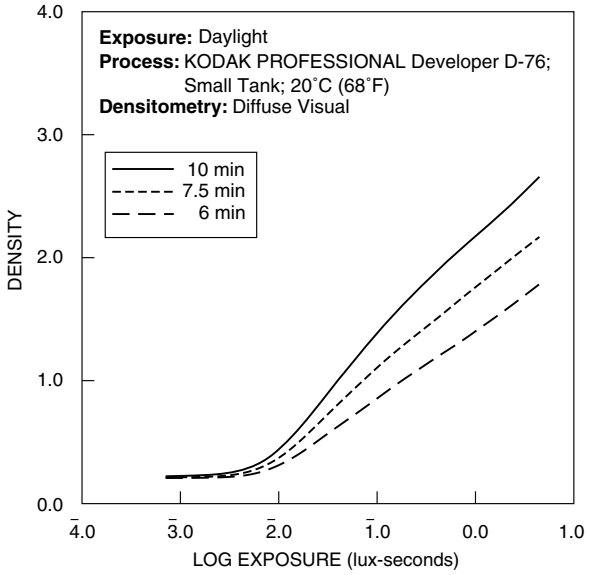


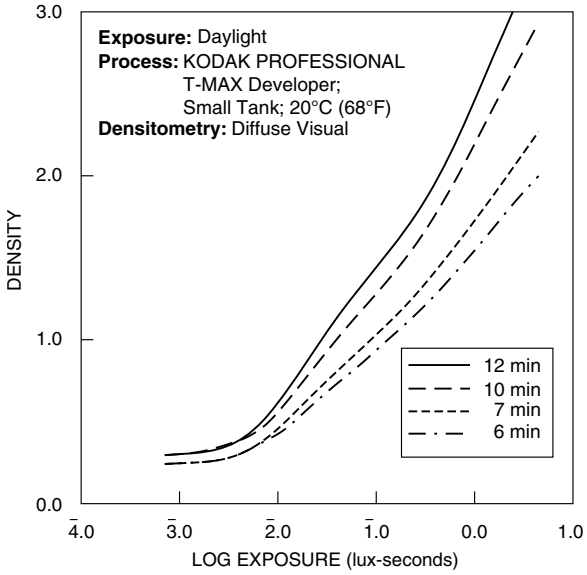
*Sensitivity = reciprocal of exposure (ergs/cm^2) required to produce specified density

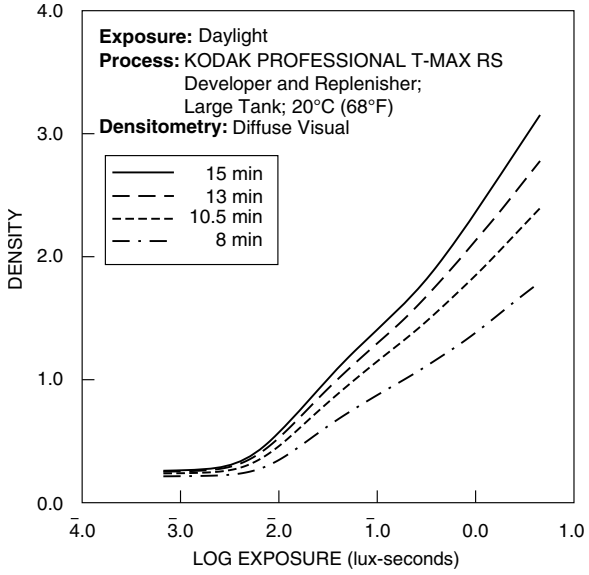
F002_0511AC

* The blue sensitivity of KODAK PROFESSIONAL T-MAX Films is slightly less than that of other Kodak panchromatic black-and-white films. This enables the response of these films to be closer to the response of the human eye. Therefore, blues may be recorded as slightly darker tones with these films—a more natural rendition.

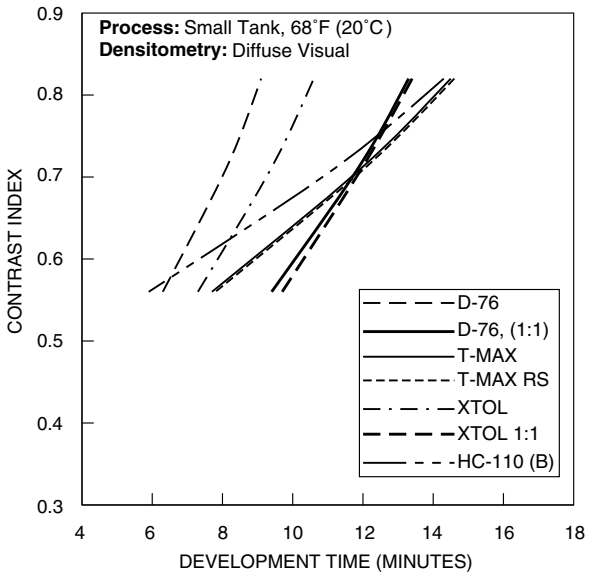
KODAK PROFESSIONAL T-MAX 100 Film
Characteristic Curves

