

KODAK PROFESSIONAL D-76 Developer



KODAK PROFESSIONAL D-76 Developer provides full emulsion speed and excellent shadow detail with normal contrast, and produces fine grain with a variety of continuous-tone black-and-white films. For greater sharpness, but with a slight increase in graininess, you can use a 1:1 dilution of this developer. It yields a long density range, and its development latitude allows push processing with relatively low fog.

Proper replenishment of D-76 Developer with KODAK PROFESSIONAL D-76R Replenisher will increase the capacity of the developer and maintain process consistency without an increase in the development time.

AGITATION

Proper agitation is very important for consistent and uniform results. Agitation helps remove the by-products of development from the surface of the film so that fresh developer can act on the exposed silver halide in the emulsion. Because agitation affects the rate of development, particularly in high-density areas, you can achieve consistent negative quality only if agitation is uniform over the whole surface of the film, and when the degree of agitation is similar for each film or batch of films.

Agitation should *always* consist of irregular or random movements that will not cause solution currents to flow over the film constantly in any one direction; these currents increase film density along their paths, causing nonuniformity.

Agitating Rolls in a Small Tank: The times given for small-tank processing 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 2.5 cm (1 inch) 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 cycle, depending on your results. For KODAK PROFESSIONAL T-MAX 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 25.4 cm (10-inch) 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 the agitation intervals. 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 Short Rolls in a Large Tank: You can process several short rolls (1.5 metres [5 feet] or less) in a large tank. Wind each roll onto a spiral reel. Load the reels on a rack, in a basket, or on a spindle, and place the rack, basket, or spindle in the tank (typically a 3.8-litre [1-gallon] or a 13-litre [3 ½-gallon] tank). Many racks can hold up to 30 rolls of 35 mm film or 18 rolls of 120-size film. Use the following agitation procedure:

1. Start the timer. Lower the rack, basket, or spindle into the developer, and tap it quickly and sharply against the tank to dislodge air bubbles from the surface of the film. Air bubbles can interfere with development and produce low-density circles on the film.
2. Agitate the film continuously for the first 15 to 30 seconds by raising and lowering the rack, basket, or spindle approximately 1 cm (½ inch). Be sure to keep the reels in the solution. *Do not* agitate the rack, basket, or spindle for the remainder of the first minute.
3. Agitate once each minute (after the first minute) by lifting the rack, basket, or spindle completely out of the developer, tilting it approximately 30 degrees to drain it for 5 to 10 seconds, and reimmersing it. Alternate the direction of tilting the rack, basket, or spindle.

Agitating Sheet Film in a Tray: To process an individual sheet, start the timer, and slide the film smoothly into the

developer. Rock the tray immediately to make sure the film is covered with solution. To agitate, first raise the left side of the tray about 1.9 cm ($\frac{3}{4}$ inch), 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. Agitate continuously throughout the development time.

To process 2 to 6 sheets together, follow the procedure below, which includes a prewet step. Prewetting will prevent the sheets from sticking together and will promote even development.

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, and 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. Start the timer. Make sure that the sheet is covered with developer, and transfer the rest of the sheets to the developer quickly, one at a time, in the same way. Interleave the stack, from bottom to top, until development is complete.
Note: When you use interleaving agitation, it is important to go through the stack of films completely. Rotate the first sheet in the developer 180 degrees from the rest of the stack so that the notch is at the opposite end. This identifies it as the first sheet in; be sure that it is the first sheet you remove from the solution.
4. At the end of the development time, transfer the sheets to the stop bath one at a time. 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.

Agitating Sheet Film in a Large Tank: Be sure to separate the sheets by at least 1 cm ($\frac{1}{2}$ inch). When you process films of different sizes together in the same tank, such as 8 x 10-inch and 4 x 5-inch films, separate the hangers containing the different-size films with a hanger loaded with an 8 x 10-inch sheet of acetate or scrap film to avoid uneven development or scratching of the larger sheets. This unevenness is caused by turbulence around the central frame of the multiple-film hanger during agitation. To agitate a sheet of film or a batch of sheet films in hangers in a tank, follow this procedure:

1. Start the timer. Lower the hangers as a unit into the developer. Tap the hangers sharply against the rim of the tank two or three times to dislodge air bubbles from the surface of the film. (Air bubbles can interfere with development and produce low-density circles on the film.)
2. Allow the hangers to remain undisturbed for the remainder of the first minute.
3. Lift all the hangers out of the solution and tilt them almost 90 degrees to the left. Reimmerse the hangers, lift them out again, and then tilt them almost 90 degrees to the right. Do this as quickly and smoothly as possible—in about 5 to 7 seconds.
4. After you reimmerse the hangers, check their spacing.
5. Repeat this agitation cycle once every minute during the development time.

