KODAK XTOL Developer

KODAK XTOL Developer is a two-part powder developer for processing Kodak and other manufacturers' normally exposed, pushed, or pulled black-and-white films. It offers full emulsion speed and easy mixing, and can be used as both a developer and a replenisher in a variety of equipment, from small tanks (8 to 64 fluidounces), trays, or rotary tubes to high-volume processors.

FEATURES	BENEFITS
• Ascorbic acid-based black-and-white film developer	• Very high image quality at full emulsion speed
• No hydroquinone	• Convenient, room-temperature mixing for immediate use
• Two-part powder	• Quick, easy mixing
• One solution for both developer and replenisher	• Versatility • Simplified mixing and storage procedures
• Excellent keeping properties	• Good shelf life (six months after mixing when stored in full bottles) • High resistance to breakdown from oxidation during storage or in replenished processes • Less waste
• Robust, abuse-tolerant, clean-working solution	• Stable performance across a range of temperatures, dilutions, and agitation methods • Less frequent tank cleaning
• Contrast Index similar to that produced by other developers	• Negatives with printing characteristics like those processed in other general-purpose developers
• Excellent emulsion speed with normal and push processing	• Enhanced shadow contrast and improved highlight detail with some films
• Fine grain and high sharpness	• Enhanced sharpness, especially with 1:1 dilution • Enlargeability of negatives 10 percent greater with equivalent sharpness and grain (image quality)

Note: Kodak has tested XTOL Developer for long-term keeping by using typical equipment and procedures. Results indicate that mixed XTOL Developer stored for one year at room temperature (70°F [21°C]) in a full tightly closed bottle provides satisfactory results with Kodak black-and-white films when used at full strength. Some customers, however, have reported problems with developer stored for periods between six months and one year. Most often the problems related to loss of developer activity when customers were using a 1:3 or 1:2 dilution of the developer to process KODAK T-MAX 100 Professional Film.

To help ensure best results, we have changed our recommended shelf life and dilutions for XTOL Developer. The new recommendations are the same as those for KODAK Developer D-76 (full strength and 1:1).

The change in recommendations does not indicate any change in the formulation of the developer. If you have been consistently obtaining satisfactory results with diluted developer and you use the mixed developer before keeping characteristics can become a concern, you may want to continue your current procedures. However, Kodak publications will no longer include development recommendations for the 1:2 and 1:3 dilutions of the developer.

SIZES AVAILABLE

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

To Make	CAT No.
1 litre	888 8182
5 litres	875 1752
50 litres	818 4517

MIXING

Note: Observe precautionary information on the containers and in the Material Safety Data Sheets.

For this amount of developer:	Start with this amount of water:
1 litre	750 mL
5 litres	4 litres
50 litres	40 litres

1. Start with an amount of water that is approximately 75 percent of the total volume indicated on the package. See the table above. The water should be at normal room temperature, about 65 to 85°F (18 to 30°C).
2. With stirring, slowly add Part A. Stir until the powder is completely dissolved. At this point, the solution may appear somewhat tawny or copper-colored. This is normal.
3. Continue stirring, and slowly add Part B. Stir until the powder is completely dissolved. The coppery tint will clear from the solution as you add Part B.
4. Add water to bring the final solution to 1, 5, or 50 litres.
5. Stir until the solution is uniform.

If correctly mixed, the specific gravity of the working tank solution is 1.085 ± 0.003 measured at 77 ± 0.5°F (25 ± 0.3°C) at pH 8.2 ± 0.05.

STORAGE OF MIXED SOLUTIONS

Store mixed KODAK XTOL Developer in full, tightly closed containers or in a replenisher tank with a floating lid. To maintain shelf life, minimize the amount of air space in the storage container. Partially filled containers allow oxidation of the solution.

STORAGE LIFE OF UNUSED SOLUTIONS		
In Full, Tightly Closed Container	**In Partially Filled, Tightly Closed Container**	**In Replenisher Tank with Floating Lid**
6 months	At least 2 months	Indefinitely if new solution is added to replace that used by the processor

Note: If you use XTOL Developer diluted 1:1, dilute it just before you use it, and discard it after processing one batch of film. Do not reuse or replenish this diluted solution.

SMALL-TANK, TRAY, AND ROTARY-TUBE PROCESSING

See the appropriate table on the following pages for starting-point recommendations for specific films.

Note: Some rotary-tube processors allow replenishment of the developer. See "Replenishment" for more information.

Using Full-Strength Developer

Choose the appropriate table for development times and temperatures for using fresh, full-strength KODAK XTOL Developer. The capacity of the full-strength developer with normal, unreplenished processing is approximately 15 rolls of 135-36 or 120 film (or the equivalent of 80 square inches [516 square centimetres]) per litre, with time compensation.

Time Compensation. To process the maximum number of rolls of film per litre of full-strength XTOL Developer, use time compensation according to the table below. Discard the developer after you process 15 rolls of film per litre.

Time Compensation for KODAK XTOL Developer		
Film Size	**Number of Rolls (per litre)**	**Development-Time Increase**
135-36 or 120 rolls (80 square inches* or equivalent)	1 to 5	Use normal development time
	6 to 10	Increase normal development time by 15 percent
	11 to 15	Increase adjusted development time by 15 percent

* 80 square inches = one 135-36 or 120 roll, four 4 x 5-inch sheets, or one 8 x 10-inch sheet; 160 square inches = one 220 roll.

Minimum Solution Volume. The volume of full-strength KODAK XTOL Developer needed to cover the film will depend on the size of your tank or tray or the design of your rotary-tube processor.

Using Diluted Developer

Choose the appropriate development time and temperature table for starting-point recommendations for specific films in small tanks, tray, and rotary tubes.

You can dilute KODAK XTOL Developer 1:1 with water (developer:water) for one-shot (single-use) processing. Dilution at 1:1 will provide slightly greater film speed, enhanced sharpness and shadow detail, and slightly more grain.

Use diluted developer only once. Do not replenish or reuse diluted developer.

Minimum Solution Volume. The volume of diluted KODAK XTOL Developer needed to cover the film will depend on the size of your tank or tray or the design of your rotary-tube processor. However, the minimum amount of diluted developer needed to cover the film may not contain enough active ingredients to develop the film fully in the recommended time. We recommend always starting with at least 100 mL (3.5 fluidounces) of full-strength developer to prepare the diluted solution for each 135-36 or 120 roll (or the equivalent of 80 square inches [516 square centimetres]).

Note: If your water supply is exceptionally hard (above 200 ppm of $CaCO^3$), you may need to use conditioned water to avoid cloudiness when you mix higher dilutions. Contact your water authority for information on the water in your area.

Using Seasoned Developer

To use seasoned XTOL Developer in an unreplenished manual process, see the appropriate development time and temperature table for starting-point recommendations for specific films.

You can take the solution from the developer overflow line or the working tank of an in-control replenished process. You can also "pre-season" fresh XTOL Developer by adding 6.5 mL of KODAK Developer Starting Solution (CAT 146 6382) per litre of developer. Or use 1 mL of

KODAK EKTACHROME R-3 First Developer II Starter (CAT 869 9795 [U.S. and Australia] or CAT 524 0007 [Europe]) per litre of XTOL Developer.

Agitating Rolls in Small Tanks

The times given for small-tank processing in the development time and temperature tables are based on the following agitation procedure:

1. Fill the empty tank with developer.
2. Start the timer. In the dark, carefully place the loaded reel into the developer solution.
3. Quickly attach the top to the tank. Firmly tap the bottom of the tank against the work surface from a height of approximately 1 inch (2.5 cm) to dislodge air bubbles from the surface of the film. Air bubbles can interfere with development and produce low-density circles on the film.
4. Provide initial agitation of up to 5 cycles, depending on your results. For KODAK T-MAX Professional Films, provide initial agitation of 5 to 7 cycles in 5 seconds. For an invertible tank, one cycle consists of rotating the tank upside down and then back to the upright position. For a noninvertible tank, one cycle consists of sliding the tank back and forth over a 10-inch (25.4 cm) distance. With tanks that have a handle for turning the reel, rotate the reel back and forth gently through about one-half turn at a rate of one cycle per second during initial and subsequent agitation. Steps 2 through 4 will take approximately 7 to 20 seconds, depending on the type of tank.
5. Let the tank sit for the remainder of the first 30 seconds.
6. After the first 30 seconds, agitate for 5 seconds at 30-second intervals. Agitation should consist of 2 to 5 cycles, depending on the contrast you need and the type of tank.