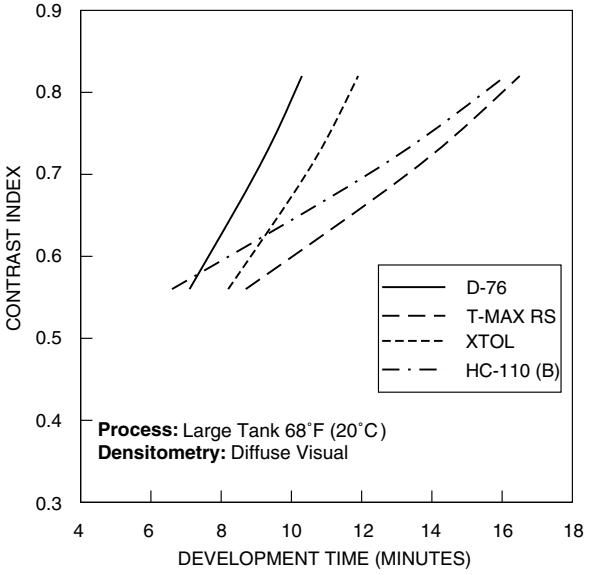


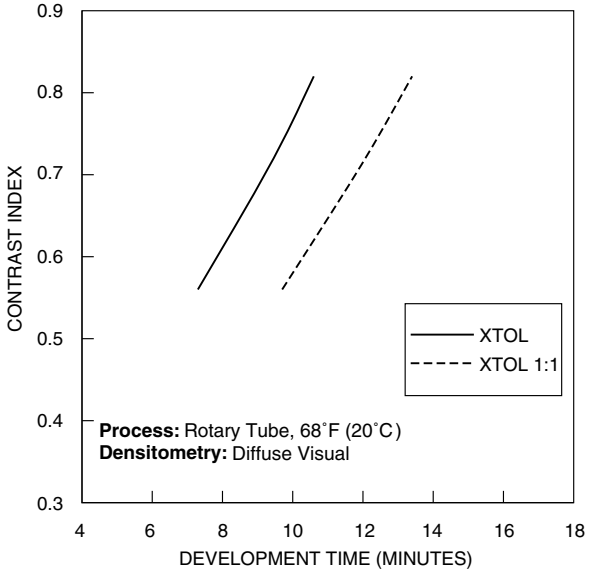


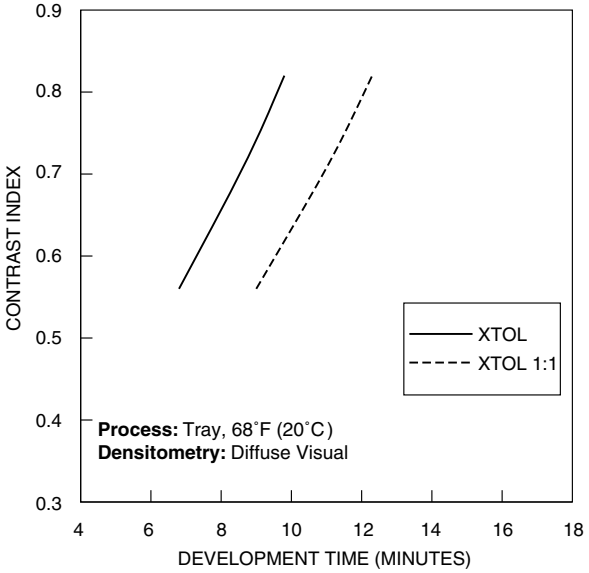


KODAK PROFESSIONAL T-MAX 100 Film
Contrast Index Curves



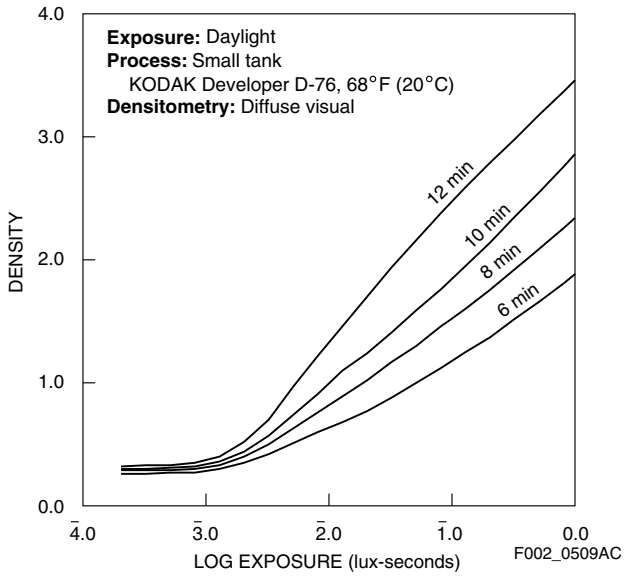


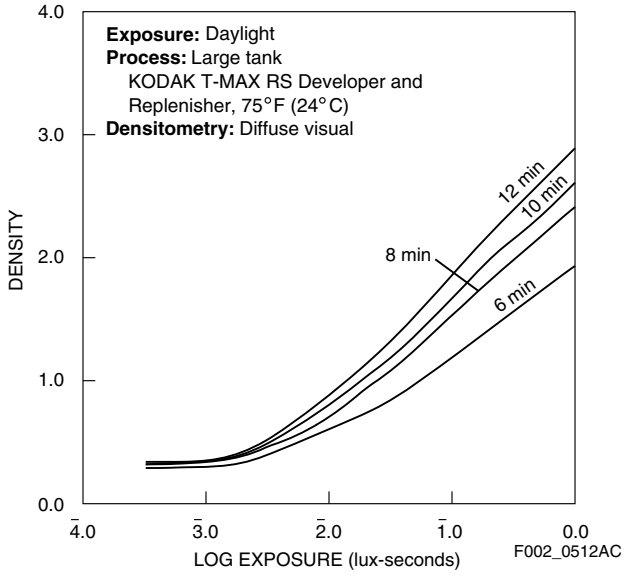


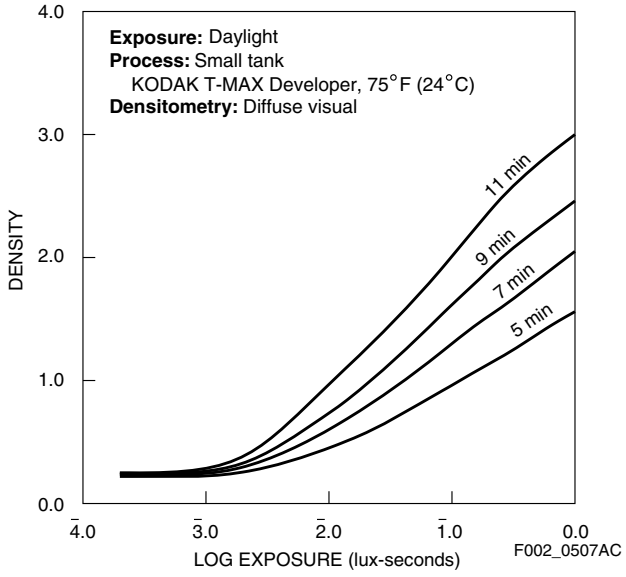


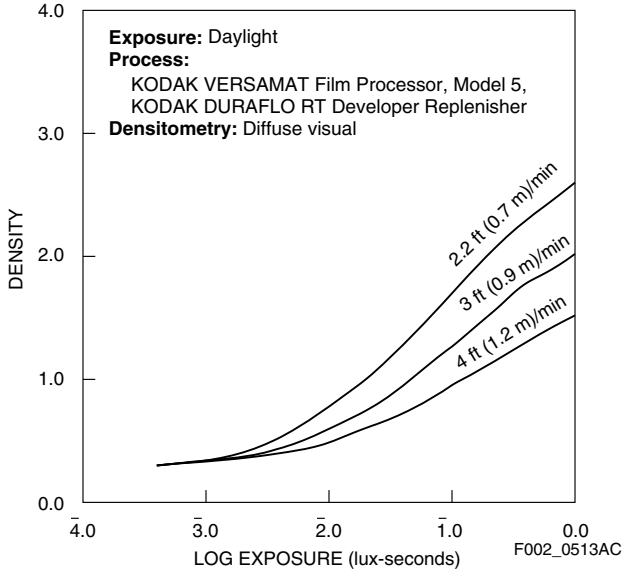
NOTICE: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent 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.