Note: Each agitation cycle should take about 6 seconds. When you process large sheets of film (e.g., 8 x 10 inches), be careful not to dislodge them from the hangers by lifting them from the solution too quickly.

DEVELOPMENT TIMES

The development times in the following tables are starting-point recommendation; for critical applications, run tests to determine the best development time. If your films are consistently too low in contrast, increase the development time slightly (10 to 15 percent); if they are too contrasty, decrease the development time slightly (10 to 15 percent).

If you use D-76 Developer diluted 1:1, dilute it just before you use it, and discard it after processing the batch of film. Before using the diluted developer, make certain that there are no air bubbles in the solution. If air is coming out of the solution and forming bubbles, let the solution stand until the bubbles dissipate. Don't reuse or replenish the diluted solution. You can develop one 135-36 roll (80 square inches) in 473 mL (16 ounces) or two rolls together in 946 mL (one quart) of diluted developer. If you process one 135-36 roll in a 237 mL (8-ounce) tank or two 135-36 rolls in a 473 mL (16-ounce) tank, increase the development time by 10 percent (see the following tables).

Roll Films

KODAK PROFESSIONAL D-76 Developer (Full Strength)

KODAK Film	Development Times (Minutes)									
	Small Tank*					Large Tank†				
	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)
T-MAX 100 Professional	10 ½	9	8	7	6	11 ½	10	9	8	6 ½
PROFESSIONAL T-MAX 100	7 ½	6 ½	5 ½	5	4 ¼	8 ¼	7 ¼	6 ½	5 ¾	4¾
T-MAX 400 Professional and PROFESSIONAL T-MAX 400	9	8	7	6 ½	5 ½	10	9	8	7 ½	6 ½
T-MAX P3200 Professional	See the table below					See the table below				
VERICHROME Pan	8	7	5 ½	5	4 ½	9	8	7	6	5
PLUS-X Pan / PX PLUS-X Pan Professional / PXP	6 ½	5 ½	5	4 ½	3¾	7 ½	6 ½	6	5 ½	4 ½
PROFESSIONAL PLUS-X 125	6 ½	5 ½	5	4 ½	4	7 ¼	6 ¼	5¾	5¼	4 ½
TRI-X Pan	9	8	7 ½	6 ½	5 ½	10	9	8	7	6
TRI-X Pan Professional	9	8	7 ½	7	6	10	9	8 ½	8	7
PROFESSIONAL TRI-X 400 Film / 400TX	8	6¾	6¼	5 ½	4¾	9¼	7¾	7	6 ½	5 ½
PROFESSIONAL TRI-X 320 Film / 320TXP	10	9	8¼	7 ½	6 ½	11 ½	10¼	9 ½	8¾	7 ½
High Speed Infrared	9 ½	8 ½	7 ½	7	6	10	9	8	7 ½	6 ½

* With agitation at 30-second intervals.

† With agitation at 1-minute intervals.

Note: Tank development times shorter than 5 minutes may produce poor uniformity.

KODAK T-MAX P3200 Professional Film in KODAK PROFESSIONAL D-76 Developer (Full Strength)

Exposed at EI	Development Times (Minutes)				
	Small Tank*				
	20°C (68°F)	21°C (70°F)	24°C (75°F)	27°C (80°F)	29°C (85°F)
400/27°	10 ½	9 ½	7 ½	6	4 ½
800/30°	11	10	8	6 ½	5
1600/33°	11 ½	10 ½	8 ½	7	5 ½
3200/36°	15	13 ½	11	8 ½	7 ½
6400/39°	17 ½	16	12 ½	10 ½	9

* With agitation at 30-second intervals.

Note: Tank development times shorter than 5 minutes may produce poor uniformity.

