

Guide to Manual Processing of NDT Films



To reach the desired density on a radiograph, many people use set exposure factors and then adjust development time—or "sight develop"—to compensate for under- or overexposed images.

Today, you can eliminate that guesswork and get much more consistent results by using KODAK INDUSTREX Films with our exclusive T-GRAIN Emulsion technology. The key is to use the correct exposure factors when you're shooting the images. We've provided handy KODAK NDT Exposure Calculators to help you determine the right factors for each situation.

By removing the processing variable, you'll get better consistency and higher productivity in the darkroom. Our films provide stable contrast and a relatively stable speed over a wider range of developer temperatures—unlike older film technologies that have highly variable speed, relative to developer temperature and immersion time.

When using an Ir-192 source, you can use the KODAK NDT Exposure Calculator to determine correct exposure (based upon density desired).

Then follow these simple processing recommendations.

Timer and Thermometer

These are essential. They must be accurate and in good condition.

Safelight

Use a KODAK LED Safelight (660nm red) or a red safelight filter (i.e. KODAK 1, 1A, or 2 Safelight Filter) in a suitable safelight lamp equipped with a 15-watt bulb. Keep the film at least 4 feet (1.2 metres) from the safelight.

Note: Other safelight filters (i.e. KODAK 8 and GBX-2 Safelight Filter) which block radiation at 550nm and shorter wavelengths are also suitable for use.

Film Handling

Do not bend film. Handle only by the edges to avoid finger marks and abrasions when loading on hangers. Separate hangers in solutions so that films will not touch each other or the tank wall.

RECOMMENDED CHEMICALS

Developer

Use KODAK INDUSTREX Single-Part Developer and Replenisher.

Stop Bath

Use KODAK Indicator Stop Bath or any acetic acid stop bath mixed at a 3% solution (mix KODAK 28% Acetic Acid at 110 mL/L).

Use a stop bath for 30 seconds. Using a stop bath checks development—rapidly preventing most spotting or streaking—and prolongs the life of the fixing bath.

A running water rinse for one minute may be substituted for a stop bath. However, it may not provide results equivalent to an acetic acid stop bath solution.

Fixer

Use KODAK INDUSTREX LO Fixer and Replenisher or KODAK Rapid Fixer.

Replenishment Rates

Maintain the chemical activity and solution level in the tank by adding replenisher according to instructions below:

Solution	Replenishment Volume	
	per 35 x 43 cm (14 x 17 inch) sheet	per m ²
Developer	100 mL	665 mL
Fixer*	180 mL	1200 mL

* For optimum archivability, a 10% increase in fixer replenishment rate may be desirable.

Stir solutions vigorously after each addition. Follow the manufacturer's instructions for the specific developer replenisher and fixer replenisher you are using.

Additionally:

- When removing films from developer tank, DO NOT ALLOW EXCESS SOLUTION TO DRAIN BACK INTO TANK. Normally this will carry out the proper amount of solution to permit correct replenishment.
- Use floating covers on developer tanks to reduce oxidation and evaporation; store developer replenisher in a closed container.
- Fill the developer and fixer tank to its original level each morning with developer or fixer replenisher solution (topping off).
- Discard solution after adding two tank volumes of replenisher to tank, or at least once a month, and refill with fresh solution.

ENSURING PROCESS QUALITY

Residual Thiosulfate Test

To ensure good keeping characteristics for radiographs, use a test kit such as the KODAK Hypo Test Kit (CAT 196 5847). This test determines whether film has been adequately washed and provides an estimate of the archival life you can expect. The kit comes complete with testing solution and a visual estimator.

Residual Silver Test Solution

An overworked fixing bath contains complex silver thiosulfate compounds that cannot be removed completely by washing. KODAK Residual Silver Test Solution ST-1 provides a quick and accurate method for determining when a fixing bath should be discarded.

Water	100 mL
Sodium Sulfide (Anhydrous)	2 grams

To Use: Store stock solution in a small stoppered bottle not more than 3 months. Dilute 1 part stock solution with 9 parts water. (Replace working solution weekly.) Place a drop of ST-1 Solution on the margin of processed film. Remove solution after 2 to 3 minutes. Any yellowing of test area indicates the presence of silver. Refix film in fresh fixer and rewash. The yellow stain is permanent.