KODAK PROFESSIONAL T-MAX 400 Film
Characteristic Curves

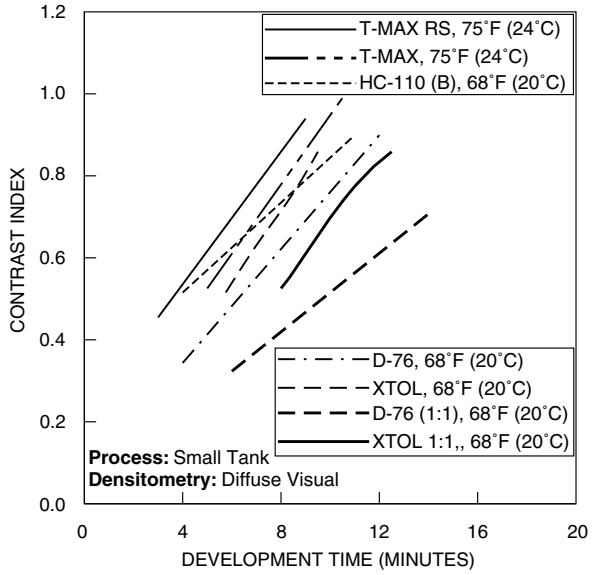


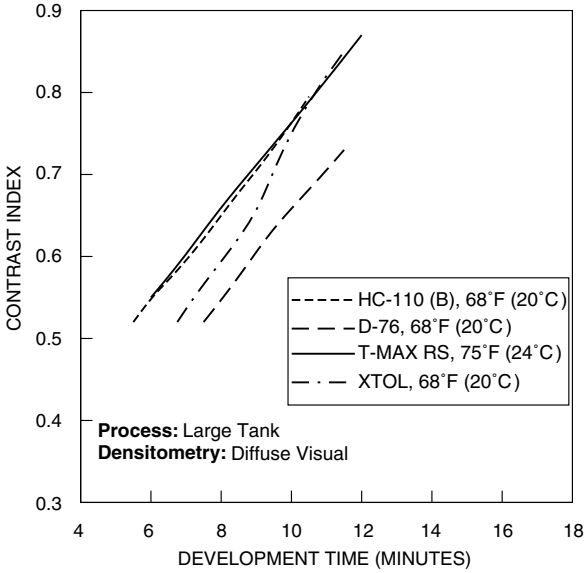


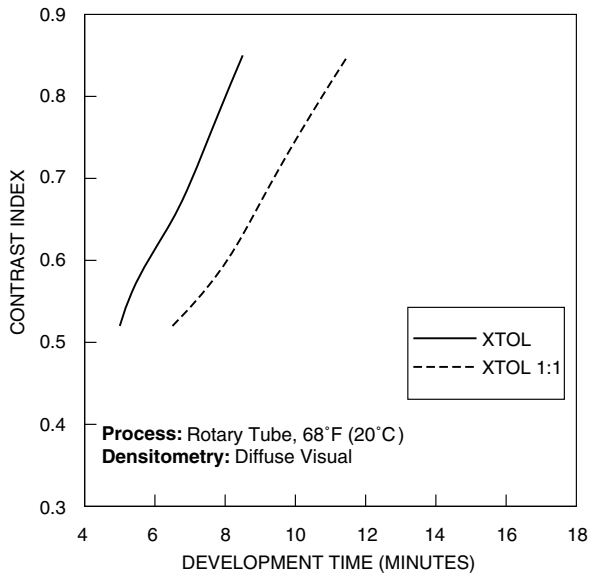


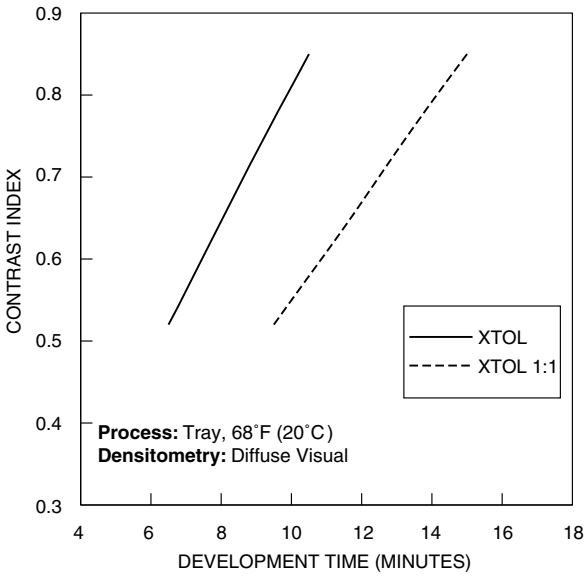


KODAK PROFESSIONAL T-MAX 400 Film
Contrast Index Curves









DARKROOM RECOMMENDATIONS

Do not use a safelight. Handle unprocessed film in total darkness. Do not develop this film by inspection.

Note: Some darkroom timers will glow (fluoresce) for some time after you turn off the lights in a darkroom. To avoid fogging this film, turn the face of timers away from the area where you handle unprocessed film.

The afterglow from fluorescent lights will also fog this film. Make sure your darkroom is *completely* dark before you handle unprocessed film.

STORAGE AND HANDLING

KODAK PROFESSIONAL T-MAX P3200 Film is very sensitive to environmental radiation; expose and process it promptly. Request *visual* inspection of this film at airport x-ray inspection stations.

Store unexposed film at 75°F (24°C) or lower in the original sealed package. For protection from heat in areas with temperatures consistently higher than 75°F (24°C), you can store the film in a refrigerator. If film has been refrigerated, allow the package to warm up to room temperature for 1 to 1 1/2 hours before opening it.

Load and unload your camera in subdued light, and rewind the film completely before unloading the camera.

Store processed film in a cool, dry place.

EXPOSURE

KODAK PROFESSIONAL T-MAX P3200 Film is specially designed to be used as a multi-speed film. The speed you use depends on your application; make tests to determine the appropriate speed.

The nominal speed is EI 1000 when the film is processed in KODAK PROFESSIONAL T-MAX Developer or KODAK PROFESSIONAL T-MAX RS Developer and Replenisher, or EI 800 when it is processed in other Kodak black-and-white developers. It was determined in a manner published in ISO standards. For ease in calculating exposure and for consistency with the commonly used scale of film-speed numbers, the nominal speed has been rounded to EI 800.

Because of its great latitude, you can expose this film at EI 1600 and yield negatives of high quality. There will be no change in the grain of the final print, but there may be a slight loss of shadow detail. When you need a higher speed, you can expose this film at EI 3200 or 6400. At these speeds, there will be a slight increase in contrast and graininess with additional loss of shadow detail. (See the processing tables for adjusted development times.)

Because of the shape of the characteristic curve of the film, you will obtain better shadow detail and highlight separation when you expose it at EI 3200 or 6400 than you can obtain with 400-speed films pushed by 3 stops. These higher speeds allow you to take photographs in many situations where photography was previously impossible.

To expose this film at speeds higher than EI 6400, it is critical that you make tests to determine if the results are appropriate for your needs. For best results when you expose the film at these speeds, use XTOL, T-MAX Developer or T-MAX RS Developer and Replenisher.

Note: Contrast and graininess will increase when you use higher exposure indexes.

To expose film at speed settings that are higher than the maximum setting on your camera or meter, set the meter at a lower speed; then reduce the aperture or increase the shutter speed to compensate.

You can also expose this film at EI 400 and obtain outstanding shadow detail. See the processing tables.

The speed numbers for this film are expressed as Exposure Indexes (EI). Use these exposure indexes with meters or cameras marked for ISO/ASA or ISO/DIN speeds in daylight or artificial light.

KODAK Developer or Developer and Replenisher	Exposure Index (EI)
T-MAX, T-MAX RS, or XTOL	400/27° 800/30° 1600/33° 3200/36° 6400/39° 12,500/42°* 25,000/45°*
D-76	400/27° 800/30° 1600/33° 3200/36° 6400/39°
HC-110 (Dilution B)	400/27° 800/30° 1600/33° 3200/36° 6400/39°
DURAFLO RT	800/30° 1600/33° 3200/36° 6400/39°

* Expose and process a test roll to determine if results at these exposure indexes are acceptable for your needs.