Agitating Sheet Film in Trays

To process a single sheet:

1. Fill a tray with water that is at the same temperature as the developer.
2. Slip the film into the developer. Rock the tray immediately to make sure the film is covered with solution.
3. Agitate the film by first raising the left side of the tray about 3/4 inch (2 cm). Lower it smoothly, and then immediately raise and lower the side nearest to you. Next, raise and lower the right-hand side, then the near side again. This agitation cycle takes about 8 seconds.
4. Agitate continuously throughout the development time.
5. At the end of the development time, drain the sheet for a few seconds and transfer it to the stop bath. To avoid contaminating the developer with stop bath, use one hand for lifting the sheet from the developer and the other hand for placing it in the stop bath.

To process two to six sheets together:

1. Fill a tray with water that is at the same temperature as the developer.
2. Immerse the sheets one at a time, emulsion side up, in the tray of water. Make sure that each sheet is covered with water before inserting the next one. Agitate by moving the bottom sheet to the top of the stack every few seconds. Go through the stack twice. Be careful that the corners of the sheet you are handling do not scratch the sheet under it.
3. Take the bottom sheet out of the tray of water, drain it for a few seconds, and place it in the developer, emulsion side up. Make sure that the sheet is covered with developer. Transfer the rest of the sheets to the developer in the same way. Interleave the stack, from bottom to top, until development is complete.
   Note: When you use interleaving agitation, go through the stack of sheets completely. Rotate the first sheet in the developer 180° from the rest of the stack so that the notch is at the opposite end. This identifies it as the first sheet; be sure that it is the first sheet you remove from each solution.
4. At the end of the development time, transfer the sheets to the stop bath one at a time in the order they were placed in the developer. Drain each sheet for the same time that the sheets were drained in Step 3 when placed in the developer. To avoid contaminating the developer with stop bath, use one hand for lifting the sheets from the developer and the other hand for placing them in the stop bath.

Final Steps in Small-Tank, Tray, and Rotary-Tube Processing

Step	Time	Comments
Stop Bath	30 seconds	Agitate continuously.
Fixer	Twice as long as it takes the film to clear (lose its milky appearance); see the specific film or fixer instructions.	Agitate continuously for the first 30 seconds and for 5 seconds at 30-second intervals after that.
Rinse	30 seconds	Rinse the film in the tank under running water.
Hypo Clearing Agent	1 to 2 minutes	Agitate continuously for the first 30 seconds and at 30-second intervals after that.

Step	Time	Comments
Wash	5 minutes	Run the wash water at least fast enough to provide a complete change of water in the container in 5 minutes. For rapid washing in a small tank, fill the tank to overflowing with fresh water and then dump it all out. Repeat this cycle 10 times.
PHOTO-FLO Solution	30 seconds to 1 minute	To minimize drying marks, treat the film with KODAK PHOTO-FLO Solution after washing.
Dry	As needed	Dry in a dust-free place.

LARGE-TANK (REPLENISHED) PROCESSING

See the large-tank development time and temperature tables for starting-point recommendations for specific films. For critical applications, run tests to determine the best development time. These recommendations are based on a nitrogen-burst agitation cycle of two seconds at 10-second intervals. Significantly more agitation may require slightly shorter development times; less agitation may require longer times.

If you have a broad film mix that requires a wide variety of development times, you may want to establish a few standard batch cycles, such as 5, 6, 7, 8, 10, and 12 minutes. Then you can assign each film to the nearest batch cycle, based on the recommendations in the tables.

Starting (Preseasoning) a Fresh Working Tank Solution

To start or preseason a fresh working tank solution:

1. Add 6.5 mL of KODAK Developer Starting Solution (CAT 146 6382) per litre of tank volume to the empty developer tank. Or use 1 mL of KODAK EKTACHROME R-3 First Developer II Starter (CAT 869 9795 [U.S. and Australia] or CAT 524 0007 [Europe]) per litre of XTOL Developer.
2. Fill the developer tank with fresh KODAK XTOL Developer solution.
3. Stir or recirculate until the solution is uniform.

If you choose not to preseason the fresh tank, initial development times will be about 10 percent shorter than those in the tables, but times will approach the times in the tables as the tank approaches a steady state.

Converting to KODAK XTOL Developer from Another Developer

Before changing to KODAK XTOL Developer, run several KODAK Black-and-White Film Process Control Strips (CAT 180 2990) through your current in-control process at each of your standard development times. Measure and note the Contrast Index of these strips. Drain and clean the developer tank.

To make a fresh working tank solution, follow the mixing directions above for starting a fresh working tank. Run several more process control strips, adjusting the development time and/or temperature until the process produces Contrast Index results that match your previous Contrast Index results.

For more information, see KODAK Publication No. Z-133E, *Monitoring and Troubleshooting KODAK Black-and-White Film Processes* (CAT 889 4784).

Replenishment

You can replenish this developer in systems that use the full-strength solution (not diluted developer). Use XTOL Developer as a replenisher at a rate of 70 mL for each 135-36 or 120 roll, or the equivalent of 80 square inches (516 square centimetres), of film processed.

You can monitor replenished systems with KODAK Black-and-White Film Process Control Strips (CAT 180 2990). Adjust the replenishment rate up or down in 10 mL increments to keep the process on aim. Allow adequate time for the process to stabilize between replenishment-rate adjustments. Use the lowest replenishment rate that will maintain process control. For more information, see KODAK Publication No. Z-133E, *Monitoring and Troubleshooting KODAK Black-and-White Film Processes* (CAT 889 4784).

System Maintenance

KODAK XTOL Developer is very clean-working, and will rarely need replacement in a properly replenished and maintained process.

Take these steps for routine maintenance:

- Minimize air access to the replenisher tanks. Use floating lids.
- Use a small amount of water to rinse the developer from processor parts left exposed to air after shutdown.
- Replace evaporation losses with water at processor start-up.
- If your processor is equipped with recirculation filters, check them frequently, and change them as needed.

DISPOSAL

Dispose of used developer in accordance with your local regulations. Refer to the Material Safety Data Sheets for more information.

If you have environmental or safety questions about Kodak products or services, contact Kodak Environmental Services at 716-477-3194, between 8 a.m. and 5 p.m. (Eastern time).

Kodak also maintains a 24-hour health hotline to answer questions about the safe handling of photographic chemicals. If you need health-related information about Kodak products, call 1-716-722-5151.

DEVELOPMENT TABLES

The following pages contain tables of starting-point development times and temperatures for developer solutions with and without dilution in small tanks, trays, rotary tubes, and large-tank replenished systems. This information includes processing data for Kodak films as well as for a sampling of other manufacturers' films. For critical applications, run tests to determine the best development time. Data for nominal film speeds are in **bold face** type.

Roll Films

Important

Development times shorter than 5 minutes (4 minutes in rotary tubes) may produce unsatisfactory uniformity.

