

KODAK PROFESSIONAL TRI-X

320 and 400 Films

Kodak

TECHNICAL DATA / BLACK-AND-WHITE FILM

May 2007 • F-4017

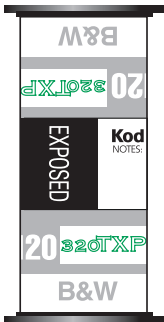
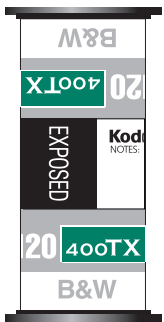
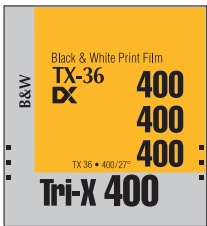
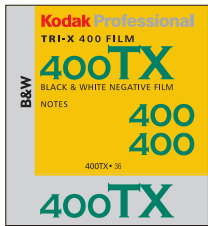
—NOTICE—

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-4017):

Former packaging, refer to Kodak publication F-9:



KODAK PROFESSIONAL TRI-X 320 and 400 Films are high-speed panchromatic films that are a good choice for photographing dimly lighted subjects or fast action, for photographing subjects that require good depth of field and fast shutter speeds, and for extending the distance range for flash pictures. TRI-X 400 Film (400TX) is available in 120 and 135 sizes and 35 and 70 mm long rolls. You can retouch the 120-size film on the emulsion side. TRI-X 400 Film is recommended for push-processing applications.

TRI-X 320 Films (320TXP) feature excellent tone gradation and brilliant highlights. They are especially well suited to low-flare interior lighting or flash illumination. They are also useful for portraiture with low-contrast backlighting outdoors.

One TRI-X 320 Film (320TXP) is available in 120 and 220 sizes on a 3.9-mil acetate base, the other is available in sheets on a 7-mil ESTAR Thick Base. You can retouch these films on the emulsion or base side.

| FEATURES | BENEFITS |
|--------------------------|-----------------------------------------------------------------------|
| • Fine grain | • Good for producing high-quality images |
| • Wide exposure latitude | • Rich tonality maintained with overexposure and underexposure |
| • High sharpness | • Good for applications that require a moderate degree of enlargement |
| • High resolving power | • Good rendition of detail |

SIZES AVAILABLE

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

STORAGE AND HANDLING

Load and unload your camera in subdued light.
High temperatures or high humidity may produce unwanted quality changes. Store unexposed film at 24°C (75°F) or lower in the original sealed package. Always store film (exposed or unexposed) in a cool, dry place. For best results, process film as soon as possible after exposure.
Protect processed film from strong light, and store it in a cool dry place. For more information, see KODAK Publication No. E-30, *Storage and Care of KODAK Films and Papers—Before and After Processing*.

EXPOSURE

Daylight

Use the exposures in the table below for average front-lit subjects from 2 hours after sunrise to 2 hours before sunset.

| Lighting Conditions | Shutter Speed (second) and Lens Opening | |
|---------------------------------------|-----------------------------------------|----------------|
| | TRI-X 320 Film | TRI-X 400 Film |
| Bright/Hazy Sun on Light Sand or Snow | 1/500 f/16 | 1/500 f/22 |
| Bright or Hazy Sun, Distinct Shadows | 1/500 f/11* | 1/500 f/16† |
| Weak, Hazy Sun (Soft Shadows) | 1/500 f/8 | 1/500 f/11 |
| Cloudy Bright (No Shadows) | 1/500 f/5.6 | 1/500 f/8 |
| Heavy Overcast, Open Shade‡ | 1/500 f/4 | 1/500 f/5.6 |

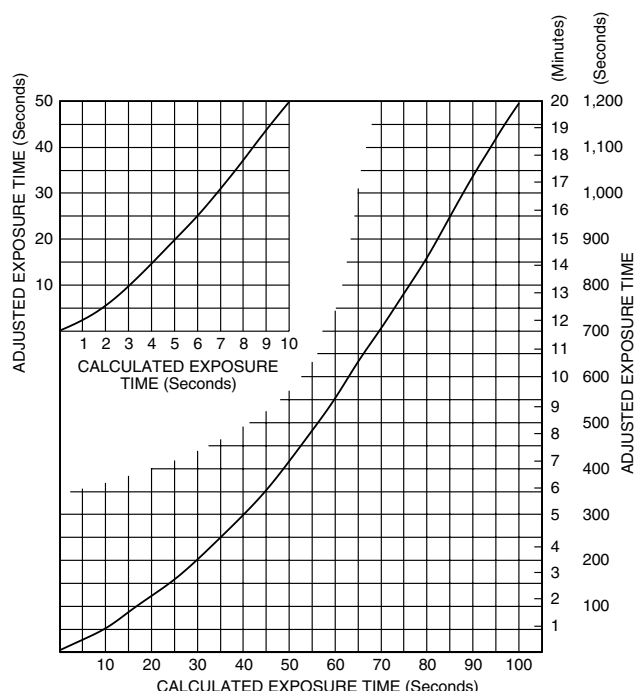
* Use f/5.6 at 1/500 for backlit close-up subjects.
† Use f/8 at 1/500 for backlit close-up subjects.
‡ Subject shaded from the sun but lighted by a large area of clear sky.

Exposure and Development Adjustments for Long and Short Exposures

At the exposure times in the table below, compensate for the reciprocity characteristics of this film by increasing exposure and adjusting the development as shown.

| If Indicated Exposure Time Is (Seconds) | Use This Lens-Aperture Adjustment | OR This Adjusted Exposure Time (Seconds) | AND Use This Development Adjustment |
|-----------------------------------------|-----------------------------------|------------------------------------------|-------------------------------------|
| 1/100,000 | +1 stop | Change Aperture | +20% |
| 1/10,000 | +1/2 stop | Change Aperture | +15% |
| 1/1,000 | None | None | +10% |
| 1/100 | None | None | None |
| 1/10 | None | None | None |
| 1 | +1 stop | 2 | -10% |
| 10 | +2 stops | 50 | -20% |
| 100 | +3 stops | 1200 | -30% |

It may be difficult to use the table to estimate the adjusted times for calculated exposure times between 1 and 100 seconds. The graphs that follow will help you find the adjusted times for calculated exposure times between those given in the table.



F002_0062GC

Filter Corrections

Multiply the normal exposure time by the filter factor.