Adjustments for Long and Short Exposures

At the exposure times in the table below, compensate for the reciprocity characteristics of these films by increasing the exposure as shown.

If Indicated Exposure Time Is (Seconds)	Use This Lens-Aperture Adjustment	OR	This Adjusted Exposure Time (Seconds)
1/10,000	None		None
1/1,000	None		None
1/100	None		None
1/10	None		None
1	+1/3 stop		Change Aperture
10	+2/3 stop		15
100	+2 stops		400

Filter Corrections

Increase exposure by the filter factor or the number of stops indicated when you use filters. For greatest exposure accuracy with a through-the-lens meter, take the meter reading without the filter over the lens, and then increase your exposure as shown in the table.

KODAK WRATTEN Gelatin Filter	Daylight			Tungsten		
	Increase Lens Aperture By (f-stops)	OR	Increase Exposure By (Filter Factor)	Increase Lens Aperture By (f-stops)	OR	Increase Exposure By (Filter Factor)
No. 8 (yellow)	2/3		1.5	1/3		1.2
No. 11 (yellowish green)	1 2/3		3	1 2/3		3
No 12 (deep yellow)	2/3		2	1/3		1.2
No. 15 (deep yellow)	2/3		2	2/3		1.5
No. 25 (red)	3		8	2		4
No. 47 (blue)	3		8	4 2/3		25
No. 58 (green)	2 2/3		6	2 2/3		6
Polarizing Filter	1 2/3		2.5	1 1/3		2.5

Note: Filter factors for other black-and-white professional films are different.

MANUAL PROCESSING

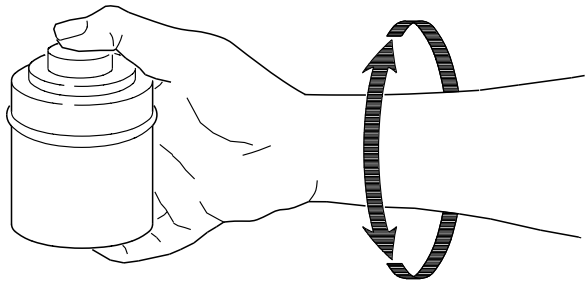
Handle unprocessed film in total darkness. Do not develop this film by inspection.

With properly exposed film, the starting-point development times in the tables should produce negative contrast suitable for printing with a diffusion enlarger. For printing with a condenser enlarger, you may want to reduce the development time to produce a lower contrast; as a starting point, you can use the development time for the exposure index *one stop lower* than the exposure index you used to expose the film (see the processing tables). For example, if you exposed your film at EI 3200 and will print the negatives with a condenser enlarger, use the development time given for EI 1600.

Small-Tank Processing (8- or 16-ounce tank)

With small single- or double-reel tanks, drop the loaded film reel into the developer and attach the top to the tank. Firmly tap the tank on the top of the work surface to dislodge any air bubbles. Provide initial agitation of 5 to 7 inversion cycles in 5 seconds, i.e., extend your arm and vigorously twist your wrist 180 degrees.

Then repeat this agitation procedure at 30-second intervals for the rest or the development time.



KODAK Developer or Developer and Replenisher	Exposed at EI/DIN	Development Time in Minutes					
		68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	80°F (27°C)	85°F (29°C)
T-MAX	400/27°	8½	8	7½	6½	5½	4½*
	800/30°	9½	9	8½	7½	6½	5½
	1600/33°	10½	10	9	8	7	6
	3200/36°	12	11½	10½	9½	8	6½
	6400/39°	13½	13	12	11	9	7½
	12,500/42°	15½	14½	13½	12	10	8½
	25,000/45°	NR	16	15	13½	11½	9½
T-MAX (1:7)	800/30°	—	—	—	13	—	—
T-MAX (1:9)	800/30°	—	—	—	19½	—	—
T-MAX RS	400/27°	9	8½	7½	7	6½	5½
	800/30°	10½	9½	9	8½	7½	6½
	1600/33°	12	11	10	9½	8½	7
	3200/36°	14½	13	12	11½	10	8½
	6400/39°	16½	15	13½	13	11½	10
	12,500/42°	18½	17	15½	14½	13	11
	25,000/45°	NR	NR	17	16½	14½	12½
XTOL	400/27°	9½	8½	7¾	6¾	5¼	4¼*
	800/30°	10½	9½	8¾	7½	6	4½*
	1600/33°	11½	10½	9½	8¼	6½	5
	3200/36°	13½	12¼	11¼	9½	7½	6
	6400/39°	15¼	14	12¾	11	8½	6¾
	12,500/42°	17¼	15¾	14¼	12¼	9¾	7½
	25,000/45°	19	17½	15¾	13¾	10¾	8½
XTOL (1:1)	400/27°	12½	11½	—	10	8	—
	800/30°	14	13	—	11½	9	—
	1600/33°	16	14	—	12½	10	—
	3200/36°	18½	16½	—	14½	11½	—
	6400/39°	20½	18½	—	16	13	—
	12,500/42°	22½	20½	—	18	14½	—
	25,000/45°	25	23	—	20	16	—
D-76	400/27°	10½	9½	8½	7½	6	5
	800/30°	11½	10½	9½	8½	6½	5½
	1600/33°	12½	11½	10½	9	7½	6
	3200/36°	14	13	11½	10½	8½	6½
	6400/39°	15½	14	13	11½	9	7½
HC-110 (Dilution B)	400/27°	7½	6½	5½	5	4¼*	3¾*
	800/30°	8½	7¼	6¼	5¾	4¾*	4¼*
	1600/33°	9¼	8	6¾	6¼	5¼	4½*
	3200/36°	10½	9	7¾	7	6	5¼
	6400/39°	12	10¼	8¾	8	6¾	5¾

* Development times shorter than 5 minutes may produce unsatisfactory uniformity.

NR = Not recommended

Note: These development times are suggested starting points. Make tests to determine the best development time for your application.

Large-Tank Processing (1/2- to 3 1/2-gallon tank)

Agitate continuously for the first 15 to 30 seconds by raising and lowering the basket, rack, or spindle 1/2 inch. *Do not* agitate the basket, rack, or spindle for the remainder of the first minute. Then agitate once per minute by lifting the basket, rack, or spindle out of the developer, tilting it approximately 30 degrees, draining it for 5 to 10 seconds, and reimmersing it. Alternate the direction of tilting the basket, rack, or spindle.

KODAK Developer or Developer and Replenisher	Exposed at EI	Development Time in Minutes			
		68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)
T-MAX RS	400/27°	10	9½	8½	8
	800/30°	12	10½	10	9½
	1600/33°	13½	12½	11½	10½
	3200/36°	16½	14½	13½	13
	6400/39°	NR	17	15	14½
	12,500/42°	NR	NR	17½	16½
XTOL	400/27°	10½	9½	—	7½
	800/30°	11¾	10¾	—	8½
	1600/33°	13	12	—	9¼
	3200/36°	15¼	13¾	—	10¾
	6400/39°	17¼	15¾	—	12¼
	12,500/42°	19¼	17½	—	13¾
	25,000/45°	21½	19½	—	15¼

NR = Not recommended

Note: These development times are suggested starting points. Make tests to determine the best development time for your application.