Fixer Test Solution

KODAK Fixer Test Solution, FT-1, checks the silver content of the fixer bath.

Water at 27°C (80°F)	750 mL
Potassium Iodide	190 grams
Water to make	1 litre

To 5 drops of KODAK Fixer Test Solution, FT-1, add 5 drops of the fixing bath and 5 drops of water. Discard the fixer if a yellow-white precipitate forms instantly. (Any slight milkiness can be disregarded.)

You can also use Silver Estimating Test Papers to measure the silver content in your fixer. One supplier is USI International, Inc. (www.silverprofit.com).

KODAK NDT Exposure Calculator

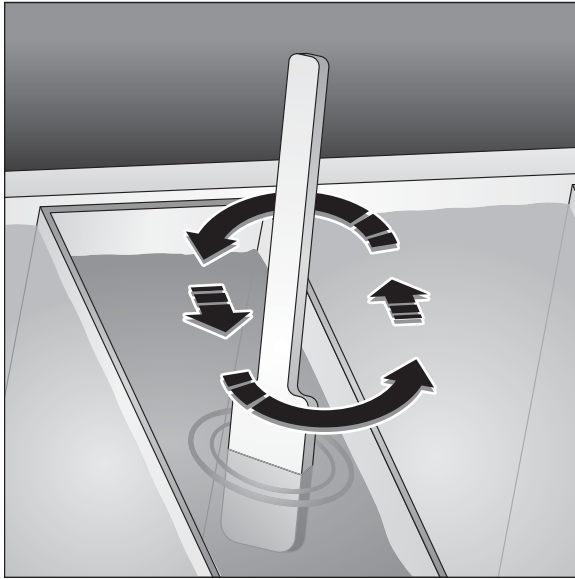
The KODAK NDT Exposure Calculator eliminates guesswork in determining the proper exposure and processing when using an Ir-192 source. It provides the proper exposure for a given material thickness, distance, source strength, and development*. Today, many shots are lost due to sight adjustment of density during the development cycle, so we've removed the development variable to make your results more consistent. But again, getting the proper exposure is critical—so use the calculator for the correct factor for your situation.

Metric	CAT 841 9335
Imperial	CAT 176 9967

* The KODAK NDT Exposure Calculator was standardized with a development time of 4 minutes at 72°F (22°C).

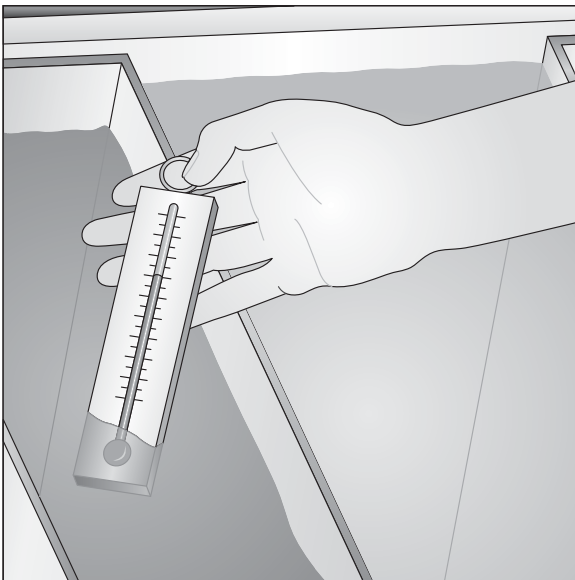
Your Step-by-Step Guide to Processing KODAK INDUSTREX Films

1) Stir Solutions



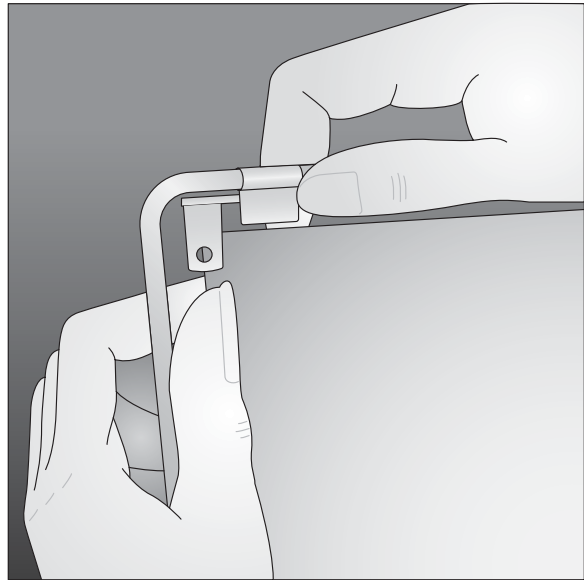
Stir developer and fixer to equalize their temperatures. Use separate paddles for each to avoid contamination.