TABLE 1: Processing Roll Film with FRESH, FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Small Tanks					Rotary Tubes (with Continuous Agitation)			
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)
KODAK PLUS-X Pan / PX / 5062 KODAK PLUS-X 125 Pro	135	32/64	0.52	5¾	4½*	4*	3*	2½*	5	4	3¼*	2½*
		125	**0.58**	**6½**	**5¼**	**4¾***	**3¾***	**2¾***	**5½**	**4½**	**4**	**3***
		250	0.65	7¾	6½	5¾	4½*	3½*	6¼	5½	4¾	3½*
		500	0.75	9¼	8	7¼	5½	4¼*	7¾	6½	6	4½
		1000	0.85	12¼	10¼	9¼	7¼	5¼	10	8	7½	6
KODAK PLUS-X Pan Professional / PXP / 6057 KODAK PLUS-X 125 Pro	120/220	32/64	0.52	5¾	4½*	4*	3*	2½*	5	4	3¼*	2½*
		125	**0.58**	**6¾**	**5½**	**5***	**3¾**	**3***	**5¾**	**4½**	**4**	**3***
		250	0.65	8	6¾	6	4¾*	3½*	6¾	5½	5	3½*
		500	0.75	11	8½	7½	5¾	4½*	8½	7	6	4½
		1000	0.85	16	11½	10	7¾	6	11	9	8	6
KODAK VERICHROME Pan / VP / 6041	120	32/64	0.52	6¼	5	4½*	3½*	2½*	5	4	3½*	2½*
		125	**0.58**	**7½**	**6**	**5¼**	**4***	**3***	**6**	**5**	**4**	**3***
		250	0.65	8¾	7	6	4¾*	3½*	7	6	5	4
		500	0.75	11	8½	7½	5¾	4½*	8½	7½	6½	5
		1000	0.85	13½	11	9½	7¼	5½	10½	9	8	6
KODAK TRI-X Pan / TX / 5063 KODAK TRI-X 400 Pro	135	100/200	0.52	6½	5½	5	4*	3¼*	5	4½	4	3*
		400	**0.58**	**7¾**	**6¾**	**6**	**4¾***	3¾*	**5¾**	5	**4½**	**3½***
		800	0.65	9	7¾	7	5½	4¼*	6½	5½	5	4
		1600	0.75	10½	9	8	6½	5	8	7	6	5
		3200	0.85	12½	10½	9½	7½	5¾	9½	8	7	6
KODAK TRI-X Pan / TX / 6043 KODAK TRI-X 400 Pro	120	100/200	0.52	6¾	5½	4¾*	3¾*	3*	5	4¼	4	3*
		400	**0.58**	**7½**	**6¼**	**5½**	**4¼***	**3½***	**6**	5	**4½**	**3½***
		800	0.65	8½	7	6¼	5	4*	7	5¾	5	4
		1600	0.75	10¼	8¾	7¾	6	4¾*	8½	7	6¼	5
		3200	0.85	12	10¼	9	7	5½	10	8	7½	6

TABLE 1: Processing Roll Film with FRESH, FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Small Tanks					Rotary Tubes (with Continuous Agitation)			
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)
KODAK TRI-X Pan Professional / TXP / 6049	120/220	80/160	0.52	6¼	5¼	4¾*	3¾*	3*	5	4	3½*	3*
		320	**0.58**	**7½**	**6¼**	**5½**	**4½***	**3½***	**5½**	**4½**	**4**	**3½***
		640	0.65	9	7½	6¾	5½	4¼*	6½	5½	5	4
		1250	0.75	11½	9½	8½	6¾	5½	8½	7	6½	5
		2500	0.85	14½	11¾	10½	8½	7	11	9	8½	6½
KODAK T-MAX 100 Professional / TMX / 5052 KODAK T-MAX 100 Pro	135	25/50	0.52	7	5¾	5	4*	3¼*	6	5	4½	3½*
		100	**0.58**	**8**	**6¾**	**6**	**4½***	**3¾***	**7**	**6**	**5¼**	**4**
		200	0.65	9	7¾	7	5¼	4¼*	8	7	6	4½
		400	0.75	10½	9	8	6¼	5	9½	8	7	5½
		800	0.85	12	10½	9½	7¼	6	11½	9	8	6½
KODAK T-MAX 100 Professional / TMX / 6052 KODAK T-MAX 100 Pro	120	25/50	0.52	7	5¾	5	4*	3¼*	6	5	4½	3¼*
		100	**0.58**	**8**	**6¾**	**6**	**4½***	**3¾***	**7**	**5¾**	**5**	**3¾***
		200	0.65	9	7¾	7	5¼	4¼*	8¼	6¾	5¾	4¼
		400	0.75	10½	9	8	6	5	10	8¼	7	5
		800	0.85	12	10¼	9½	7¼	6	11¾	9½	8¼	6
KODAK T-MAX 400 Professional / TMY / 5053 KODAK T-MAX 400 Pro	135	100/200	0.52	6¾	5¾	5	4*	3¼*	6	5	4½	3½*
		400	**0.58**	**7½**	**6½**	**5¾**	**4½***	**3½***	**6½**	**5½**	**5**	**4**
		800	0.65	8½	7¼	6½	5	4*	7½	6½	5½	4½
		1600	0.75	10	8½	7½	6	4¾*	8½	7½	6½	5
		3200	0.85	11½	9½	8½	6¾	5½	10	8½	7½	5¾
KODAK T-MAX 400 Professional / TMY / 6053 KODAK T-MAX 400 Pro	120	100/200	0.52	6¾	5¾	5¼	4*	3¼*	5½	4¾	4¼	3¼*
		400	**0.58**	**7½**	**6½**	**5¾**	**4½***	**3½***	**6¼**	**5¼**	**4¾**	**3¾***
		800	0.65	8½	7¼	6½	5¼	4*	7¼	6¼	5½	4¼
		1600	0.75	10	8½	7¾	6	4¾*	8½	7¼	6½	5
		3200	0.85	11½	10	9	7	5½	10	8½	7½	5¾
KODAK T-MAX P3200 Professional / TMZ / 5054	135	100/200	0.48	8½	7	6¼	5	4*	7	6	5½	4½
		400	0.52	9	7½	6¾	5½	4¼*	8	7	6	5
		800	0.58	10	8¼	7½	6	4¾*	9	8	7	5½
		1600	**0.65**	**11**	**9¼**	**8½**	**7**	**5¼**	**10**	**9**	**8**	**6**
		3200	**0.75**	**13**	**11**	10	**8**	**6¼**	**12**	**10**	**9**	**7**
		6400	0.85	15	12½	11½	9¼	7	14½	11½	10	8
		12500	0.95	19	15¼	13¼	10¾	8¼	17	13½	12	9
		25000	1.05	23	18½	16½	12½	9½	NR	NR	NR	NR

TABLE 1: Processing Roll Film with FRESH, FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Small Tanks					Rotary Tubes (with Continuous Agitation)			
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)
KODAK EKTAPAN / PNT / 4162	70 mm	25/50	0.52	6	5¼	4½*	3¾*	2¾*	Not Applicable			
		100	**0.58**	**8½**	**7**	**6¼**	**5**	**4***				
		200	0.65	10½	9	8	6½	5				
		400	0.75	13½	11½	10	8	6½				
		800	0.85	16¾	14¼	13	10	8¼				
KODAK High Speed Infrared / HIE / 2481	135	See Pub No. F-13	0.52	6½	5½	5	4*	3¼*	5¼	4½	4	3¼*
			0.58	7¼	6	5½	4½*	3¾*	5¾	5	4½	3¾*
			0.65	8	6¾	6	5	4¼*	6¼	5½	5	4
			0.75	9¼	7¾	7	5¾	4¾*	7	6¼	5½	4½
			0.85	10½	9	8	6½	5½	8	7	6¼	5¼
AGFAPAN APX 25	135	12	0.52	4½*	3¾*	3½*	2¾*	2¼*	4	NR	NR	NR
		25	**0.58**	**5¾**	**4¾***	**4¼***	**3¼***	**2¾***	**6**	**4**	**2***	**1***
		50	0.65	8	6½	5¾	4¼*	3½*	9	6	4	2½*
		100	0.75	14½	10¼	8¾	6½	5¼	14	10	7½	5
		200	0.85	NR	NR	NR	NR	NR	NR	NR	NR	NR
AGFAPAN APX 100	135	25/50	0.52	6½	5¾	5¼	4½*	3¼*	5	4½	4¼	2½*
		100	**0.58**	**8**	**6¾**	**6¼**	**5**	**4***	**6**	**5½**	**5**	**3***
		200	0.65	10	8¾	7¾	6	4¾*	7½	7	6	3¾*
		400	0.75	13	11	10	7½	6	9½	8½	7½	4¾
		800	0.85	15½	13	11½	9	7	12	10	9	6
AGFAPAN 400	135	100/200	0.52	8	6½	5¾	4½*	3½*	6½	5½	4½	3½*
		400	**0.58**	**9½**	**8**	**7**	**5½**	**4***	**8**	**6½**	**5½**	**4**
		800	0.65	12	9¾	8½	6½	5	9½	7¾	6½	5
		1600	0.75	15	12¼	11	8½	6½	12	9½	8	6½
		3200	0.85	19	14½	13½	10½	8	15	12	10	8
FUJI NEOPAN 400 Professional	135	100/200	0.52	9	7½	6½	5	3¾*	6	5	4½	3¼*
		400	**0.58**	**10**	**8¼**	**7¼**	**5¾**	**4½***	**7**	**6**	**5½**	**3¾***
		800	0.65	11½	9¾	8¾	6½	5	8½	7¼	6½	4½
		1600	0.75	13½	11½	10½	8	6¼	10½	9	8	5½
		3200	0.85	16	13½	12	9½	7½	12½	11	10	7