Rotary-Tube Processing

Follow the agitation recommendations for your processor.

KODAK Developer or Developer and Replenisher	Exposed at EI/DIN	Development Time in Minutes					
		68°F (20°C)	70°F (21°C)	72°F (22°C)	75°F (24°C)	80°F (27°C)	85°F (29°C)
T-MAX	400/27°	8½	8	7½	6½	5½	4½*
	800/30°	9½	9	8½	7½	6½	5½
	1600/33°	10½	10	9	8	7	6
	3200/36°	12	11½	10½	9½	8	6½
	6400/39°	13½	13	12	11	9	7½
	12,500/42°	15½	14½	13½	12	10	8½
	25,000/45°	NR	16	15	13½	11½	9½
T-MAX RS	400/27°	9	8½	7½	7	6½	5½
	800/30°	10½	9½	9	8½	7½	6½
	1600/33°	12	11	10	9½	8½	7
	3200/36°	14½	13	12	11½	10	8½
	6400/39°	16½	15	13½	13	11½	10
	12,500/42°	18½	17	15½	14½	13	11
	25,000/45°	NR	NR	17	16½	14½	12½
XTOL	400/27°	9½	8½	7¾	6¾	5¼	4¼*
	800/30°	10½	9½	8¾	7½	6	4½*
	1600/33°	11½	10½	9½	8¼	6½	5
	3200/36°	13½	12¼	11¼	9½	7½	6
	6400/39°	15¼	14	12¾	11	8½	6¾
	12,500/42°	17¼	15¾	14¼	12¼	9¾	7½
	25,000/45°	19	17½	15¾	13¾	10¾	8½
XTOL (1:1)	400/27°	12½	11½	—	10	8	—
	800/30°	14	13	—	11½	9	—
	1600/33°	16	14	—	12½	10	—
	3200/36°	18½	16½	—	14½	11½	—
	6400/39°	20½	18½	—	16	13	—
	12,500/42°	22½	20½	—	18	14½	—
	25,000/45°	25	23	—	20	16	—
D-76	400/27°	10½	9½	8½	7½	6	5
	800/30°	11½	10½	9½	8½	6½	5½
	1600/33°	12½	11½	10½	9	7½	6
	3200/36°	14	13	11½	10½	8½	6½
	6400/39°	15½	14	13	11½	9	7½
HC-110 (Dilution B)	400/27°	7½	6½	5½	5	4¼*	3¾*
	800/30°	8½	7¼	6¼	5¾	4¾*	4¼*
	1600/33°	9¼	8	6¾	6¼	5¼	4½*
	3200/36°	10½	9	7¾	7	6	5¼
	6400/39°	12	10¼	8¾	8	6¾	5¾

* Development times shorter than 5 minutes may produce unsatisfactory uniformity.

NR = Not recommended

Note: These development times are suggested starting points. Make tests to determine the best development time for your application.

Final Steps

Rinse at 70 to 85°F (21 to 29°C) with agitation in KODAK Indicator Stop Bath or running water for 30 seconds.

Fix at 70 to 85°F (21 to 29°C) for 3 to 5 minutes with vigorous agitation in KODAK Rapid Fixer. Be sure to agitate the film frequently during fixing.

Note: To keep fixing times as short as possible, we strongly recommend using KODAK Rapid Fixer. If you use another fixer, such as KODAK Fixer or KODAFIX Solution, fix for 5 to 10 minutes or twice the time it takes for the film to clear. You can check the film for clearing after 3 minutes in KODAK Rapid Fixer or 5 minutes in KODAK Fixer or KODAFIX Solution.

Important

Your fixer will be exhausted more rapidly with this film than with other films. If your negatives show a magenta (pink) stain after fixing, your fixer may be near exhaustion, or you may not have used a long enough time. If the stain is slight, it will not affect image stability, negative contrast, or printing times. You can remove a slight pink stain with KODAK Hypo Clearing Agent. However, if the stain is pronounced and irregular over the film surface, refix the film in fresh fixer.

Wash for 20 to 30 minutes in running water at 70 to 85°F (21 to 29°C) with a flow rate that provides at least one complete change of water in 5 minutes. To save time and conserve water, use KODAK Hypo Clearing Agent.

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

MACHINE PROCESSING

Roller-Transport Processors

KODAK VERSAMAT Film Processors

You can process this film in roller-transport processors, such as the KODAK VERSAMAT Film Processor, Model 5, 11, or 411, with KODAK DURAFLO RT Developer Starter, KODAK DURAFLO RT Developer Replenisher, and KODAK Rapid Fixer.

Processing Steps and Conditions for KODAK VERSAMAT Film Processors

Step	No. of Racks	Path Length		Temperature
		Model 11	Models 5 and 411	
Develop	2	8.5 ft (2.6 m)	4 ft (1.2 m)	80 ± 0.5°F (26.5 ± 0.3°C)
Fix	3	12 ft (3.8 m)	6 ft (1.9 m)	80°F (26.5) nominal
Wash	2	8 ft (2.4 m)	4 ft (1.2 m)	70 to 75°F (21 to 24°C)
Dry		8 ft (2.4 m)	4 ft (1.2 m)	105 to 140°F (40.5 to 60°C)

The recommended machine speeds for processing KODAK PROFESSIONAL T-MAX P3200 Film are as follows:

EI	Machine Speed	Development Time
KODAK VERSAMAT Film Processor, Models 5 and 411		
800/30°	0.7 m (2.2 ft) / min	109 seconds
1600/33°	0.6 m (2.0 ft) / min	120 seconds
3200/36°	0.5 m (1.7 ft) / min	141 seconds
6400/39°	0.5 m (1.5 ft) / min	160 seconds
KODAK VERSAMAT Film Processor, Model 11		
800/30°	1.4 m (4.5 ft) / min	113 seconds
1600/33°	1.2 m (4.0 ft) / min	128 seconds
3200/36°	1.1 m (3.5 ft) / min	146 seconds
6400/39°	0.9 m (3.0 ft) / min	170 seconds

Processing Conditions for Other Roller-Transport Processors

Select a starting point from either of the above tables. The development time is measured from the time the film enters the developer to the time it enters the fixer. Differences in machine design that affect agitation and crossover times from one tank to the next may require development-time adjustments.

Replenishment Rates

Replenisher—Use an average replenishment rate of 0.20 mL per square inch of film processed.
Fixer—Use 0.55 mL per square inch of film processed.

Note: T-MAX Films require a higher-than-normal fixer replenishment rate.

Large-Tank Rack-and-Tank Processors

The development times for large-tank rack-and-tank processors are based on a machine speed that transfers the film every 2 minutes. The times given below are starting-point recommendations. Make tests to determine if results are acceptable for your needs.

Large-Tank Rack-and-Tank Processing

KODAK Developer or KODAK Developer and Replenisher	EI	Development Time* in Minutes
T-MAX RS at 72°F (22°C)	400/27° to 800/30° 1600/33° 3200/36° 6400/39° 12,500/42°	6 to 8 8 to 10 10 to 12 12 to 14 14 to 16
XTOL at 75°F (24°C)	400/27° to 800/30° 1600/33° to 3200/36° 6400/39° to 12,500/42°	6 to 8 8 to 10 10 to 12

* Development time depends on agitation and tank size.