2) Check Temperature



Check temperature of solutions with an accurate thermometer, rinsing it off after checking each one. Adjust temperature as needed.

3) Load Film on Hanger



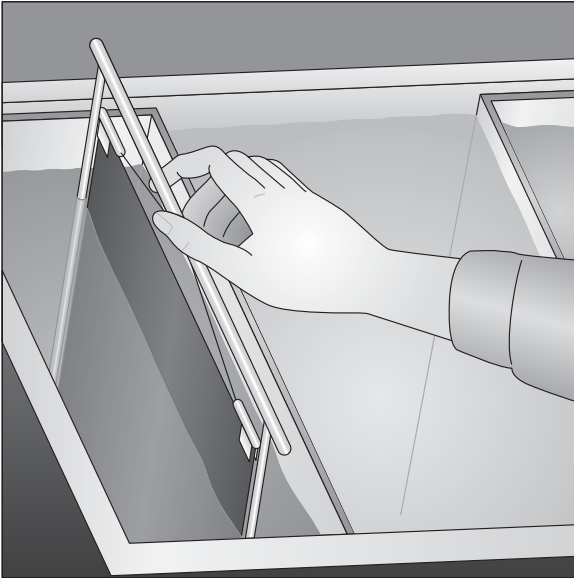
Attach film carefully to proper-sized hanger. Attach lower corners first. Avoid finger marks, scratches or bending.

4) Set Timer for Developing



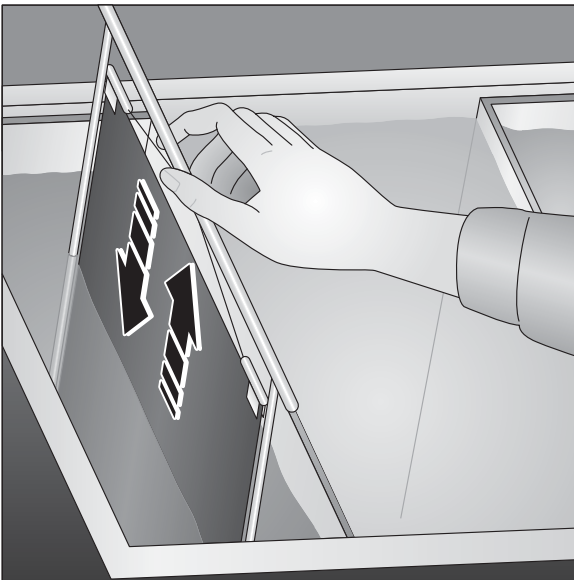
Set timer. **5 minutes** at 68°F (20°C) is recommended. (4 minutes at 72°F [22°C] if using the KODAK NDT Exposure Calculator).

5) Immerse Film in Developer



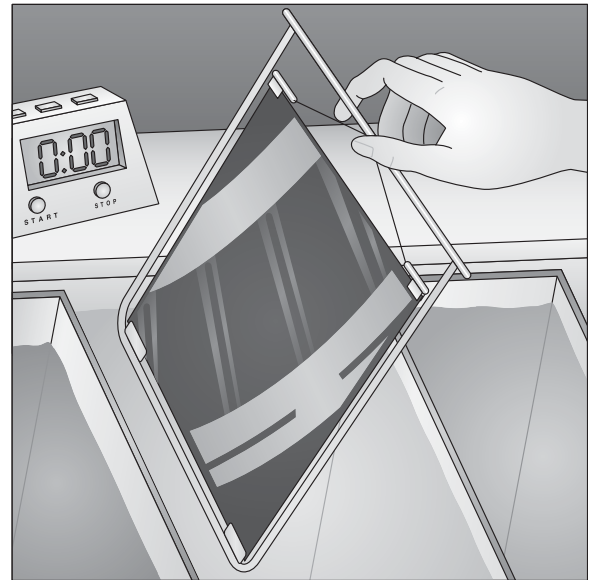
Completely immerse film. Do it smoothly, and without pausing to avoid streaking. Start timer.