KODAK PROFESSIONAL TRI-X 400 Film / 400TX

| KODAK WRATTEN Gelatin Filter | Daylight Filter Factor | Tungsten Filter Factor |
|------------------------------|------------------------|------------------------|
| No. 8 (yellow) | 2 | 1.5 |
| No. 11 (yellowish green) | 4 | 3 |
| No. 12 (deep yellow) | 2.5 | — |
| No. 15 (deep yellow) | 2.5 | 1.5 |
| No. 25 (red)* | 8 | 5 |
| No. 47 (blue)* | 6 | 12 |
| No. 58 (green)* | 6 | 6 |
| Polarizing Filter | 2.5 | 2.5 |

* Filter recommended for making separation negatives.

KODAK PROFESSIONAL TRI-X 320 Film / 320TXP

| KODAK WRATTEN Gelatin Filter | Daylight Filter Factor | Tungsten Filter Factor |
|------------------------------|------------------------|------------------------|
| No. 8 (yellow) | 2 | 1.5 |
| No. 11 (yellowish green) | 4 | 4 |
| No. 15 (deep yellow) | 2.5 | 2 |
| No. 25 (red)* | 8 | 5 |
| No. 29 (red)*† | 16 | 10 |
| No. 47 (blue)* | 6 | 10 |
| No. 58 (green)* | 8 | 8 |
| Polarizing Filter | 2.5 | 2.5 |

* Filter recommended for making separation negatives.

† For TRI-X 320 sheet film only.

DARKROOM RECOMMENDATIONS

Handle unprocessed film in total darkness.

Using a safelight *will* affect your results. If absolutely necessary, after development is half complete, you can use a safelight equipped with a KODAK 3 Safelight Filter (dark green) with a 15-watt bulb for a few seconds. Keep the safelight at least 4 feet (1.2 metres) from the film. Run tests to determine that safelight use gives acceptable results for your application.

For information on safelight testing, see KODAK Publication No. K-4, *How Safe Is Your Safelight?*

PROCESSING

The following starting-point recommendations are intended to produce a contrast index of 0.56. Make tests to determine the best development time for your application.

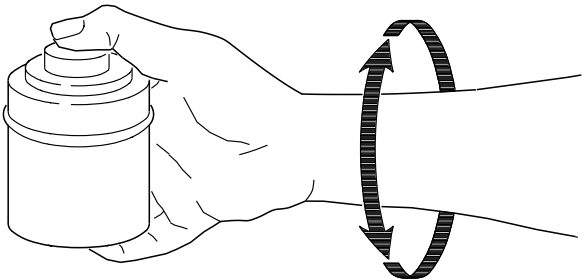
Note: Tank development times shorter than 5 minutes may produce unsatisfactory uniformity.

MANUAL PROCESSING

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 of the development time.



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.

TRI-X 400 Film / 400TX

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | | | | | | |
|-----------------------------------------------------------------------|----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Small Tank* | | | | | Large Tank† | | | | |
| | 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 | 6¾ | 6 | 5¾ | 5½ | 4¾ | NR | | | | |
| T-MAX RS | 4¾ | 4½ | 4¼ | 4 | 3½ | 5½ | 5 | 4¾ | 4½ | 4 |
| HC-110 (B) | 4½ | 3¾ | 3½ | 3 | 2½ | 5 | 4½ | 4 | 3½ | 3 |
| D-76 | 8 | 6¾ | 6¼ | 5½ | 4¾ | 9¼ | 7¾ | 7 | 6½ | 5½ |
| D-76 (1:1) | 10¾ | 9¾ | 9 | 8½ | 7¾ | 12¼ | 11 | 10½ | 9¾ | 8¾ |
| XTOL | 8 | 7 | 6¼ | 5¾ | 4¾ | 9¼ | 8 | 7¼ | 6½ | 5½ |
| XTOL (1:1) | 10 | 9 | 8½ | 8 | 7¼ | 11½ | 10½ | 9¾ | 9¼ | 8¼ |
| MICRODOL-X | 10¼ | 9¼ | 8¾ | 8¼ | 7½ | 11¾ | 10¾ | 10 | 9½ | 8½ |
| MICRODOL-X (1:3) | 18¾ | 17 | 16 | 15 | 13½ | NR | 19½ | 18¼ | 17¼ | 15½ |
| DK-50 (1:1) | 7 | 6 | 5½ | 5 | 4½ | 7½ | 6½ | 6 | 5½ | 5 |

* With agitation at 30-second intervals. Development times shorter than 5 minutes may produce unsatisfactory results.

† With manual agitation at 1-minute intervals. Development times shorter than 5 minutes may produce unsatisfactory results.

NR = Not Recommended.

TRI-X 320 Film / 320TXP—Rolls

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | | | | | | |
|-----------------------------------------------------------------------|----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Small Tank* | | | | | Large Tank† | | | | |
| | 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 | 8¼ | 7¼ | 6¾ | 6¼ | 5¼ | NR | | | | |
| T-MAX RS | 4½ | 4 | 3½ | 3¼ | 2¾ | 5 | 4½ | 4¼ | 3¾ | 3¼ |
| HC-110 (B) | 5¼ | 4¾ | 4¼ | 4 | 3½ | 6¼ | 5½ | 5 | 4½ | 4 |
| D-76 | 10 | 9 | 8¼ | 7½ | 6½ | 11½ | 10¼ | 9½ | 8¾ | 7½ |
| D-76 (1:1) | 14¼ | 12¾ | 11¾ | 10¾ | 9¼ | — | — | — | — | — |
| XTOL | 8¾ | 7¾ | 7¼ | 6½ | 5¾ | 10¼ | 9 | 8¼ | 7½ | 6½ |
| XTOL (1:1) | 12½ | 11¼ | 10¼ | 9½ | 8 | — | — | — | — | — |
| MICRODOL-X | 11½ | 10¼ | 9½ | 8¾ | 7½ | 13¼ | 11¾ | 10¾ | 10 | 8½ |

* With agitation at 30-second intervals. Development times shorter than 5 minutes may produce unsatisfactory results.

† With manual agitation at 1-minute intervals. Development times shorter than 5 minutes may produce unsatisfactory results.

NR = Not Recommended.