KODAK PROFESSIONAL T-MAX P3200 Film in KODAK PROFESSIONAL D-76 Developer (Full Strength)

Exposed at EI	Development Times (Minutes)				
	Small Tank*				
	20°C (68°F)	21°C (70°F)	24°C (75°F)	27°C (80°F)	29°C (85°F)
400/27°	10 ½	9 ½	7 ½	6	5
800/30°	11 ½	10 ½	8 ½	6 ½	5 ½
1600/33°	12 ½	11 ½	9	7 ½	6
3200/36°	14	13	10 ½	8 ½	6 ½
6400/39°	15 ½	14	11 ½	9	7 ½

* With agitation at 30-second intervals.

Note: Tank development times shorter than 5 minutes may produce poor uniformity.

KODAK PROFESSIONAL D-76 Developer (1:1)

KODAK Film	Development Times (Minutes)									
	Small Tank*					Large Tank†				
	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)
T-MAX 100 Professional	14 ½	12	11	10	8 ½	—	—	—	—	—
PROFESSIONAL T-MAX 100	11	9 ½	8 ½	7 ½	6 ¼	—	—	—	—	—
T-MAX 400 Professional and PROFESSIONAL T-MAX 400	14 ½	12 ½	11	10	9	—	—	—	—	—
VERICHROME Pan	11	9	8	7	6	12 ½	10	9	8	7
PLUS-X Pan PLUS-X Pan Professional	8	7	6 ½	6	5	10	9	8	7 ½	7
PROFESSIONAL PLUS-X 125	10	8 ½	7 ¾	7 ¼	6	11 ¼	9 ¾	8 ¾	8	6 ¾
TRI-X Pan	11	10	9 ½	9	8	13	12	11	10	9
PROFESSIONAL TRI-X 400 Film / 400TX	10 ¾	9 ¾	9	8 ½	7 ¾	12 ¼	11	10 ½	9 ¾	8 ¾
PROFESSIONAL TRI-X 320 Film / 320TXP	14 ¼	12 ¾	11 ¾	10 ¾	9 ¼	—	—	—	—	—

* With agitation at 30-second intervals.

† With agitation at 1-minute intervals.

Sheet Films

KODAK PROFESSIONAL D-76 Developer (Full Strength)

KODAK Sheet Film	Development Times (Minutes)									
	Tray*					Large Tank†				
	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)
T-MAX 100 Professional	9 ½	7	6 ½	5 ½	5	11 ½	9 ½	8 ½	7 ½	7
PROFESSIONAL T-MAX 100	6 ¾	5 ¾	5 ¼	4 ¾	4	8 ¼	7 ¼	6 ½	5 ¾	4 ¾
T-MAX 400 Professional and PROFESSIONAL T-MAX 400	9 ½	7	6 ½	6	5 ½	11	10	9	8	7
TRI-X Pan Professional / TXT	6	5 ½	5	5	4 ½	7 ½	7	6 ½	6	5 ½
PROFESSIONAL TRI-X 320 Film / 320TXP	6 ¾	6	5 ½	5	4 ½	8 ½	7 ½	7	6 ¼	5 ½
PLUS-X Pan Professional / PXT	7	6	5 ½	5	4 ½	9	8	7 ½	7	6
EKTAPAN	9	8	7	6 ½	5 ½	11	10	9	8 ½	7 ½
High Speed Infrared / HSI	11	9 ½	8 ½	7 ½	6 ½	10	9	8	7 ½	6 ½

* With continuous agitation.

† With agitation at 1-minute intervals.

Processing “Pushed” Roll Films in a Small Tank

Use the development times in the table below to process roll films exposed at speeds higher than their normal ISO or EI ratings. When you expose the film listed in the table at a speed 1 stop faster than the rated speed, we recommend that you develop them for the normal time.

The underexposure latitude of these films is wide enough to give you good results with finer grain than you would obtain with push processing.

KODAK PROFESSIONAL D-76 Developer (Full Strength)

KODAK Roll Film	Development Times (Minutes)			
	20°C (68°F)	24°C (75°F)	20°C (68°F)	24°C (75°F)
	EI 200 (Normal Processing)		EI 400 (2-Stop Push Processing)	
T-MAX 100 Professional	9	6	11	7 ½
PROFESSIONAL T-MAX 100	6 ½	4 ¼	8 ¼	5 ½
	EI 800 (Normal Processing)		EI 1600 (2-Stop Push Processing)	
T-MAX 400 Professional and PROFESSIONAL T-MAX 400	8	5 ½	10 ½	7
TRI-X Pan	8	5 ½	13	10
PROFESSIONAL TRI-X 400 Film / 400TX	8	4 ¾	9 ½	6 ½

Rotary-Tube Processing

Follow the agitation recommendations for your processor.