6) Agitate Film



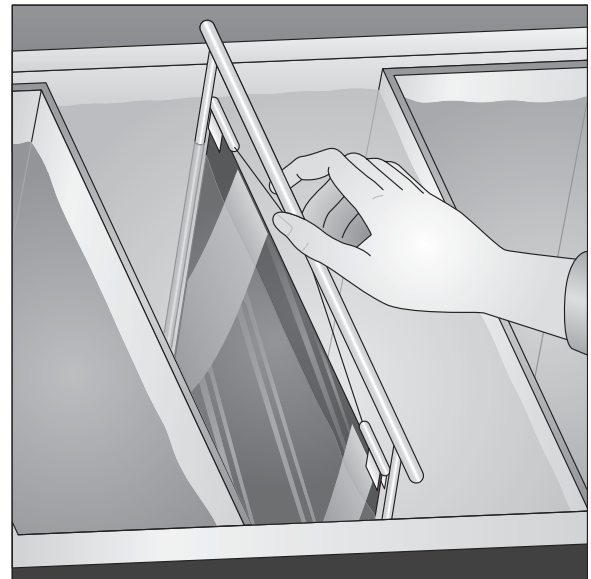
Tap hanger to dislodge air bubbles immediately after immersion in the developer. **Agitate for 5 seconds every 30 seconds.**

7.) Drain (Outside Developer)



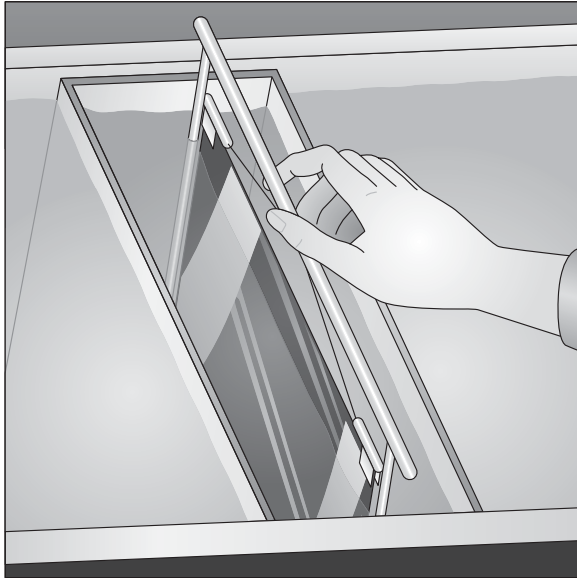
When the timer goes off, quickly lift the hanger out of the developer. Then drain film **for a moment** into the space between the tanks. For faster drainage, tilt the hanger.

8) Immerse in Stop Bath



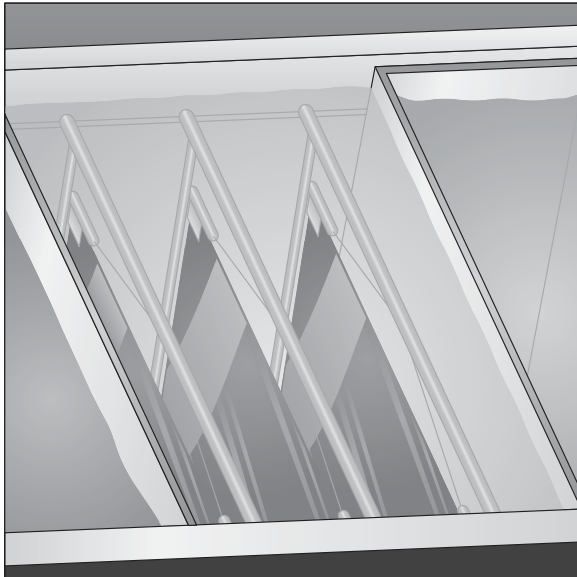
Place film in stop bath for **30 seconds**. Then agitate moderately, lift from stop bath, and drain well.