TABLE 1: Processing Roll Film with FRESH, FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Small Tanks					Rotary Tubes (with Continuous Agitation)			
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)
FUJI NEOPAN 1600 Professional	135	200	0.52	4¼*	4*	3½*	3*	2¼*	3½*	3*	2¾*	2*
		400	0.58	5	4½*	4*	3¼*	2½*	4	3¼*	3*	2¼*
		800	0.65	5½	5	4½*	3½*	3*	4½	3¾*	3¼*	2½*
		1600	**0.75**	**6½**	**5¾**	**5**	**4***	**3½***	**5¼**	**4½**	**4**	**2¾***
		3200	0.85	7½	6½	5½	4¾*	4*	6	5¼	4¾	3¼*
		6400	0.95	9	7¼	6½	5½	4¾*	7	6	5½	4
ILFORD PAN F Plus	135	25	0.52	7¼	6	5½	4¼*	3¼*	5	4¾	4½	2¾*
		50	**0.58**	**8½**	**7**	**6**	**4¾***	**3¾***	**6**	**5½**	**5**	**3¼***
		100	0.65	9½	8	7	5½	4¼*	7	6½	6	3¾*
		200	0.75	11	9	8	6¼	4¾*	8	7½	7	4½
		400	0.85	12½	10	9	7	5½	9½	8¾	8	5¼
ILFORD FP-4 Plus	135	32/64	0.52	8	6½	5½	4½*	3½*	6	5¼	4½	3*
		125	**0.58**	**9½**	**8**	**6½**	**5¼**	**4***	**7**	**6**	**5½**	**3¾***
		250	0.65	11	9	7½	6	4½*	8½	7½	6½	4½
		500	0.75	14	11	9¼	7½	5½	10½	9	8	5½
		1000	0.85	17½	14	11½	9¼	7	12½	11	10	6¾
ILFORD HP-5 Plus	135	100/200	0.52	8½	7½	6¾	5¼	4*	6	5	4½	3½*
		400	**0.58**	**10**	**8½**	**8**	**6¼**	**4¾***	**7½**	**6¼**	**5½**	**4¼**
		800	0.65	12	10½	9½	7½	5¾	9	7½	6½	5
		1600	0.75	16	13	12	9	7	11	9½	8½	6¼
		3200	0.85	NR	17½	15	11½	8½	13½	11½	10½	8
ILFORD DELTA 100 Professional	135	25/50	0.52	8	6¾	6	4½*	3½*	5½	5	4½	3½*
		100	**0.58**	**9½**	**8**	**7**	**5½**	**4¼***	**7**	**6**	**5½**	**4¼**
		200	0.65	11½	9½	8½	6½	5	9	7½	6½	5
		400	0.75	14½	11½	10½	8	6¼	11½	9¼	8	6¼
		800	0.85	18½	14½	12¾	9½	7½	14	11½	10	7½
ILFORD DELTA 400 Professional	135	100/200	0.52	7	6	5½	4¼*	3¼*	6	5¼	4¾	3¼*
		400	**0.58**	**8**	**7**	**6¼**	**5**	**4***	**7**	**6¼**	**5½**	**3¾***
		800	0.65	9½	8	7½	5¾	4½*	8	7	6¼	4½
		1600	0.75	11½	10	9	7	5½	9½	8	7¼	5¼
		3200	0.85	14	12	10¾	8¼	6½	11	9¼	8½	6¼

* Development times shorter than 5 minutes (4 minutes in rotary tubes) may produce unsatisfactory uniformity.
NR= Not recommended, as determined by testing.

Important

Development times shorter than 4 minutes may produce unsatisfactory uniformity.

TABLE 2: Processing Roll Film in Replenished Systems with FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Rotary Tubes (with Continuous Agitation and Seasoned Developer)				Large Tanks (with Seasoned Developer)				
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK PLUS-X Pan / PX / 5062 KODAK PLUS-X 125 Pro	135	32/64	0.52	6	4¾	4	3*	7	5¾	5	3½*	2½*
		125	**0.58**	**7**	**5½**	**5**	**3½***	**7½**	**6½**	**6**	**4**	**3***
		250	0.65	8¼	6¾	6	4	9	8	7	5	3¾*
		500	0.75	10½	8½	7½	5	11½	10	9	7	5
		1000	0.85	NR	11½	10	7	16½	13	11	8½	6¾
KODAK PLUS-X Pan Professional / PXP / 6057 KODAK PLUS-X 125 Pro	120/220	32/64	0.52	6	4¾	4	3*	7½	5¾	5	3½*	2½*
		125	**0.58**	**7**	**5¾**	**5**	**3½***	**8½**	**6¾**	**6**	**4½**	**3¼***
		250	0.65	8½	7	6	4½	10½	8½	7½	5½	4
		500	0.75	11	9	8	6	13	10¾	10	7¼	5¼
		1000	0.85	14	11½	10½	8	NR	15	13½	10	7
KODAK VERICHROME Pan / VP / 6041	120	32/64	0.52	6	5	4¼	3*	7½	6¼	5½	4	3*
		125	**0.58**	**7**	**5¾**	**5**	**3½***	**8½**	**7**	**6**	**4½**	**3½***
		250	0.65	8½	6¾	6	4½	10	8	7	5¼	4
		500	0.75	11	8½	7½	5½	13½	11	9½	6¾	5
		1000	0.85	14	11½	10	7½	18	14	12	8¾	6½
KODAK TRI-X Pan / TX / 5063 KODAK TRI-X 400 Pro	135	100/200	0.52	6	5	4½	3½*	8½	7	6¼	5	3½*
		400	**0.58**	**7**	**5¾**	**5¼**	**4**	**9½**	**8**	**7½**	**5½**	**4**
		800	0.65	8	7	6¼	5	10½	9	8	6¼	4¾
		1600	0.75	10	8¼	7½	6	12½	10½	9½	7½	5½
		3200	0.85	12	10	9	7	14½	12	11	8½	6½
KODAK TRI-X Pan / TX / 6043 KODAK TRI-X 400 Pro	120	100/200	0.52	6	5	4½	3¼*	8	6½	5½	4	3*
		400	**0.58**	**7**	**6**	**5¼**	**4**	**9**	**7½**	**6½**	4¾	3¾*
		800	0.65	8	6¾	6	4¾	10½	8¾	7¾	5¾	4½*
		1600	0.75	10	8½	7½	5½	12½	10½	9½	7	5¼
		3200	0.85	12	10	9	6½	14½	12½	11	8¼	6¼