KODAK PROFESSIONAL D-76 Developer (Full Strength)

KODAK Film	EI	18°C (65°F)	20°C (68°F)	21°C (70°F)	22°C (72°F)	24°C (75°F)
T-MAX 100 Professional	100/200	—	6 ½	6	5 ½	5
	400	—	9	8 ½	8	7
	800	NR	NR	NR	NR	NR
PROFESSIONAL T-MAX 100	100/200	7 ½	6 ¼	5 ¾	5 ¼	4 ¼
	400	—	8 ¼	7 ½	6 ¾	5 ½
T-MAX 400 Professional and PROFESSIONAL T-MAX 400	400	—	6 ½	6 ½	6	5 ½
	800	—	7	6 ½	6	5 ½
	1600	—	9	8 ½	8	7
	3200	NR	NR	NR	NR	NR
T-MAX P3200 Professional	400	—	8	7 ½	7 ¼	6 ½
	800	—	8 ½	8	7 ¾	7
	1600	—	9	8 ½	8	7 ½
	3200	—	11 ½	11	10 ½	9 ½
	6400	—	13 ½	13	12	11
PROFESSIONAL T-MAX P3200	400	—	7 ½	6 ½	5 ½	5
	800	—	8 ½	7 ¼	6 ¼	5 ¾
	1600	—	9 ¼	8	6 ¾	6 ¼
	3200	—	10 ½	9	7 ¾	7
	6400	—	12	10 ¼	8 ¾	8
PLUS-X Pan / PX	125	5 ½	5	4	3 ½	3
PLUS-X Pan Professional / PXP	125	7	6	5	4 ½	4 ½
PROFESSIONAL PLUS-X 125	125	6 ½	5 ½	5	4 ½	4
	500	9	7 ¾	7	6 ½	5 ½
TRI-X Pan	400/800	7 ½	7	6	5	4
	1600	—	—	9	8	7
	3200	—	—	11	10	9 ½
TRI-X Pan Professional	320	—	7 ½	7	6 ½	5 ½
PROFESSIONAL TRI-X 400 Film / 400TX	400/800	8	6 ¾	6 ¼	5 ½	4 ¾
	1600	11 ¼	9 ½	8 ¾	7 ¾	6 ½
	3200	12 ¾	11	9 ¾	9	7 ½
PROFESSIONAL TRI-X 320 Film / 320TXP—Rolls	320/640	10	9	8 ¼	7 ½	6 ½
PROFESSIONAL TRI-X 320 Film / 320TXP—Sheets	320/640	6	5 ¼	4 ¾	4 ½	4

STORAGE LIFE AND CAPACITY

Use the table below as a guide to the keeping properties of KODAK PROFESSIONAL D-76 Developer and D-76R Replenisher. The table also indicates the capacity of the developer without replenishment.

Store stock solutions in tightly closed bottles. Solutions in full bottles have a longer shelf life; partially filled bottles allow some oxidation of the solution.

Solution	Storage Life				Useful Capacity Per Gallon (Litre)	
	Stock Solution in Tightly Closed Bottle		Working Solution in		8 x 10-inch Sheets in Tray	135-36 or 120 Rolls in Tank
	Full	Half-Filled	Tray	Tank*		
D-76 Developer	6 months	2 months	24 hours	1 month	16 (4) [†]	16 (4) ^{†‡}
D-76 Developer (1:1)	NA	NA	24 hours	NA	8 (2)	8 (2) [†]
D-76R Replenisher	6 months	2 months	NA	NA	NA	NA

* With floating lid.

† With time compensation; increase the development time by 15 percent after every four 8 x 10-inch sheets or 4 rolls per gallon processed.

‡ After you develop each batch, you can add replenisher to extend the capacity of the developer to 120 sheets per gallon. *Do not increase development times if you use replenisher.* See "Replenishment" below.

NA = Not applicable

If you use D-76 Developer diluted 1:1, dilute it just before you use it, and discard it after processing one batch of film. Don't reuse or replenish this solution.

To extend the useful capacity of D-76 Developer diluted 1:1—when processing two 36-exposure rolls in a 16-ounce tank—increase the recommended time by about 10 percent.