Tray and Large-Tank Processing —Sheets

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

TRI-X 320 Film / 320TXP—Sheets

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | |
|-----------------------------------------------------------------------|----------------------------|----------------|----------------|----------------|----------------|
| | Tray* | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| T-MAX RS | 3 | 2¾ | 2½ | NR | NR |
| HC-110 (B) | 3¾ | 3¼ | 3 | 2¾ | 2½ |
| D-76 | 6 ¾ | 6 | 5½ | 5 | 4½ |
| D-76 (1:1) | 10¼ | 9 | 8½ | 7¾ | 6¾ |
| XTOL | 6¾ | 6 | 5½ | 5 | 4½ |
| XTOL (1:1) | 9½ | 8½ | 7¾ | 7¼ | 6¼ |
| MICRODOL-X | 8¾ | 7¾ | 7¼ | 6¾ | 5¾ |
| DK-50 (1:1) | 5 | 5 | 4½ | 4½ | 4 |

* With continuous agitation.

TRI-X 320 Film / 320TXP—Sheets

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | | | | | | |
|-----------------------------------------------------------------------|----------------------------|----------------|----------------|----------------|----------------|--------------------------------|----------------|----------------|----------------|----------------|
| | Large Tank* | | | | | Large Tank With Gaseous Burst† | | | | |
| | 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 | 4 | 3½ | 3¼ | NR | NR | 3 | 2¾ | 2½ | NR | NR |
| HC-110 (B) | 4¾ | 4¼ | 4 | 3½ | 3 | 3¾ | 3¼ | 3 | 2¾ | 2½ |
| D-76 | 8½ | 7½ | 7 | 6¼ | 5½ | 6¾ | 6 | 5½ | 5 | 4½ |
| D-76 (1:1) | 12¾ | 11¼ | 10½ | 9¾ | 8½ | 10¼ | 9 | 8½ | 7¾ | 6¾ |
| XTOL | 8½ | 7½ | 7 | 6¼ | 5½ | 6¾ | 6 | 5½ | 5 | 4½ |
| XTOL (1:1) | 12 | 10½ | 9¾ | 9 | 7¾ | 9½ | 8½ | 7¾ | 7¼ | 6¼ |
| MICRODOL-X | 11 | 9¾ | 9 | 8¼ | 7¼ | 8¾ | 7¾ | 7¼ | 6¾ | 5¾ |
| DK-50 (1:1) | 7 | 6½ | 6 | 5½ | 5 | 5 | 5 | 4½ | 4½ | 4 |

* With manual agitation at 1-minute intervals.

† With gaseous-burst agitation (1 second every 10 seconds) that provides pressure to raise the solution level 5/8 inch (16 mm). Development times shorter than 5 minutes may produce unsatisfactory uniformity.

Rotary-Tube Processing

Follow the agitation recommendations for your processor. The design of the machine and the agitation will significantly affect the development time required to obtain optimum contrast. The times given below are starting-point recommendations. Make tests to determine if results are acceptable for your needs.

TRI-X 400 Film / 400TX

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | |
|-----------------------------------------------------------|----------------------------|-------------|-------------|-------------|-------------|
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| T-MAX | 6¾ | 6 | 5¾ | 5½ | 4¾ |
| T-MAX RS | 4¾ | 4½ | 4¼ | 4 | 3½ |
| XTOL | 8 | 7 | 6¼ | 5¾ | 4¾ |
| XTOL (1:1) | 10 | 9 | 8½ | 8 | 7¼ |
| HC-110 (B) | 4½ | 3¾ | 3½ | 3 | 2½ |
| D-76 | 8 | 6¾ | 6¼ | 5½ | 4¾ |
| D-76 (1:1) | 10¾ | 9¾ | 9 | 8½ | 7¾ |

TRI-X 320 Film / 320TXP—Rolls

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | |
|-----------------------------------------------------------|----------------------------|-------------|-------------|-------------|-------------|
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| T-MAX | 8¼ | 7¼ | 6¾ | 6¼ | 5¼ |
| T-MAX RS | 4½ | 4 | 3½ | 3¼ | 2¾ |
| XTOL | 8¾ | 7¾ | 7¼ | 6½ | 5¾ |
| XTOL (1:1) | 12½ | 11¼ | 10¼ | 9½ | 8 |
| HC-110 (B) | 5¼ | 4¾ | 4¼ | 4 | 3½ |
| D-76 | 10 | 9 | 8¼ | 7½ | 6½ |
| D-76 (1:1) | 14¼ | 12¾ | 11¾ | 10¾ | 9¼ |
| MICRODOL-X | 11½ | 10¼ | 9½ | 8¾ | 7½ |
| DK-50 (1:1) | 9 | 8 | 7½ | 7 | 6 |

TRI-X 320 Film / 320TXP—Sheets

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Development Time (Minutes) | | | | |
|-----------------------------------------------------------|----------------------------|-------------|-------------|-------------|-------------|
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| T-MAX | NR | | | | |
| T-MAX RS | 2¾ | 2½ | 2¼ | NR | NR |
| XTOL | 6 | 5¼ | 4¾ | 4½ | 4 |
| XTOL (1:1) | 8¼ | 7¼ | 6¾ | 6¼ | 5½ |
| HC-110 (B) | 3¼ | 3 | 2¾ | 2½ | 2¼ |
| D-76 | 6 | 5¼ | 4¾ | 4½ | 4 |
| D-76 (1:1) | 9 | 8 | 7¼ | 6¾ | 6 |
| MICRODOL-X | 7¾ | 6¾ | 6¼ | 5¾ | 5 |

FINAL STEPS

65 to 75°F (18 to 24°C).

| Step/Solution | Time (min:sec) |
|-----------------------------------------------------------------------------------------|----------------------------------------------------|
| Rinse —with agitation: | |
| KODAK Indicator Stop Bath | 0:30 |
| KODAK EKTAFLO Stop Bath | 0:30 |
| Fix —with frequent agitation: | |
| KODAK Fixer | 5:00 to 10:00 |
| KODAK Rapid Fixer | 2:00 to 4:00 |
| KODAFIX Solution | 2:00 to 4:00 |
| KODAK POLYMAX T Fixer (1:3) | 2:00 to 4:00 |
| Wash : | |
| Running Water —OR— Rinse with water KODAK Hypo Clearing Agent Running water | 20:00 to 30:00 0:30 1:00 to 2:00 5:00 |
| Final Rinse : | |
| KODAK PHOTO-FLO Solution | 0:30 |
| Dry —in a dust-free place | |

PUSH PROCESSING

Push processing allows you to expose the film at higher film-speed numbers for conditions such as low-level light, stop action, or existing light. However, there will be a loss of shadow detail and an increase in graininess.

Because of these films' exposure latitude, you can underexpose by one stop and use normal processing times. Prints will show a slight loss in shadow detail.