TABLE 2: Processing Roll Film in Replenished Systems with FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Rotary Tubes (with Continuous Agitation and Seasoned Developer)				Large Tanks (with Seasoned Developer)				
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK TRI-X Pan Professional / TXP / 6049	120/220	100/200	0.52	6	5	4¼	3½*	7½	6¼	5½	4¼	3½*
		400	**0.58**	**7**	**5¾**	**5**	**4¼**	**9½**	**7½**	**6½**	**5¼**	**4¼**
		800	0.65	8	6¾	6¼	5	11½	9¼	8	6¼	5
		1600	0.75	11	9¼	8	6½	15	11¾	10	8	6½
		3200	0.85	NR	11½	10	8	18½	15	13	10½	7¾
KODAK T-MAX 100 Professional / TMX / 5052 KODAK T-MAX 100 Pro	135	25/50	0.52	7½	6½	6	4	9½	8	7¼	5½	4¼
		100	**0.58**	**9**	7¾	7	**5**	**11½**	**9½**	**8½**	**6¼**	**5**
		200	0.65	11	9	8	6	13½	11¼	9¾	7½	5¾
		400	0.75	13½	11	9½	7	15½	13	11½	8¾	6¾
		800	0.85	17½	13½	11	8	18	15¼	13½	10	7½
KODAK T-MAX 100 Professional / TMX / 6052 KODAK T-MAX 100 Pro	120	25/50	0.52	8	6	5	3¾*	9	7½	6½	5	3¾*
		100	**0.58**	**9½**	**7**	**6**	**4½**	**11**	**8¼**	**7½**	**5½**	**4¼**
		200	0.65	11	8¼	7	5¼	11¼	9½	8½	6¼	5
		400	0.75	13	10	8½	6¼	12½	10¾	10	7¼	5¾
		800	0.85	15½	12	10	7½	15	12½	11½	8½	6¾
KODAK T-MAX 400 Professional / TMY / 5053 KODAK T-MAX 400 Pro	135	100/200	0.52	7	6	5½	4	8	6¾	6	5	3½*
		400	**0.58**	**8**	**6¾**	**6**	**4½**	**9**	**7¾**	**7**	**5½**	**4**
		800	0.65	9	7¾	7	5	10½	9	8	6	4½
		1600	0.75	10½	9	8	6	12	10	9	7	5¼
		3200	0.85	12	10¼	9	7	13½	11½	10	8	6
KODAK T-MAX 400 Professional / TMY / 6053 KODAK T-MAX 400 Pro	120	100/200	0.52	7¼	5½	4½	3¾*	8½	7¼	6	4¾	3½*
		400	**0.58**	**8¼**	**6½**	**5½**	**4¼**	**9¼**	**7¾**	**6¾**	**5¼**	**4**
		800	0.65	9½	7½	6¼	4¾	10	8½	7½	6	4½
		1600	0.75	11	8¾	7½	5¾	11¾	10	8¾	6¾	5¼
		3200	0.85	12½	10	8½	6¾	13¼	11¼	10	7¾	6
KODAK T-MAX P3200 Professional / TMZ / 5054	135	100/200	0.48	9	7	6	5	10	8	7½	5½	4½
		400	0.52	10	8	7	5½	11	9	8	6¼	5
		800	0.58	11	9¼	8	6	12	10	9	7	5½
		1600	**0.65**	**13**	**10¼**	**9**	**7**	**13**	**11**	**10**	**7¾**	**6**
		3200	**0.75**	**15**	**12**	**10½**	**8**	**15**	**13**	**11½**	**9**	**7**
		6400	0.85	17	13½	12	9	16½	15	13½	10½	8
		12500	0.95	20	15½	13½	10½	21	17	15½	12½	9½
		25000	1.05	24	18	16	13	NR	21	18½	15	11½

TABLE 2: Processing Roll Film in Replenished Systems with FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Rotary Tubes (with Continuous Agitation and Seasoned Developer)				Large Tanks (with Seasoned Developer)				
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK High Speed Infrared / HIE / 2481	135	See Pub No. F-13	0.52	6½	5¾	5¼	4	8½	6¾	6	4¾	4
			0.58	7¼	6¼	5¾	4½	10	8	7	5½	4½
			0.65	8	7	6½	5	11½	9	8	6¼	5
			0.75	9½	8¼	7½	6	13	10¼	9	7	5½
			0.85	11	9¼	8½	7	14½	11½	10	7¾	6
AGFAPAN APX 25	135	12	0.52	4	3*	NR	NR	6½	5¼	4½	3½*	3*
		25	**0.58**	**6**	**5**	**4½**	**3***	**8½**	**6½**	**5¾**	**4½**	**4**
		50	0.65	10	7½	6½	4½	12½	10	8½	6½	5
		100	0.75	15	12	10½	7½	NR	16	14	11	8
		200	0.85	NR	NR	NR	NR	NR	NR	NR	NR	12
AGFAPAN APX 100	135	25/50	0.52	7	6	5½	3½*	9	7	6½	5	4
		100	**0.58**	**8½**	**7¼**	**6½**	**4¼**	**11**	**9**	**8**	**6½**	**5**
		200	0.65	10½	9	8	5¼	13½	11	10	8	6
		400	0.75	13	11	10	6½	17½	14	12	9½	7½
		800	0.85	17	14½	13	8	NR	19	16	12	9½
AGFAPAN 400	135	100/200	0.52	8	6½	5½	4¼	10	8	7½	5½	4
		400	**0.58**	**9½**	**7½**	**6½**	**5**	**12**	**10**	**9**	**6½**	**5**
		800	0.65	12	9½	8	6	14	11½	10½	8	6
		1600	0.75	15	12½	10½	7½	18½	14	12½	9½	7½
		3200	0.85	18	15	13	9½	NR	20	16½	11½	9
FUJI NEOPAN 400 Professional	135	100/200	0.52	7	6	5¼	3½*	9	7½	6¾	5	4
		400	**0.58**	**8**	**7**	**6¼**	**4¼**	**10**	**8¼**	**7½**	**5½**	**4½**
		800	0.65	9½	8	7¼	5	11½	9½	8½	6½	5
		1600	0.75	11½	9¾	8½	6	13½	11½	10	8	6
		3200	0.85	13½	11½	10	7½	16	13½	12	9½	7
FUJI NEOPAN 1600 Professional	135	200	0.52	4¼	3½*	3¼*	2½*	5½	4¾	4¼	3¼*	2½*
		400	0.58	4¾	4	3½*	2¾*	6	5¼	4¾	3¾*	3*
		800	0.65	5½	4¾	4	3*	6¾	6	5½	4¼	3½*
		1600	**0.75**	**6½**	**5½**	**4¾**	**3¼***	**8**	**7**	**6¼**	**5**	**4**
		3200	0.85	7½	6¼	5½	4	9	8	7	5½	4½
		6400	0.95	8½	7½	6½	4¾	10½	9	8	6¼	5

TABLE 2: Processing Roll Film in Replenished Systems with FULL-STRENGTH DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	Rotary Tubes (with Continuous Agitation and Seasoned Developer)				Large Tanks (with Seasoned Developer)				
				65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
ILFORD PAN F Plus	135	25	0.52	7	6¼	5½	3¼*	9½	7½	7	5	3½*
		50	**0.58**	**8½**	**7¼**	**6½**	**4**	**11**	**9**	**8**	**6**	**4½**
		100	0.65	10	8½	7½	5	13	11	9½	7	5
		200	0.75	12	10¼	9½	6	16	13	11½	8½	6
		400	0.85	14½	12½	11	7	19	16	14	10½	7½
ILFORD FP-4 Plus	135	32/64	0.52	9½	7¾	6½	4½	11½	9	8	6	4½
		125	**0.58**	**11**	**9**	**7½**	**5¼**	**13½**	**11**	**9½**	**7**	**5**
		250	0.65	13	10¾	9½	6¼	16	12½	11	8	6
		500	0.75	16	13½	12	7¾	21	15½	13½	10	7
		1000	0.85	19	16	14	9½	NR	NR	17	12½	9
ILFORD HP-5 Plus	135	100/200	0.52	8½	6¾	5½	4	11½	9	8	6	4½
		400	**0.58**	**9½**	**7¾**	**6½**	**5**	**13¼**	**10½**	**9½**	**7**	**5½**
		800	0.65	11½	9½	8	6	15¾	13	11½	8½	6½
		1600	0.75	14	11½	10	7¼	NR	15½	13½	10	8
		3200	0.85	17	14¼	12½	9	NR	19½	17½	13	10
ILFORD DELTA 100 Professional	135	25/50	0.52	8½	7¼	6½	4¼	10½	8	7	5½	4¼
		100	**0.58**	**10½**	**8½**	**7½**	**5¼**	**12½**	**10**	**8½**	**6½**	**5**
		200	0.65	13	10½	9	6½	15½	12	10½	8	6
		400	0.75	16½	13½	11½	8	NR	15	13	10	7½
		800	0.85	20	16½	14½	10	NR	19	16½	12½	9½
ILFORD DELTA 400 Professional	135	100/200	0.52	7½	6¼	5½	4	9	7½	6½	5	4
		400	**0.58**	**8½**	**7**	**6¼**	**4½**	**10½**	**8½**	**8**	**6**	**4½**
		800	0.65	10	8¼	7¼	5¼	12	10	9	7	5¼
		1600	0.75	12	9½	8½	6¼	14	11½	10	8	6
		3200	0.85	14½	11½	10	7½	16½	13½	12	9½	7½