9) Fix Adequately



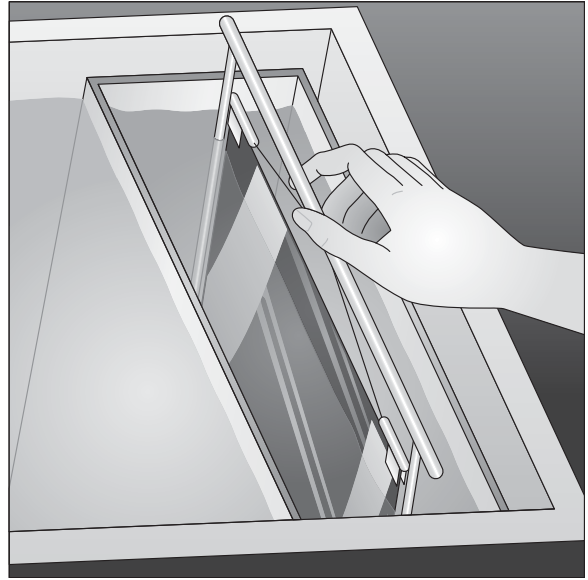
Immerse film in fixer for **3 to 6 minutes**, agitating for **5 seconds every 30 seconds**. Film should remain in fixer for twice the time it takes to "clear" it (when the milky look disappears). **Never fix film for less than 3 minutes.**

10) Wash Completely



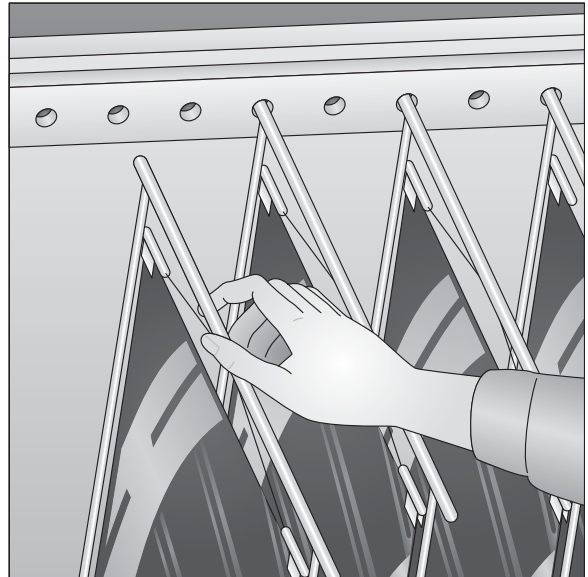
Place film hangers in tank of running water for **10 to 30 minutes**. Keep ample space between hangers (water must flow over the tops).

11) Final Rinse



If facilities permit, use a final rinse of KODAK PHOTO-FLO Solution to speed drying and prevent water marks. Immerse film for about **30 seconds**, and then drain for several seconds.

12) Place in Dryer



Dry film at room temperature in a dust-free area or suitable drying cabinet. Temperature must not exceed 120°F (49°C). When dry remove from hangers and insert in envelopes.

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Developer Times and Temperatures

Developer Temperature	Development Time (Minutes)*	Acetic Acid Stop Bath	Fixer	Wash†
68°F (20°C)	5	30 to 60 seconds (Continuous moderate agitation)	3 to 6 minutes or twice the time to clear film (Vigorous agitation for 15 seconds then 5 seconds every 30 seconds)	10 to 30 minutes in running water† (8 volume changes per hour)
72°F (22°C)	4			
75°F (24°C)	3			
79°F (26°C)	2			

* If it is necessary to process film at temperatures around 75°F (23.9°C) the fixer solution should be renewed frequently. The film should be fixed to provide maximum hardening and the washing time should be limited to 15 minutes.

† KODAK Hypo Clearing Agent can be used following the fixer to reduce wash times and conserve water. First rinse films in running water for 30 seconds, then use Hypo Clearing Agent for 1 to 2 minutes, followed by a final running water wash for 5 minutes.

‡ KODAK Photo-Flo Solution may be used after washing to reduce water spots and drying marks.

NOTICE: While the sensitometric data in this publication are typical of production coatings, they do not represent standards which must be met by Kodak. Varying storage, exposure, and processing conditions will affect results. The company reserves the right to change and improve product characteristics at any time.

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