You can underexpose by two stops if you increase development time by push processing. Prints will show an increase in contrast and graininess with further loss of shadow detail. However, results should be acceptable for many applications. Expose a test roll to determine the film speed that gives the best results for your application.

You can underexpose TRI-X 400 Film / 400TX by three stops if you increase development time by push processing. Prints will show an increase in contrast and graininess, and an additional loss of shadow detail. However, results should be acceptable for some applications. Expose some test rolls to determine the film speed that gives the best results for your application.

TRI-X 400 Film / 400TX

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Small Tank; Agitation at 30-second intervals | | | | | | | | | |
|-----------------------------------------------------------------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|
| | EI 1600 (2-Stop Push Process) Development Time (Minutes) | | | | | EI 3200 (3-Stop Push Process) Development Time (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 | 9½ | 8¾ | 8¼ | 7¾ | 7 | NR | NR | NR | NR | 8¼ |
| T-MAX RS | 8½ | 7¾ | 7¼ | 6¾ | 6 | — | 9½ | 9 | 8¼ | 7½ |
| HC-110 (B) | 7 | 6 | 5½ | 5 | 4¼ | — | — | — | — | — |
| D-76 | 11¼ | 9½ | 8¾ | 7¾ | 6½ | 12¾ | 11 | 9¾ | 9 | 7½ |
| D-76 (1:1) | 14¾ | 13¼ | 12½ | 11¾ | 10¾ | 17½ | 16 | 15 | 14¼ | 12¾ |
| XTOL | 11¼ | 9¾ | 8¾ | 8 | 6¾ | — | 11½ | 10½ | 9½ | 8 |
| XTOL (1:1) | 14½ | 13¼ | 12¼ | 11½ | 10½ | — | 15½ | 14½ | 13¾ | 12¼ |

NR = Not Recommended.

TRI-X 400 Film / 400TX

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Large Tank; Agitation at 1-minute intervals | | | | | | | | | |
|-----------------------------------------------------------------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|
| | EI 1600 (2-Stop Push Process) Development Time (Minutes) | | | | | EI 3200 (3-Stop Push Process) Development Time (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 | — | 8¾ | 8 | 7½ | 7 | — | — | — | — | — |
| HC-110 (B) | 8 | 6¾ | 6¼ | 5½ | 4¾ | — | — | — | — | — |
| D-76 | 12½ | 10¾ | 9¾ | 8¾ | 7½ | — | — | — | — | — |
| XTOL | 12¾ | 11 | 9¾ | 9 | 7½ | 15¼ | 13 | 11¾ | 10½ | 9 |

TRI-X 400 Film / 400TX

| KODAK PROFESSIONAL Developer or Developer and Replenisher | Rotary Tube; Continuous agitation | | | | | | | | | |
|-----------------------------------------------------------------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|
| | EI 1600 (2-Stop Push Process) Development Time (Minutes) | | | | | EI 3200 (3-Stop Push Process) Development Time (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 | 9½ | 8¾ | 8¼ | 7¾ | 7 | NR | NR | NR | NR | 8¼ |
| T-MAX RS | 8½ | 7¾ | 7¼ | 6¾ | 6 | — | 9½ | 9 | 8¼ | 7½ |
| HC-110 (B) | 7 | 6 | 5½ | 5 | 4¼ | — | — | — | — | — |
| D-76 | 11¼ | 9½ | 8¾ | 7¾ | 6½ | 12¾ | 11 | 9¾ | 9 | 7½ |
| D-76 (1:1) | 14¾ | 13¼ | 12½ | 11¾ | 10¾ | 17½ | 16 | 15 | 14¼ | 12¾ |
| XTOL | 11¼ | 9¾ | 8¾ | 8 | 6¾ | — | 11½ | 10½ | 9½ | 8 |
| XTOL (1:1) | 14½ | 13¼ | 12¼ | 11½ | 10½ | — | 15½ | 14½ | 13¾ | 12¼ |

NR = Not Recommended.

TRI-X 320 Film / 320TXP—Rolls

| KODAK PROFESSIONAL Developer | Small Tank; Agitation at 30-second intervals | | | | |
|------------------------------------|-------------------------------------------------------------|----------------|----------------|----------------|----------------|
| | EI 1250 (2-Stop Push Process) Development Time (Minutes) | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| XTOL | 13½ | 12 | 11 | — | 8¾ |
| XTOL (1:1) | — | 15¾ | 14½ | — | 11½ |

TRI-X 320 Film / 320TXP—Rolls

| KODAK PROFESSIONAL Developer | Large Tank; Agitation at 1-minute intervals | | | | |
|------------------------------|----------------------------------------------------------|-------------|-------------|-------------|-------------|
| | EI 1250 (2-Stop Push Process Development Time (Minutes)) | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| XTOL | 15¾ | 13¾ | 12½ | — | 10 |

TRI-X 320 Film / 320TXP—Rolls

| KODAK PROFESSIONAL Developer | Rotary Tube; Continuous agitation | | | | |
|------------------------------|----------------------------------------------------------|-------------|-------------|-------------|-------------|
| | EI 1250 (2-Stop Push Process Development Time (Minutes)) | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| XTOL | 13½ | 12 | 11 | — | 8¾ |
| XTOL (1:1) | — | 15¾ | 14½ | — | 11½ |

TRI-X 320 Film / 320TXP—Sheets

| KODAK PROFESSIONAL Developer | Tray; Continuous agitation | | | | |
|------------------------------|----------------------------------------------------------|-------------|-------------|-------------|-------------|
| | EI 1250 (2-Stop Push Process Development Time (Minutes)) | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| XTOL | 9¾ | 8¾ | 8 | 7½ | 6½ |
| XTOL (1:1) | 13½ | 12 | 11 | 10¼ | 8¾ |

TRI-X 320 Film / 320TXP—Sheets

| KODAK PROFESSIONAL Developer | Large Tank; Agitation at 1-minute intervals | | | | |
|------------------------------|----------------------------------------------------------|-------------|-------------|-------------|-------------|
| | EI 1250 (2-Stop Push Process Development Time (Minutes)) | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| XTOL | 12¼ | 10¾ | 10 | 9¼ | 8 |

TRI-X 320 Film / 320TXP—Sheets

| KODAK PROFESSIONAL Developer | Rotary Tube; Continuous agitation | | | | |
|------------------------------|----------------------------------------------------------|-------------|-------------|-------------|-------------|
| | EI 1250 (2-Stop Push Process Development Time (Minutes)) | | | | |
| | 65°F (18°C) | 68°F (20°C) | 70°F (21°C) | 72°F (22°C) | 75°F (24°C) |
| XTOL | 8½ | 7½ | 7 | 6½ | 5¾ |
| XTOL (1:1) | 11¾ | 10½ | 9½ | 8¾ | 7¾ |