REPLENISHMENT

Use KODAK PROFESSIONAL D-76R Replenisher to increase the capacity of D-76 Developer (full strength) and maintain process consistency without increasing the development time.

If your processing load includes *any* or *all* KODAK PROFESSIONAL T-MAX Films, use the "Modified Replenisher" mixing instructions and replenishment rate that follow. T-MAX Films are more sensitive to the developer; the modified replenisher controls the speed loss and increase in contrast that occurs with seasoning and the original replenisher.

If you process *only* films other than T-MAX Films, you can replenish using the "Original Replenisher" procedure.

Using a Modified Replenisher

Prepare the modified replenisher by mixing D-76 Developer and D-76R Replenisher according to the instructions on the packages. Then combine 5 parts of D-76 Developer with 1 part of D-76R Replenisher, and stir until the solution is completely mixed. To determine the amount of modified replenisher solution to mix, estimate the amount you will need for 3 to 4 weeks. Then select packaged developer and replenisher to mix this amount of replenisher

solution. For example, if you determine that you need 45.4 litres (12 gallons) of modified replenisher solution, prepare a 38-litre (10-gallon) package of D-76 Developer and two 3.8-litre (1-gallon) packages of D-76R Replenisher, and then combine these solutions. For consistent results, don't store the mixed modified replenisher solution for longer than 4 weeks. With low utilization (when it takes longer than 1 month to turn over the tank solution), discard the developer after 1 month.

The starting-point modified replenishment rate is 70 mL (2 ½ fluidounces) for each 135-36 or 120 roll or 8 x 10-inch sheet (or equivalent) processed. Monitor the developer activity with KODAK Black-and-White Film Process Control Strips and adjust the starting-point rate, if necessary, to keep the contrast of the film within the required range.

Discard the developer after processing 9600 square inches of film 3.8 litres (per gallon). Capacities in numbers of rolls or sheets for various film sizes follow.

Using the Original Replenisher

Add 22.2 to 29.6 mL (¾ to 1 fluidounce) of replenisher (mixed according to the instructions on the package) for each 135-36 or 120 roll or 8 x 10-inch sheet (or equivalent) processed. (This rate is usually sufficient to compensate for normal carry-out of developer from the tank, as well as chemical depletion. However, if much more of the solution is lost in processing than is replaced by replenishment, make up the loss by adding fresh *working-strength* developer.) Stir or recirculate the solution thoroughly after each addition of replenisher. Monitor the developer activity with KODAK Black-and-White Film Process Control Strips and adjust the starting-point rate, if necessary, to keep the contrast of the film within the required range.

KODAK PROFESSIONAL D-76 Developer

Discard the developer after processing 9600 square inches of film 3.8 litres (per gallon). Capacities in numbers of rolls or sheets for various film sizes follow.

Capacity for Replenished D-76 Developer

Film Size	Number of Rolls or Sheets per Gallon of Developer with Replenishment
120	120
220	60
135-24	160
135-36	120
8 x 10-inch sheets	120
4 x 5-inch sheets	480

SIZES AVAILABLE

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

KODAK D-76 Developer	CAT No.
To make 1 gallon	146 4817
To make 10 gallons	146 4825
KODAK D-76R Replenisher	
To make 1 gallon	146 4833

MORE INFORMATION

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

E-103CF	<i>Chemicals for KODAK Black-and-White Films (Matrix)</i>
F-7	<i>KODAK VERICHROME Pan Film</i>
F-8	<i>KODAK PLUS-X Pan and KODAK PLUS-X Pan Professional Films</i>
F-9	<i>KODAK TRI-X Pan and KODAK TRI-X Pan Professional Films</i>
F-10	<i>KODAK EKTAPAN Film</i>
F-13	<i>KODAK High Speed Infrared Film</i>
F-32	<i>KODAK T-MAX Professional Films</i>
F-4016	<i>KODAK PROFESSIONAL T-MAX Films</i>
F-4017	<i>KODAK PROFESSIONAL TRI-X 320 and 400 Films</i>
F-4018	<i>KODAK PROFESSIONAL PLUS-X 125 Films</i>

For the latest version of technical support publications for KODAK 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 are available from dealers who supply KODAK PROFESSIONAL Products. You can use other materials, but you may not obtain similar results.



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