Replenishment Rates

T-MAX RS Developer and Replenisher—Add 45 mL (1.5 ounces) of replenisher solution for each 135-36 roll of film processed. Stir or recirculate the solution after each addition of replenisher solution.

Note: Do not use T-MAX RS Developer and Replenisher to replenish T-MAX Developer. They are not designed to work together.

XTOL Developer—Add 70 mL (2.4 ounces) of replenisher solution for each 135-36 roll of film processed. Stir or recirculate the solution after each addition of replenisher solution.

IMAGE STRUCTURE

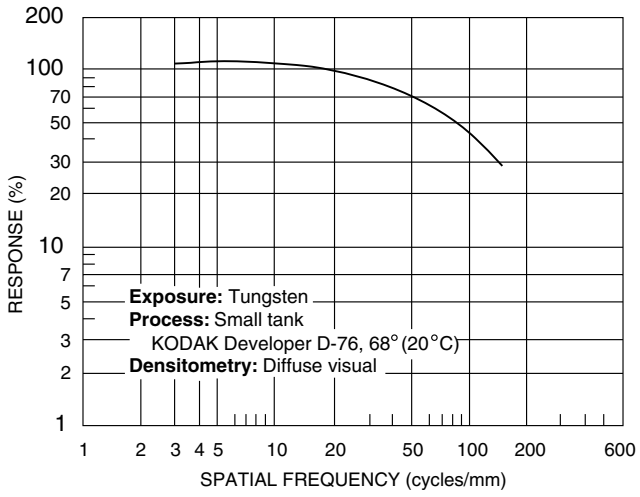
The data in this section are based on development in KODAK Developer D-76, at 68°F (20°C).

Resolving Power*	Diffuse rms Granularity†
40 lines/mm (TOC 1.6:1)	18
125 lines/mm (TOC 1000:1)	

* Determined according to a method similar to the one described in ISO 6328, *Photography—Determination of ISO Resolving Power*.
† Read at a net diffuse density of 1.00, using a 48-micrometre aperture, 12X magnification.

CURVES

Modulation Transfer Curves



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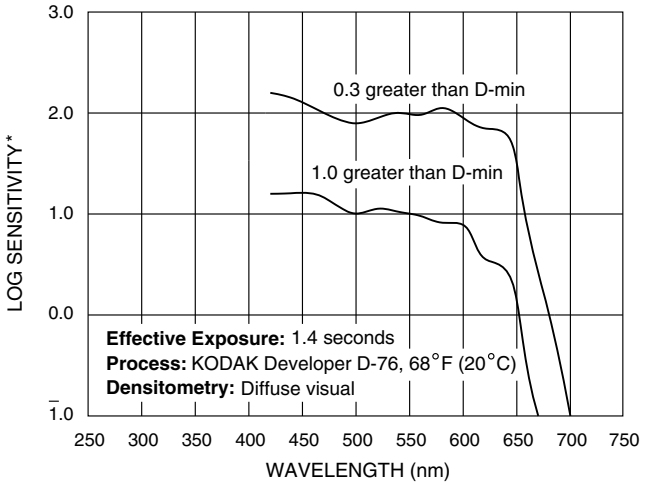
Spectral Sensitivity Curves*



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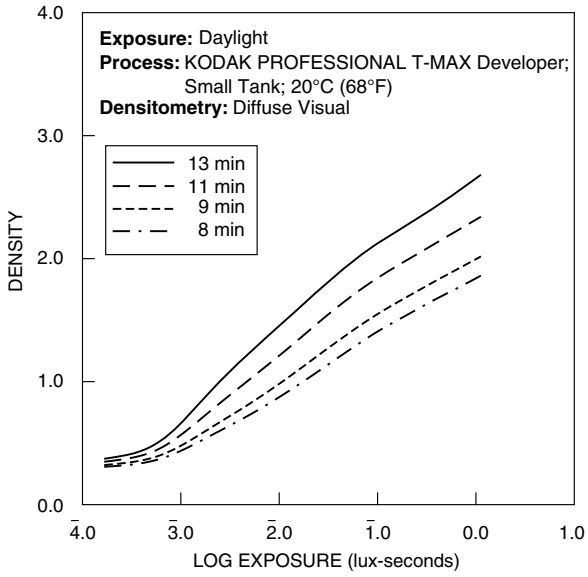
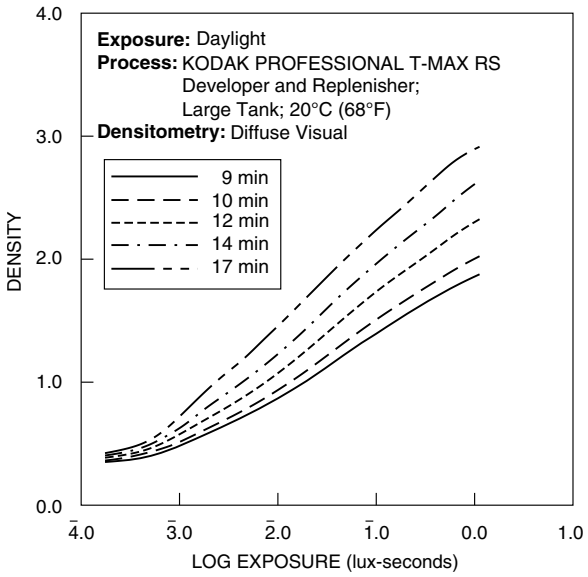
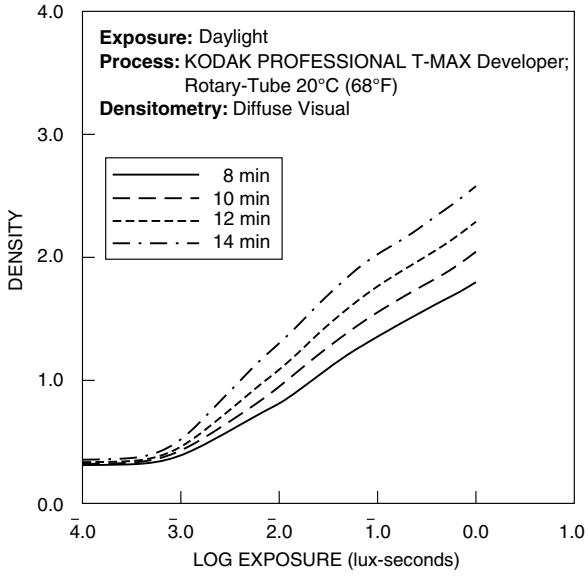
*Sensitivity = reciprocal of exposure (ergs/cm^2) required to produce specified density

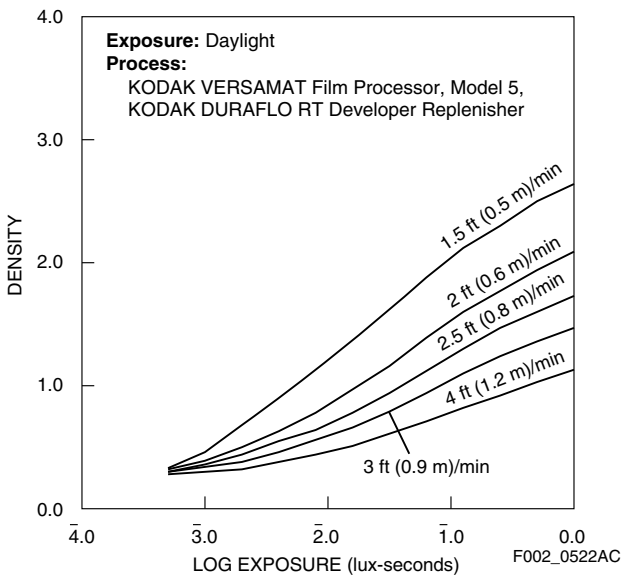
* The blue sensitivity of KODAK PROFESSIONAL T-MAX Films is slightly less than that of other Kodak panchromatic black-and-white films. This enables the response of this film to be closer to the response of the human eye. Therefore, blues may be recorded as slightly darker tones with these films—a more natural rendition.