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 TRI-X 320 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 TRI-X 320 and 400 Films are as follows:

| Processor | TRI-X 400 Film | TRI-X 320 Film Rolls | TRI-X 320 Film Sheets |
|-------------------------------------------------|-------------------|----------------------|-----------------------|
| KODAK VERSAMAT Film Processor, Models 5 and 411 | 3.2 ft per minute | 2.3 ft per minute | 3.5 ft per minute |
| KODAK VERSAMAT Film Processor, Model 11 | 6.9 ft per minute | 4.8 ft per minute | 7.3 ft 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:

| KODAK PROFESSIONAL Film | Development Time |
|---------------------------------|------------------|
| TRI-X 400 Film / 400TX | 74 seconds |
| TRI-X 320 Film / 320TX (rolls) | 106 seconds |
| TRI-X 320 Film / 320TX (sheets) | 70 seconds |

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.

Push Processing: Roller Transport Processors

To process pushed TRI-X 320 or 400 Film in a machine with DURAFLO RT Developer (working solution), use a normal machine process with the machine speed shown in the appropriate table below.

| KODAK PROFESSIONAL Film | EI | Machine Speed |
|--------------------------------------------------------|------|---------------------|
| KODAK VERSAMAT Film Processor, Models 5 and 411 | | |
| TRI-X 320 Rolls | 640 | 2.3 ft/min (normal) |
| | 1250 | 1.2 ft/min |
| TRI-X 320 Sheets | 640 | 3.5 ft/min (normal) |
| | 1250 | 1.7 ft/min |
| TRI-X 400 | 800 | 3.2 ft/min (normal) |
| | 1600 | 1.9 ft/min |
| | 3200 | 1.6 ft/min |
| KODAK VERSAMAT Film Processor, Model 11 | | |
| TRI-X 320 Rolls | 640 | 4.8 ft/min (normal) |
| | 1250 | 2.7 ft/min |
| TRI-X 320 Sheets | 640 | 7.3 ft/min (normal) |
| | 1250 | 3.7 ft/min |
| TRI-X 400 | 800 | 6.9 ft/min (normal) |
| | 1600 | 4.0 ft/min |
| | 3200 | 3.4 ft/min |

| Other Roller-Transport Processors | | |
|-----------------------------------|------|----------------------|
| KODAK PROFESSIONAL Film | EI | Development Time |
| TRI-X 320 rolls | 640 | 106 seconds (normal) |
| | 1250 | 192 seconds |
| TRI-X 400 | 800 | 74 seconds (normal) |
| | 1600 | 129 seconds |
| | 3200 | 152 seconds |
| TRI-X 320 Sheets | 640 | 70 seconds |
| | 1250 | 137 seconds |

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 PROFESSIONAL Developer or Developer and Replenisher | Time (min) at 72°F (22°C) |
| TRI-X 320 (rolls and sheets) | 320 640 | T-MAX RS | 4 to 6 |
| TRI-X 400 | 400 800 | T-MAX RS D-76 XTOL | 4 to 6 5 to 7 5 to 7 |

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.

RETOUCHING

You can retouch KODAK PROFESSIONAL TRI-X 400 Film (135 and 120 sizes) on the emulsion side. You can retouch KODAK PROFESSIONAL TRI-X 320 Film (120, 220 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.

Compared to KODAK TRI-X Pan and KODAK TRI-X Pan Professional Film, the newer TRI-X 400 and 320 Films may have a slightly different retouching “feel”.

IMAGE STRUCTURE

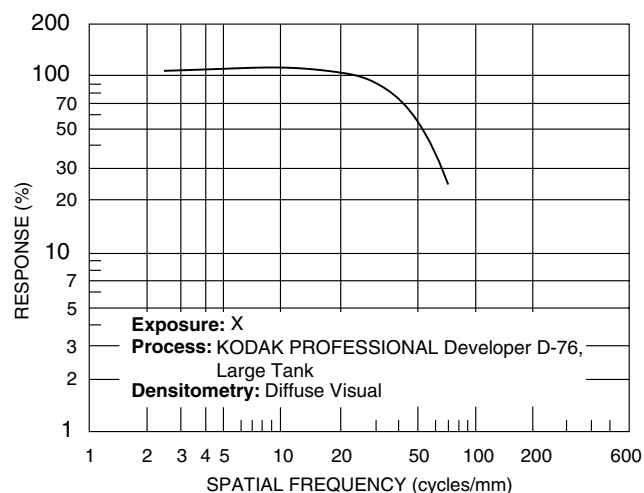
The following information was generated using the old versions of these films. Granularity testing of old and new films in several other developers suggests this information should also be valid for the new versions. The data in this section is based on development in KODAK HC-110 Developer (Dilution B), 68°F (20°C).

| KODAK Film | Diffuse rms Granularity* |
|-----------------------------------|--------------------------|
| KODAK PROFESSIONAL TRI-X 400 Film | 17 (fine) |
| KODAK PROFESSIONAL TRI-X 320 Film | 16 (fine) |

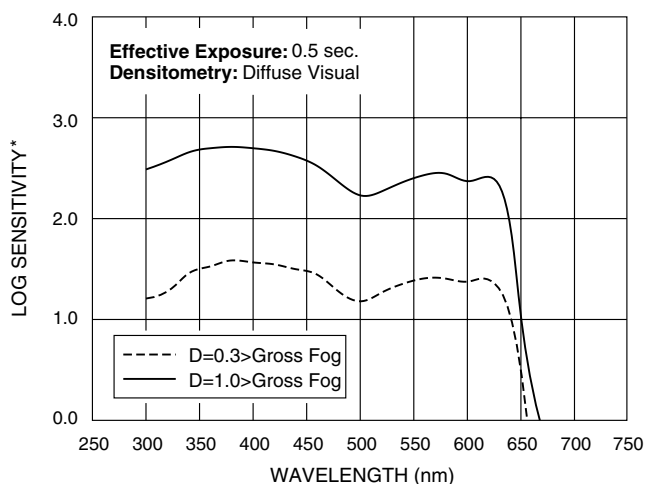
* Read at a net diffuse density of 1.0, using a 48-micrometre aperture, 12x magnification.