* Development times shorter than 4 minutes may produce unsatisfactory uniformity.
NR= Not recommended, as determined by testing.

Important

Development times shorter than 5 minutes (4 minutes in rotary tubes) may produce unsatisfactory uniformity.

TABLE 3: Processing Roll Film with FRESH, DILUTE DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	In Small-Tanks, DEVELOPER DILUTION 1:1				In Rotary-Tubes (with Continuous Agitation), DEVELOPER DILUTION 1:1			
				68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK PLUS-X Pan / PX / 5062 KODAK PLUS-X 125 Pro	135	32/64	0.52	6½	6	5	4*	4½	4	3*	2¼*
		125	**0.58**	**7½**	**7**	**5½**	**4½***	**5¾**	**5**	**3¾***	**2¾***
		250	0.65	8¾	8	6½	5¼	6¾	6	4½	3¼*
		500	0.75	11	10	8	6½	8	7	5½	4
		1000	0.85	15½	14	11	8½	9½	8½	6½	5
KODAK PLUS-X Pan Professional / PXP / 6057 KODAK PLUS-X 125 Pro	120/ 220	32/64	0.52	6	5½	4¼*	3*	4½	4	2¾*	2*
		125	**0.58**	**7¼**	**6½**	**5**	**3½***	**5¾**	**5**	**3½***	**2½***
		250	0.65	8¾	8	6	4¼*	6¾	6	4¼	3¼*
		500	0.75	11	10	7¾	5½	8¾	7½	5¼	4
		1000	0.85	15¼	14	11	7	11½	10	7	5¼
KODAK VERICHROME Pan / VP / 6041	120	32/64	0.52	6¾	6	4½*	2¾*	4½	4	3*	2¼*
		125	**0.58**	**7½**	**7**	**5¼**	**3¼***	**5¾**	**5**	**3¾***	**2¾***
		250	0.65	8¾	8	6¼	4¼*	6¾	6	4½	3¼*
		500	0.75	10¾	10	8	5½	8½	7½	5½	4¼
		1000	0.85	13¾	13	10½	7½	11	9½	6¾	5¼
KODAK TRI-X Pan / TX / 5063 KODAK TRI-X 400 Pro	135	100/200	0.52	8	7½	6½	5½	5½	5	3¾*	3*
		400	**0.58**	**8¾**	**8¼**	**7**	**6**	**6¾**	**6**	**4½**	**3½***
		800	0.65	10	9½	8	6½	7¾	7	5¼	4
		1600	0.75	11¾	11	9	7¼	9	8	6¼	4¾
		3200	0.85	13½	12½	10½	8	10½	9½	7¼	6
KODAK TRI-X Pan / TX / 6043 KODAK TRI-X 400 Pro	120	100/200	0.52	6¾	6¼	5	3¾*	5	4½	3½*	3*
		400	**0.58**	**8**	**7¼**	**6**	**4½***	**6¼**	**5½**	**4¼**	**3½***
		800	0.65	9¼	8½	7	5½	7¼	6½	5	4
		1600	0.75	11	10½	8½	6½	9	8	6	4¾
		3200	0.85	13½	12½	10¼	7¾	11½	10	7¼	5¾

TABLE 3: Processing Roll Film with FRESH, DILUTE DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	In Small-Tanks, DEVELOPER DILUTION 1:1				In Rotary-Tubes (with Continuous Agitation), DEVELOPER DILUTION 1:1			
				68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK TRI-X Pan Professional / TXP / 6049	120/ 220	80/160	0.52	7¾	7	5½	4*	5¾	5¼	4	3¼*
		320	**0.58**	**8¾**	**8**	**6½**	**5**	**6¾**	**6**	**4¾**	**3¾***
		640	0.65	10¼	9½	8	6	7¾	7	5½	4½
		1250	0.75	12¾	12	10	8	9¼	8½	6¾	5½
		2500	0.85	15¾	14½	12	10	11½	10½	8¼	6½
KODAK T-MAX 100 Professional / TMX / 5052 KODAK T-MAX 100 Pro	135	25/50	0.52	8	7¼	6	5	7¾	7	5½	4½
		100	**0.58**	**9¼**	**8½**	**7**	**5½**	**8¾**	**8**	**6¼**	**5**
		200	0.65	10¼	9½	8	6¼	9¾	9	7¼	6
		400	0.75	12¼	11½	9	7	11½	10½	8½	7
		800	0.85	14½	13	10½	8	13	12	9¾	8
KODAK T-MAX 100 Professional / TMX / 6052 KODAK T-MAX 100 Pro	120	25/50	0.52	8¾	8	6	4½*	6¾	6½	6	5½
		100	**0.58**	**10**	**9**	**6¾**	**5¼**	**7¾**	**7½**	**6¾**	**6**
		200	0.65	11	10	7½	6	8¾	8½	7¾	7
		400	0.75	12¾	11½	8¾	6¾	10¼	9¾	8¾	8
		800	0.85	15¼	13½	10	7½	11½	11	10	9
KODAK T-MAX 400 Professional / TMY / 5053 KODAK T-MAX 400 Pro	135	100/200	0.52	8	7½	6½	5½	6½	6	4¾	4
		400	**0.58**	**8¾**	**8**	**7**	**6**	**7¾**	**7**	**5½**	**4½**
		800	0.65	9½	9	7¾	6½	8¾	8	6¼	5
		1600	0.75	10¾	10	8½	7	10	9¼	7¼	6
		3200	0.85	12½	11½	9¼	7½	11½	10½	8½	7
KODAK T-MAX 400 Professional / TMY / 6053 KODAK T-MAX 400 Pro	120	100/200	0.52	8	7½	6¼	5	6	5½	4½	3¾*
		400	**0.58**	**9¼**	**8½**	**7**	**5½**	**7**	**6½**	**5¼**	**4¼**
		800	0.65	10¾	10	8	6	8¼	7½	6	4¾
		1600	0.75	12½	11½	9¼	7	9¾	9	7	5½
		3200	0.85	14¼	13	10½	8	11¼	10½	8¼	6¼