Characteristic Curves



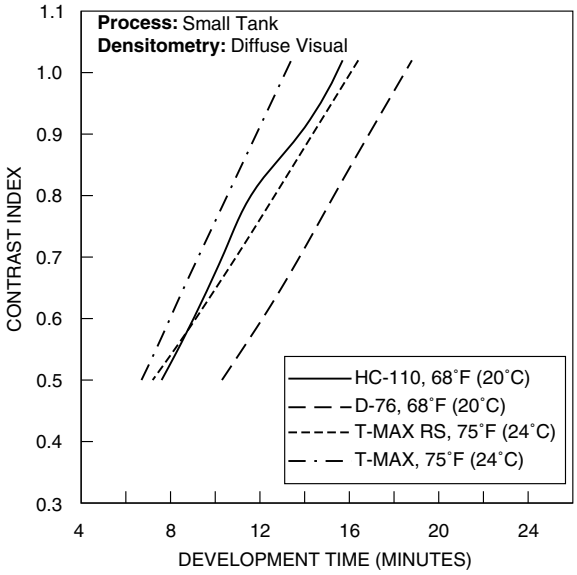


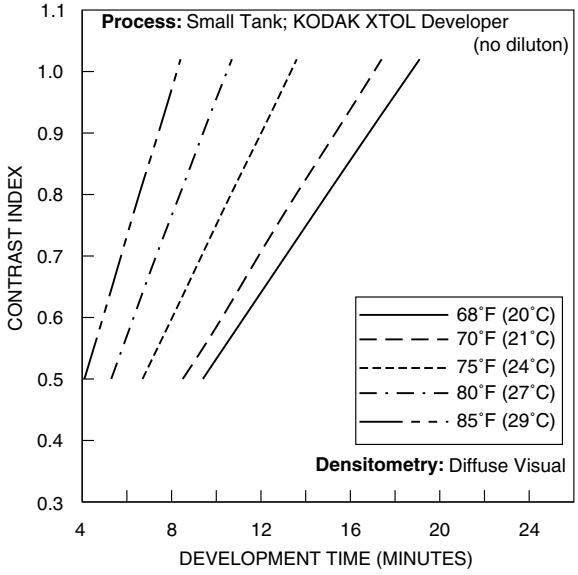


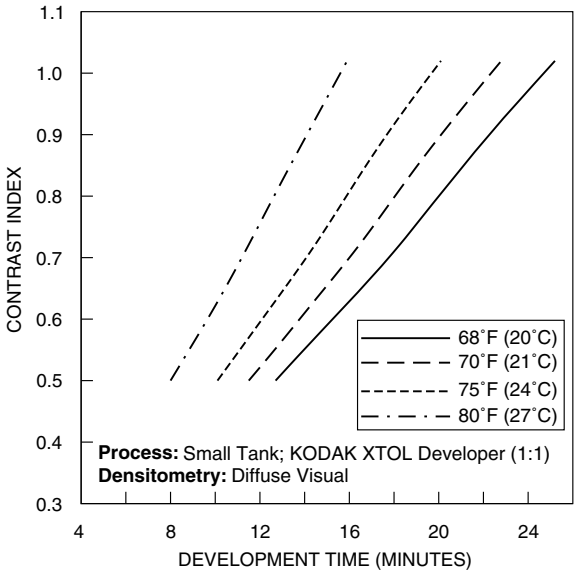


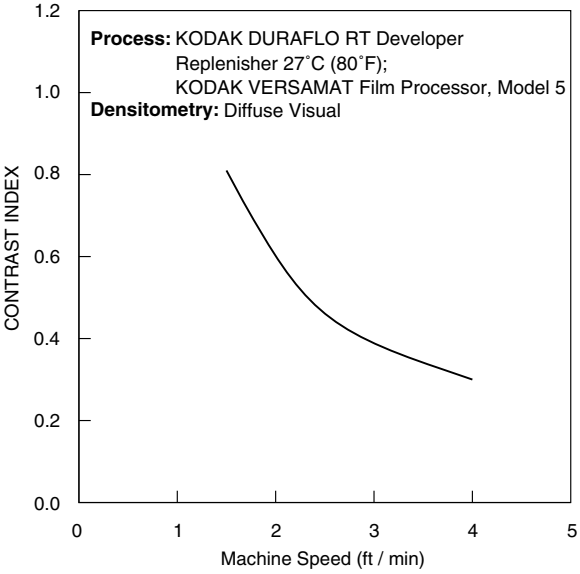
NOTICE: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent 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.