CURVES

Modulation Transfer Function



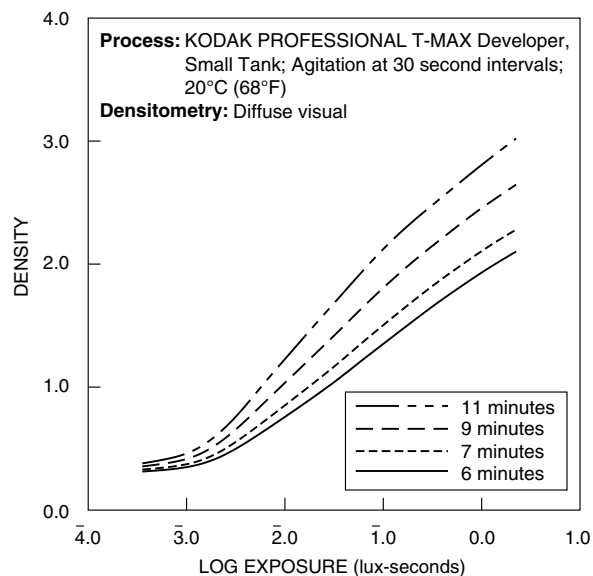
Spectral Sensitivity Curves



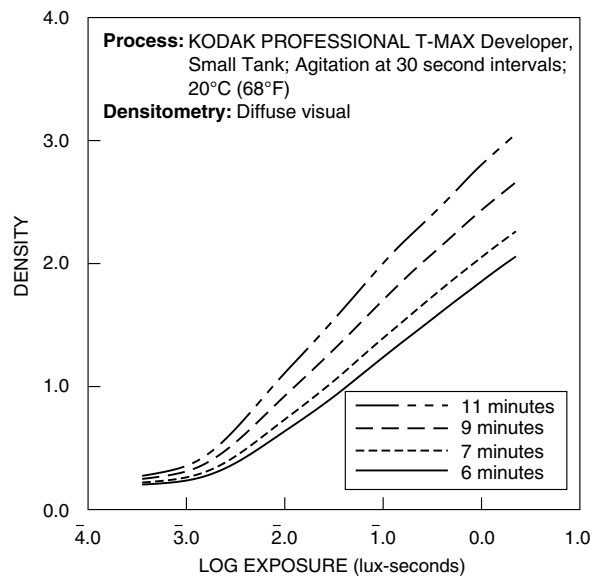
*Sensitivity = reciprocal of exposure (erg/cm^2) required to produce specified density

Note: Modulation Transfer Function and Spectral Sensitivity were generated using the older version of this film (KODAK TRI-X Pan Film 5063). Preliminary data suggests this information would be applicable to the new TRI-X Films.

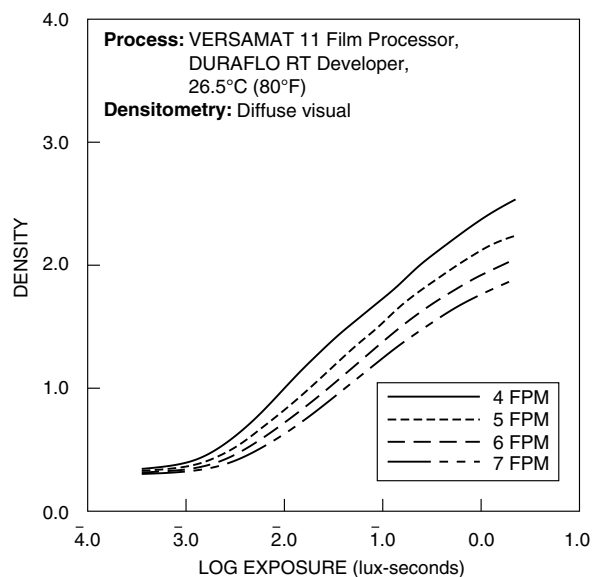
Characteristic Curves
KODAK PROFESSIONAL TRI-X 400 Film / 400TX, 35 mm



Characteristic Curves
KODAK PROFESSIONAL TRI-X 400 Film / 400TX, 120-size

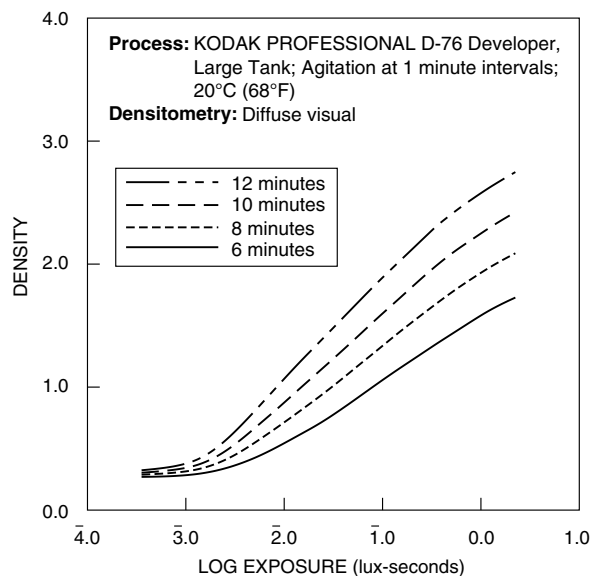


Characteristic Curves
KODAK PROFESSIONAL TRI-X 400 Film / 400TX, 35 mm

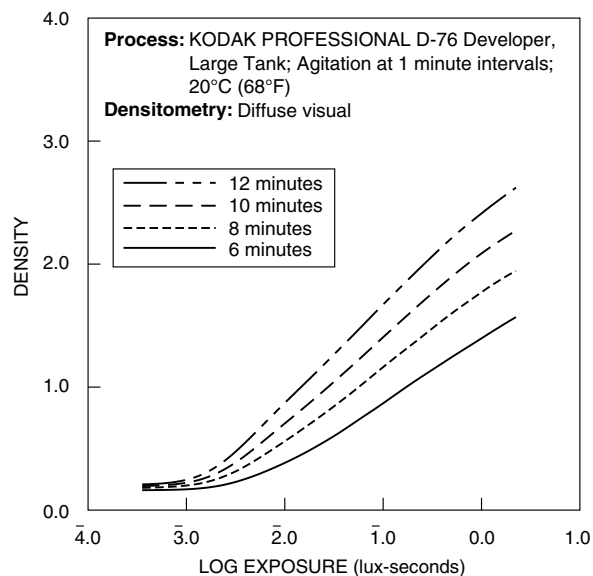


NOTICE: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent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