TABLE 3: Processing Roll Film with FRESH, DILUTE DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	In Small-Tanks, DEVELOPER DILUTION 1:1				In Rotary-Tubes (with Continuous Agitation), DEVELOPER DILUTION 1:1			
				68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK T-MAX P3200 Professional / TMZ / 5054	135	100/200	0.48	10½	9½	7½	6½	9¼	8½	6¾	5½
		400	0.52	11½	10	8½	7	9¾	9	7¼	6
		800	0.58	12½	11½	9	7½	10¾	10	8	6½
		1600	**0.65**	**14**	**13**	**10**	**8**	**12**	**11**	**9**	**7**
		3200	**0.75**	**16½**	**15**	**11½**	**9**	**13½**	**12½**	**10**	**8**
		6400	0.85	19½	17½	14	10½	15½	14½	11¾	9½
		12500	0.95	22½	20	16½	12½	17½	16½	13½	11
		25000	1.05	26	22½	20	15	21	19½	16	13
KODAK High Speed Infrared / HIE / 2481	135	See Pub No. F-13	0.52	8	7½	6¼	5	6½	6	5	4
			0.58	8¾	8¼	7	5½	7	6½	5½	4½
			0.65	9¾	9	7½	6	8	7¼	6	5
			0.75	10¾	10	8½	6¾	9	8½	7	5½
			0.85	12½	11½	9¼	7½	10	9½	8	6½
AGFAPAN APX 25	135	12	0.52	5	4½*	3½*	2¾*	4	3½*	2½*	1¾*
		25	**0.58**	**6**	**5½**	**4½***	**3½***	**4½**	**4**	**3***	**2***
		50	0.65	8	7½	6	4½*	5½	5	3¾*	2¾*
		100	0.75	10½	9½	7¾	6	7¼	6½	5	3½*
		200	0.85	14½	13	10½	8½	9¼	8½	6½	5
AGFAPAN APX 100	135	25/50	0.52	8	7½	6	4¾*	5¾	5¼	4¼	3*
		100	**0.58**	**9¾**	**9**	**7**	**5½**	**6½**	**6**	**5**	**3¾***
		200	0.65	12	11	8¼	6½	7½	7	5¾	4½
		400	0.75	15½	13½	10	7½	9¼	8½	7	5½
		800	0.85	22	18½	13	9	12	11	9	7
AGFAPAN 400	135	100/200	0.52	10½	9	6½	5	7¼	6½	5	4
		400	**0.58**	**12**	**10½**	**8**	**6**	**8¾**	**8**	**6¼**	**5**
		800	0.65	14½	13	9½	7½	11	10	7¾	6
		1600	0.75	18	16½	12½	9½	14¼	13	9¾	7
		3200	0.85	21	20	16	12	19	17	12¾	9

TABLE 3: Processing Roll Film with FRESH, DILUTE DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	In Small-Tanks, DEVELOPER DILUTION 1:1				In Rotary-Tubes (with Continuous Agitation), DEVELOPER DILUTION 1:1			
				68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
FUJI NEOPAN 400 Professional	135	100/200	0.52	8¼	7½	6	4½*	6½	5½	4	3½*
		400	**0.58**	**9¾**	**9**	**7**	**5¼**	**7½**	**6½**	**4¾**	**4**
		800	0.65	11½	10½	8	6	9	8	5¾	4¾
		1600	0.75	13½	12½	9¾	7¼	11	10	7¼	5¾
		3200	0.85	16½	15	11½	8½	13	12	9	6¾
FUJI NEOPAN 1600 Professional	135	200	0.52	5½	5	4*	3½*	4½	3¾*	3*	2½*
		400	0.58	6	5½	4½*	3¾*	5	4¼	3¼*	2¾*
		800	0.65	6¾	6¼	5	4¼*	5½	4¾	3¾*	3*
		1600	**0.75**	**7½**	**7**	**5¾**	**4¾***	**6¼**	**5½**	**4¼**	**3½***
		3200	0.85	8½	8	6½	5¼	7	6¼	5	4
		6400	0.95	9¾	9	7½	6	7¾	7	5¾	4½
ILFORD PAN F Plus	135	25	0.52	6¾	6	4½*	3½*	5	4½	3½*	3*
		50	**0.58**	**7¾**	**7**	**5¼**	**4***	**5¾**	**5¼**	**4**	**3¼***
		100	0.65	9½	8½	6¼	4½*	6½	6	4¾	3¾*
		200	0.75	11¼	10	7½	5½	7½	7	5½	4¼
		400	0.85	13	11½	8½	6½	8½	8	6¼	4¾
ILFORD FP-4 Plus	135	32/64	0.52	8½	7½	5½	4*	6¼	5½	4	3*
		125	**0.58**	**10**	**9**	**6½**	**5**	**7¼**	**6½**	**4¾**	**3½***
		250	0.65	12	10¾	8	6	8¼	7½	5½	4
		500	0.75	14½	13	9½	7	9¾	9	6¾	5
		1000	0.85	17½	15½	11½	8½	11¼	10½	8	6
ILFORD HP-5 Plus	135	100/200	0.52	10¼	9	6½	5	7½	6½	4½	3½*
		400	**0.58**	**12**	**10½**	**7½**	**5¾**	**9**	**8**	**5½**	**4¼**
		800	0.65	14¼	12½	8¾	6½	10½	9½	7	5¼
		1600	0.75	18	16	11½	8	12½	11½	9	6½
		3200	0.85	22½	20	14	10	15	14	11	8¼

TABLE 3: Processing Roll Film with FRESH, DILUTE DEVELOPER (Development Times in minutes)

ROLL FILM	FORMAT	EI	CI	In Small-Tanks, DEVELOPER DILUTION				In Rotary-Tubes (with Continuous Agitation), DEVELOPER DILUTION			
				1:1				1:1			
				68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
ILFORD DELTA 100 Professional	135	25/50	0.52	9	8	6	4¾*	6¾	6	4¼	3½*
		100	**0.58**	**10½**	**9½**	**7¼**	**5½**	**7¾**	**7**	**5**	**4**
		200	0.65	12	11	8½	6½	8¾	8	6	5
		400	0.75	14	12¾	10¼	8	11	10	7½	6
		800	0.85	16¾	15½	12½	9½	13½	12	9	7
ILFORD DELTA 400 Professional	135	100/200	0.52	9	8	6	4¾*	7	6	4½	3¼*
		400	**0.58**	**10½**	**9½**	**7**	**5½**	**8**	**7**	**5¼**	**4**
		800	0.65	12¼	11	8½	6½	9	8	6	5
		1600	0.75	14½	13	10	8	11	10	7½	6
		3200	0.85	17	15½	12	9½	13½	12½	9½	7½

* Development times shorter than 5 minutes (4 minutes in rotary tubes) may produce unsatisfactory uniformity.
NR= Not recommended, as determined by testing.

Sheet Films

Important

Development times shorter than 4 minutes may produce unsatisfactory uniformity.

TABLE 4: Processing Sheet Film in Trays or Large Tanks with FULL-STRENGTH DEVELOPER (Development Times in minutes)

SHEET FILM	EI	CI	Fresh Developer in Trays					Seasoned Developer in Large Tanks				
			65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK PLUS-X Pan Professional / PXT / 4147	32/64	0.52	6½	5¼	4¾	3¾*	3*	7½	6½	5½	4	3¼*
	125	**0.58**	**7½**	**6¼**	**5¾**	**4½**	**3½***	**8½**	**7¼**	**6½**	**4¾**	**3¾***
	250	0.65	9¼	7¾	7	5½	4½	10½	8¾	7¾	6	4½
	500	0.75	12	10	9	7	5½	14¼	12	10½	8½	6½
	1000	0.85	15	12¾	11½	9	7¼	18	15	13½	10½	8½
KODAK T-MAX 100 Professional / TMX / 4052	25/50	0.52	7½	6¼	5½	4½	3½*	9½	8	6¾	5½	4
	100	**0.58**	**8½**	**7¼**	**6½**	**5**	**4**	**10¾**	**9**	**8**	**6¼**	**4¾**
	200	0.65	9½	8¼	7½	5½	4½	12	10¼	9	7¼	5½
	400	0.75	10¾	9½	8½	6½	5¼	14½	12	11	8½	6½
	800	0.85	12	11	10	7½	6	16½	14	12½	9¾	7½
KODAK TRI-X Pan Professional / TXT / 4164	80/160	0.52	6¼	5¼	4¼	3¾*	2¾*	7	6	5	4	2¾*
	320	**0.58**	**7½**	**6½**	**5¾**	**4½**	**3½***	**8½**	**7**	**6**	**4¾**	**3½***
	640	0.65	9¼	7¾	7	5¼	4¼	10½	8¾	7½	6	4½
	1250	0.75	11½	9½	8½	6½	5¼	12¾	10¾	9½	7½	5¾
	2500	0.85	14	11¾	10½	8	6¾	15½	13¼	12	9¼	7¼
KODAK T-MAX 400 Professional / TMY / 4053	100/200	0.52	7½	6½	5½	4½	3½*	9¼	7¾	6½	5¼	4
	400	**0.58**	**8½**	**7¼**	**6¼**	**5**	**4**	**10**	**8½**	**7¼**	**5¾**	**4½**
	800	0.65	9¼	8	7	5½	4½	11¼	9½	8¼	6½	5
	1600	0.75	10¾	9¼	8	6½	5	13	11	9¾	7¾	6
	3200	0.85	12½	10½	9	7½	5¾	14¾	12½	11	8¾	6¾
KODAK EKTAPAN / PNT / 4162	25/50	0.52	6¾	5½	4¾	3¾*	2¾*	7½	6¼	5¼	4¼	3*
	100	**0.58**	**8½**	**7¼**	**6¼**	**5**	**3¾***	**9½**	**8**	**6¾**	**5½**	**4**
	200	0.65	10½	9	7¾	6	4¾	12	10	9	7	5¼
	400	0.75	13½	11½	10	8	6¼	16	13½	12	9½	7½
	800	0.85	17½	15	13	10	8	NR	17½	15	12	9½