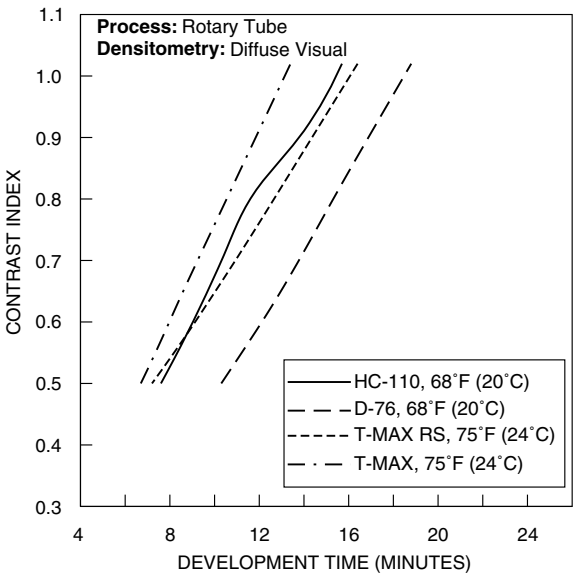
Contrast Index Curves







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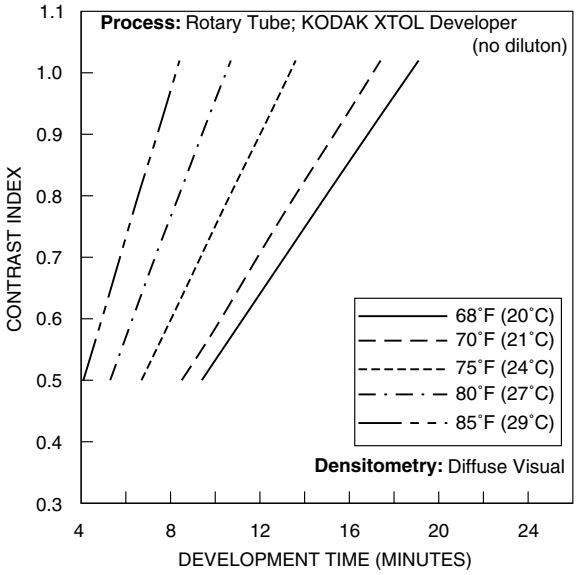
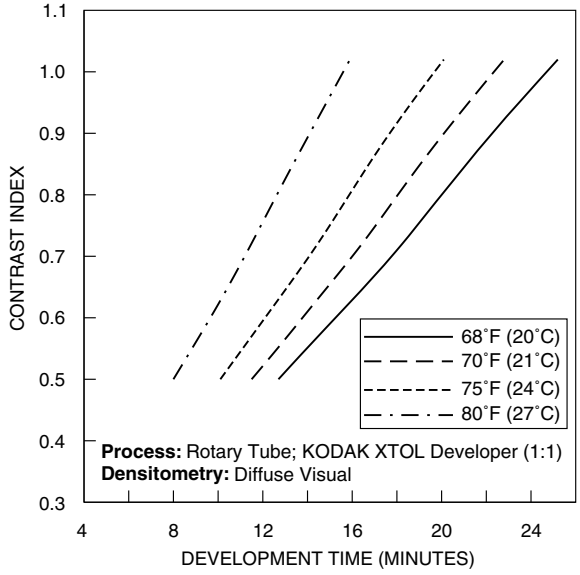
Densitometry: Diffuse Visual
CONTRAST INDEX
DEVELOPMENT TIME (MINUTES)
HC-110, 68˚F (20˚C)
D-76, 68˚F (20˚C)
T-MAX RS, 75˚F (24˚C)
T-MAX, 75˚F (24˚C)


Process: Rotary Tube; KODAK XTOL Developer
(no diluton)
Densitometry: Diffuse Visual
CONTRAST INDEX
DEVELOPMENT TIME (MINUTES)
68˚F (20˚C)
70˚F (21˚C)
75˚F (24˚C)
80˚F (27˚C)
85˚F (29˚C)


Process: Rotary Tube; KODAK XTOL Developer (1:1)
Densitometry: Diffuse Visual
CONTRAST INDEX
DEVELOPMENT TIME (MINUTES)
68˚F (20˚C)
70˚F (21˚C)
75˚F (24˚C)
80˚F (27˚C)

MORE INFORMATION

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

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 Photographic Materials—Before and After Processing
ED-1	Processing KODAK Black-and-White Films and Papers
E103BF	KODAK PROFESSIONAL Black-and-White Films
E103BP	KODAK PROFESSIONAL Black-and-White Papers
E103CF	Chemicals for KODAK PROFESSIONAL Black-and-White Films
F-2	Pathways to Black and White
G-10	KODAK AZO Paper
G-16	KODABROME II RC Paper
G-21	KODAK POLYCONTRAST III RC Paper
G-23	Toning KODAK Black-and-White Materials
G-24	KODAK POLYMAX Fine-Art Paper
G-26	KODAK POLYMAX II RC Paper
G-27	KODAK PANALURE SELECT RC Paper
G-28	KODAK P-MAX Art RC Paper
J-24	KODAK HC-110 Developer
J-78	KODAK Developer D-76
J-86	KODAK T-MAX Developers
J-87	KODAK T-MAX 100 Direct Positive Film Developing Outfit
J-109	KODAK XTOL Developer

The following books are available from photo-specialty dealers who sell Kodak products:

F-5	KODAK Professional Black-and-White Films
R-20	KODAK Black-and-White Darkroom DATAGUIDE

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

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 PROFESSIONAL T-MAX Films are available from dealers who supply KODAK PROFESSIONAL Products. You can use other materials, but you may not obtain similar results.

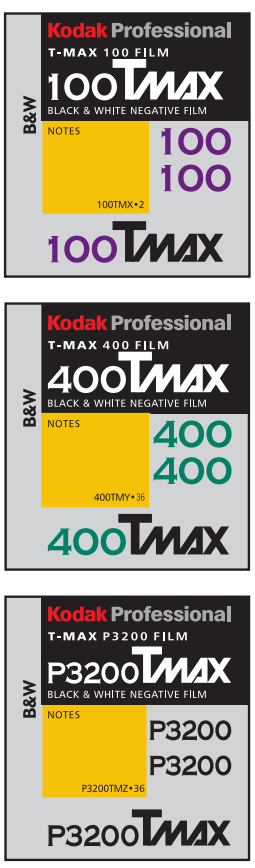
KODAK PROFESSIONAL T-MAX Films

Familiar films. New processing times. Same great prints.

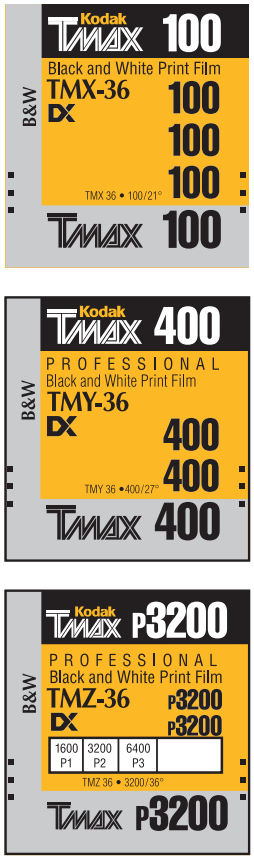
To reflect our enduring commitment to black-and-white photography, black-and-white film production will take place in an even more advanced film-coating facility. New technology applied to these superior, time-tested emulsions will result in slightly different processing times for the film family. But the same great films—those you've known and trusted for years—will still deliver the same breathtaking results.

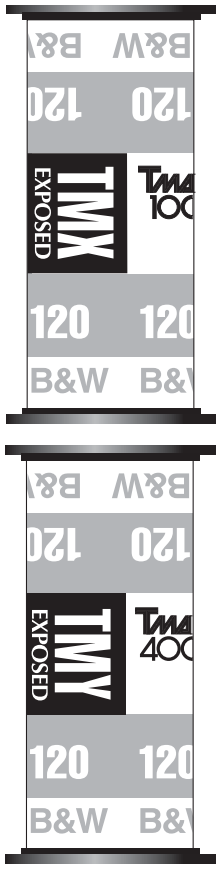
Use the packaging examples below to determine which film you have, then refer to the corresponding publication for development times.

New packaging, refer to this publication (F-4016)



Former packaging, refer to Kodak publication F-32:





Kodak, Kodak Professional, Azo, Dataguide, D-76, Duraflo, Estar, HC-110, Kodabrome, Kodafix, Microdol-X, P-Max, Panalure, Photo-Flo, Polycontrast, Polymax, T-Grain, T-Max, Versamat, Wratten, and Xtol are trademarks.

Revised 10-07
Printed in U.S.A.

KODAK PROFESSIONAL T-MAX Films
KODAK Publication No. F-4016

Film & Photofinishing Systems Group
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