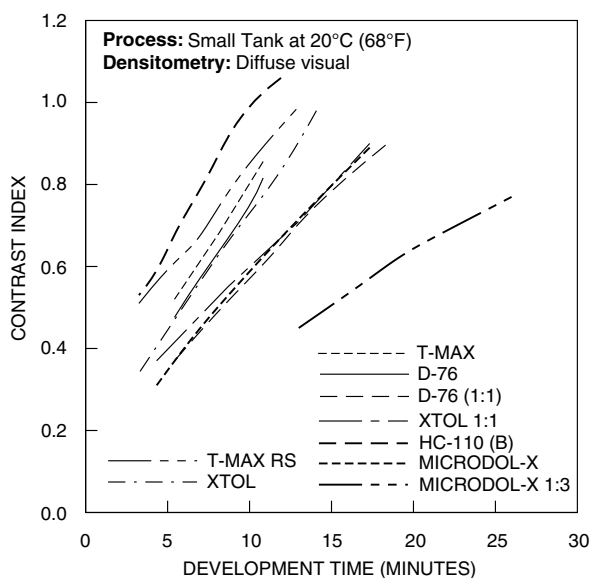
Characteristic Curves KODAK PROFESSIONAL TRI-X 400 Film / 400TX, 35 mm



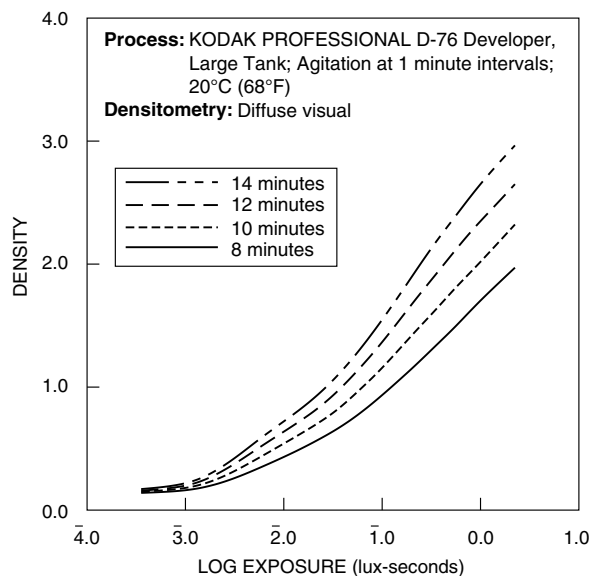
Characteristic Curves KODAK PROFESSIONAL TRI-X 400 Film / 400TX, 120-size



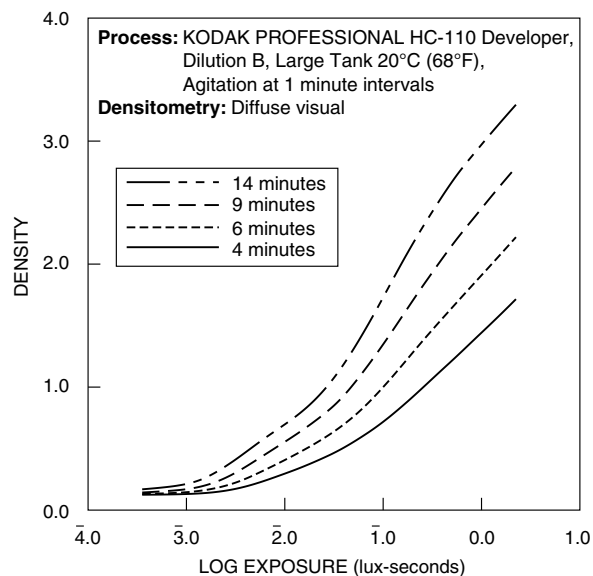
Contrast Index Curves KODAK PROFESSIONAL TRI-X 400 Film / 400TX, 35 mm and 120-size



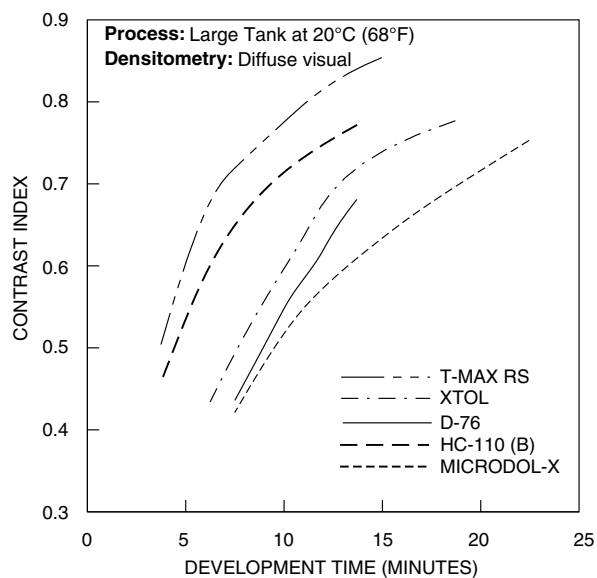
Characteristic Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, 120/220



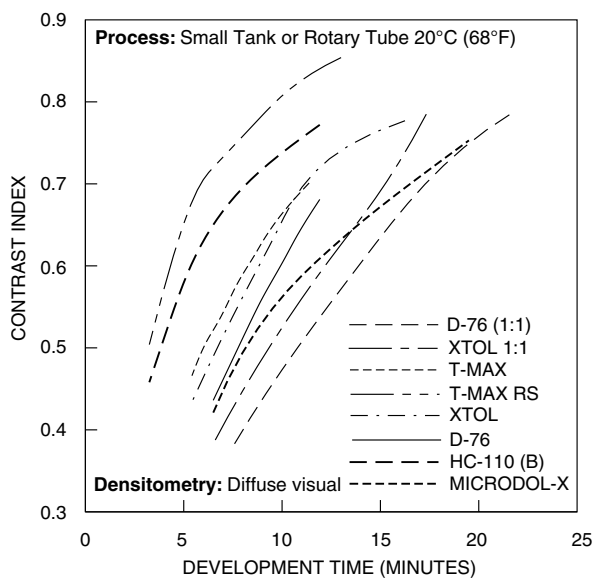
Characteristic Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, 120/220