* Development times shorter than 4 minutes may produce unsatisfactory uniformity.
NR= Not recommended, as determined by testing.

Important

Development times shorter than 4 minutes may produce unsatisfactory uniformity.

TABLE 5: Processing Sheet Film in Rotary Tubes with FULL-STRENGTH DEVELOPER (Development Times in minutes)

SHEET FILM	EI	CI	Fresh Developer				Replenished Developer			
			65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	65°F (18°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)
KODAK PLUS-X Pan Professional / PXT / 4147	32/64	0.52	4½	3¾*	3¼*	2¾*	5½	4½	4	3*
	125	**0.58**	**5½**	**4½**	**4**	**3***	**7**	**5¾**	**5**	**3¾***
	250	0.65	7	5¾	5	4	9	7¼	6	4¾
	500	0.75	9½	8	7	5¼	12½	9¾	8	6
	1000	0.85	13	11¼	10	7½	17	13¾	11½	9
KODAK T-MAX 100 Professional / TMX / 4052	25/50	0.52	6½	5½	4¾	3½*	8½	6¾	5½	4¼
	100	**0.58**	**7¾**	**6¼**	**5½**	**4¼**	**10½**	**8**	**6½**	**5**
	200	0.65	9	7¼	6¼	5	12½	9¾	7¾	6
	400	0.75	11	8¼	7¼	5¾	14½	11½	9½	7
	800	0.85	13½	10	8½	6¾	17	13¾	11½	8½
KODAK TRI-X Pan Professional / TXT / 4164	80/160	0.52	4¼	3¾*	3¼*	2½*	5¼	4½	4	3*
	320	**0.58**	**5**	**4½**	**4**	**3***	**6½**	**5½**	**4¾**	**3½***
	640	0.65	6¼	5½	5	3¾*	8	6¾	6	4½
	1250	0.75	8	7¼	6½	4¾	10	8½	7½	5½
	2500	0.85	10	8¾	8	6	13	11	9½	7
KODAK T-MAX 400 Professional / TMY / 4053	100/200	0.52	6½	5½	5	3½*	8¼	6½	5½	4¼
	400	**0.58**	**7½**	**6¼**	**5½**	**4**	**9¼**	**7½**	**6¼**	**4¾**
	800	0.65	8½	7	6¼	4½	10½	8½	7	5¼
	1600	0.75	9¾	8	7	5¼	12	9½	8	6
	3200	0.85	11¼	9	8	6	13½	11	9½	7
KODAK EKTAPAN / PNT / 4162	25/50	0.52	4½	3½*	3*	2*	5½	4½	4	2½*
	100	**0.58**	**6**	**5**	**4¼**	**3***	**8**	**6½**	**5½**	**4**
	200	0.65	7½	6½	5¾	4	10½	8¾	7½	5½
	400	0.75	10	8½	7½	5½	14	12	10½	7½
	800	0.85	13	11	9¾	7	17½	15½	14	10

* Development times shorter than 4 minutes may produce unsatisfactory uniformity.

Important

Development times shorter than 4 minutes may produce unsatisfactory uniformity.

TABLE 6: Processing Sheet Film with FRESH, DILUTE DEVELOPER (Development Times in minutes)

SHEET FILM	EI	CI	In Trays, DEVELOPER DILUTION				In Rotary-Tubes (with Continuous Agitation), DEVELOPER DILUTION			
			1:1				1:1			
			68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)	68°F (20°C)	70°F (21°C)	75°F (24°C)	80°F (27°C)
KODAK PLUS-X Pan Professional / PXT / 4147	32/64	0.52	7¼	6½	5	3¾*	5	4½	3¼*	2½*
	125	**0.58**	**8¼**	**7½**	**6**	**4¾**	**6¼**	**5½**	**4**	**3¼***
	250	0.65	10¼	9½	7½	6	7½	6¾	5	4
	500	0.75	13½	12½	10½	8	10	9	6¾	5
	1000	0.85	19	17	13	10½	12½	11½	9	7
KODAK T-MAX 100 Professional / TMX / 4052	25/50	0.52	9¼	8½	6½	5¼	6¾	6½	5¾	5
	100	**0.58**	**10½**	**9½**	**7½**	**6**	**7¾**	**7½**	**6¾**	**6**
	200	0.65	11½	10½	8½	7	9	8½	7½	6¾
	400	0.75	13¼	12	9¾	8	10½	9¾	8½	7½
	800	0.85	15¼	14	11¼	9	12	11½	10	8½
KODAK TRI-X Pan Professional / TXT / 4164	80/160	0.52	7¾	7	5	3¾*	5¾	5	3¾*	2¾*
	320	**0.58**	**9**	**8**	**6**	**4½**	**6¾**	**6**	**4½**	**3¼***
	640	0.65	10½	9½	7	5½	7¾	7	5½	3¾*
	1250	0.75	13½	12	8½	6¾	9¾	9	6¾	4½
	2500	0.85	17	15	10½	8	12	11	8¼	5½
KODAK T-MAX 400 Professional / TMY / 4053	100/200	0.52	9½	8½	6½	5½	7¼	6½	5¼	4¼
	400	**0.58**	**10½**	**9½**	**7¼**	**6**	**8¼**	**7¼**	**5¾**	**4¾**
	800	0.65	11¾	10½	8¼	6¾	9¼	8¼	6¾	5¼
	1600	0.75	13¼	12	9¼	7½	10¾	9½	7¾	6
	3200	0.85	15	13½	10½	8½	12½	11	9	7
KODAK EKTAPAN / PNT / 4162	25/50	0.52	8	7	4½	2½*	5¼	4½	3½*	2¾*
	100	**0.58**	**9½**	**8½**	**6**	**3¾***	**7¼**	**6**	**4½**	**3¼***
	200	0.65	12¼	11	8	5½	9	7¾	5½	3¾*
	400	0.75	15½	14	10½	7½	12	10	7	5
	800	0.85	19½	18	14¼	10½	14¾	12½	9	6½

* Development times shorter than 4 minutes may produce unsatisfactory uniformity.

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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.

E103CF	*Chemicals for KODAK Black-and-White Films (Matrix)*
F-7	*KODAK VERICHROME Pan Film*
F-8	*KODAK PLUS-X Pan and PLUS-X Pan Professional Films*
F-13	*KODAK High Speed Infrared Film*
F-9	*KODAK TRI-X Pan and TRI-X Pan Professional Films*
F-10	*KODAK EKTAPAN Film*
F-32	*KODAK T-MAX Professional Films*
P-255	*KODAK Technical Pan Film*
Y-30	*KODAK Plotting Form for Black-and-White Film Processing (20-sheet packages, CAT 176 9314)*

For assistance in controlling processes, the following are available:

Z-133E	*Monitoring and Troubleshooting KODAK Black-and-White Film Processes*
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