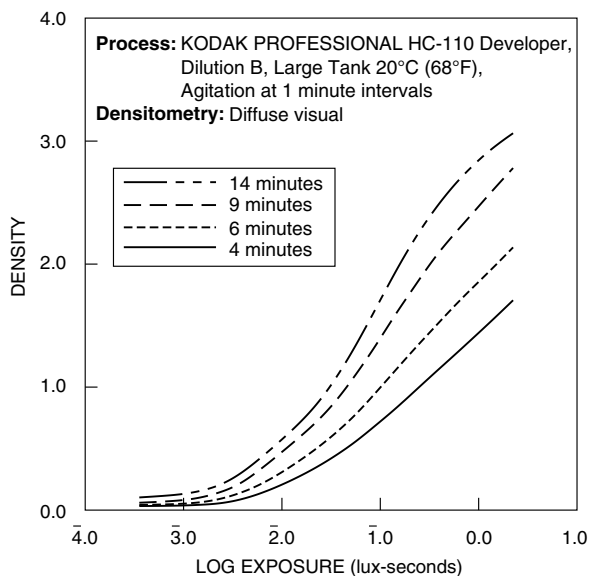
Contrast Index Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, 120/220



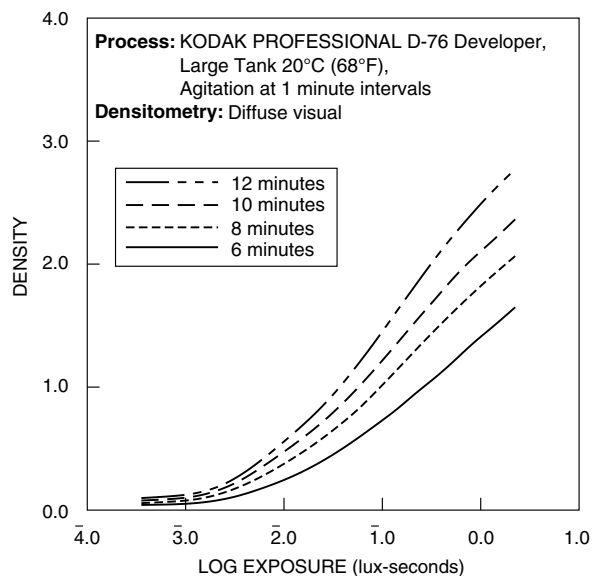
Contrast Index Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, 120/220



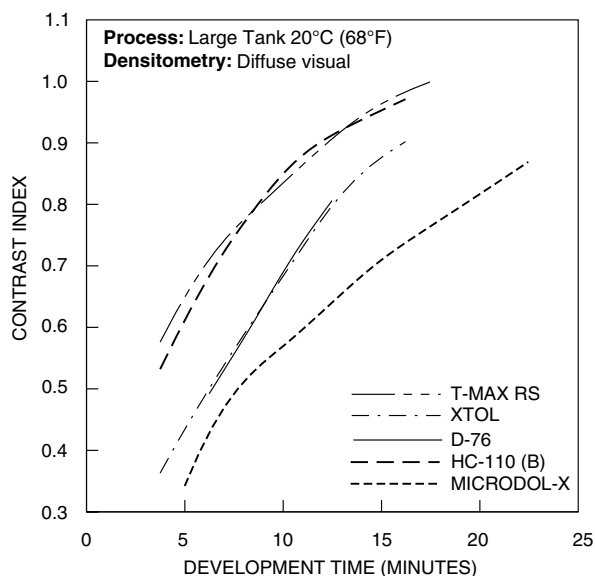
Characteristic Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, Sheets



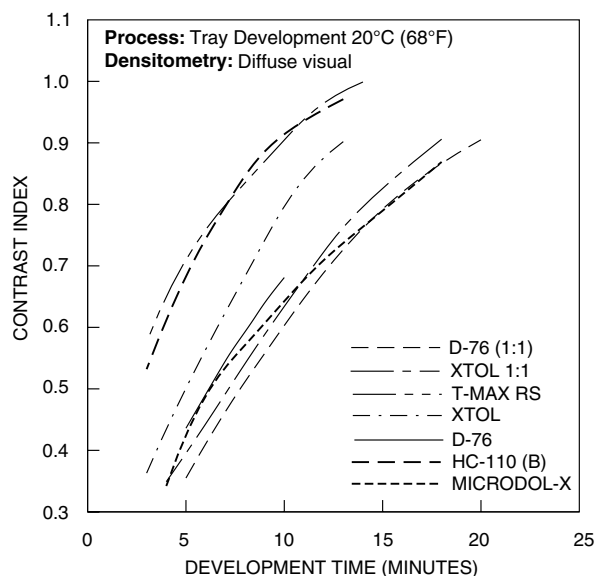
Characteristic Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, Sheets



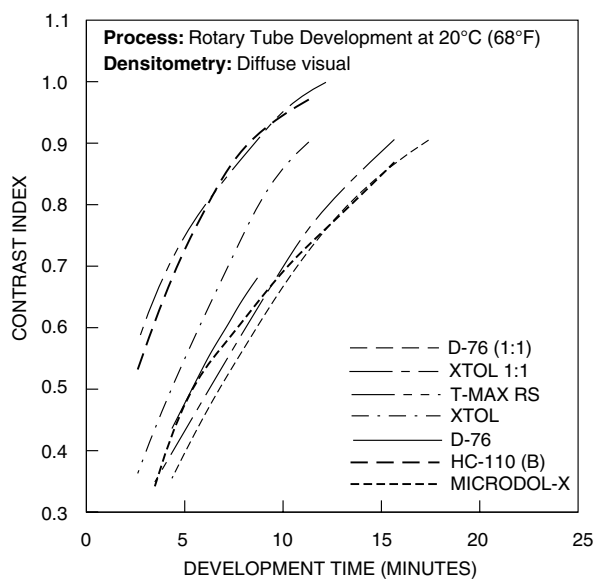
Contrast Index Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, Sheets



Contrast Index Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, Sheets



Contrast Index Curves
KODAK PROFESSIONAL TRI-X 320 Film / 320TXP, Sheets



KODAK PROFESSIONAL TRI-X 320 and 400 Films

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

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

| | |
|------|-------------------------------------------------|
| F-5 | <i>KODAK Professional Black-and-White Films</i> |
| R-20 | <i>KODAK Black-and-White Darkroom DATAGUIDE</i> |

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

Kodak, D-76, DK-50, Estar, HC-110, Kodafix, Microdol-X, Photo-Flo, Tri-X, T-Max, and Wratten are trademarks.

Minor Revision 5-07
Printed in U.S.A.

KODAK PROFESSIONAL TRI-X 320 and
400 Films
KODAK Publication No. F-4017

Film & Photofinishing Systems Group
EASTMAN KODAK COMPANY • ROCHESTER, NY 14650

Kodak