

## TECHNICAL INFORMATION

**ILFOTEC DD-X**

LIQUID CONCENTRATE REUSABLE DEVELOPER FOR LOW VOLUME BLACK AND WHITE FILM PROCESSING IN SPIRAL TANKS, DISHES, TRAYS AND ROTARY PROCESSORS

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**Overview**

ILFORD ILFOTEC DD-X is an excellent fine grain developer which gives full film speed and produces negatives that are easy to print. Correctly exposed negatives developed in ILFOTEC DD-X have a full range of tones, with depth in the shadows, a smooth transition through the mid-tones and bright detailed highlights.

ILFOTEC DD-X is designed to complement the features of all ILFORD films, especially the range of ILFORD DELTA PROFESSIONAL films. It is particularly recommended for use with DELTA 3200 PROFESSIONAL film rated at EI 3200/36. It also gives excellent results when used with quality black and white films from other manufacturers.

ILFOTEC DD-X ensures a good balance of fine grain, sharpness and tonal rendition producing negatives which allow a high degree of enlargement. In addition, it is highly recommended when fast films need to be push processed such as HP5 Plus, DELTA 400 PROFESSIONAL, DELTA 3200 PROFESSIONAL and SFX200.

ILFOTEC DD-X is supplied as a liquid concentrate diluted 1+4 for one-shot use when the highest image quality is required. However, for greater economy it can be reused but image quality will be reduced slightly.

**Mixing instructions**

Note Photographic chemicals are not hazardous when used correctly. It is recommended that gloves, eye protection and an apron or overall are worn when handling and mixing all chemicals. Always follow the specific health and safety recommendations on the chemical packaging.

Photochemical material safety data sheets containing full details for the safe handling, disposal and transportation of ILFORD chemicals are available from ILFORD agents or directly from the ILFORD web site at: [www.ilfordphoto.com](http://www.ilfordphoto.com)

Determine first either the tank size being used or the number of films to be processed and measure out the appropriate quantity of concentrate. Always use the smallest measuring cylinder available; it is easier to measure 10ml accurately in a 50ml cylinder than in a 500ml cylinder.

Add the concentrate to the mixing vessel. A large measuring jug is a good mixing vessel as it provides a check on the total quantity of solution mixed. Rinse out the measuring cylinder used for the concentrate into the mixing vessel. Finally add hot and cold water to make up the final volume at the desired temperature and stir thoroughly.

As most water drawn from pressure mains is highly aerated, we advise that users draw off the water they need and leave it to stand for a few minutes before using it to make up developers.

Thoroughly wash all utensils, measuring and mixing vessels after use. Do not contaminate developer solutions with either stop bath or fixer solutions.

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### Table of Dilutions

The following table gives a list of common spiral tank sizes - cross referenced with the amount of liquid concentrate and water required to fill the tank.

Tank Size (ml)	Dilution 1+4 Concentrate / Water
100	20/80
150	30/120
200	40/160
250	50/200
300	60/240
350	70/280
400	80/320
450	90/360
500	100/400
600	120/480
700	140/560
800	160/640
900	180/720
1000	200/800
2000	400/1600

1 litre = 33.81 US fluid ounces

3.8 litre = 1 US gallon

29.6 ml = 1 US fluid ounce.

### Note

We advise not to use amounts of concentrate less than 10ml when mixing working strength solutions as it is difficult to measure accurately such small quantities with a measuring cylinder. If it is necessary to measure out very small quantities, use a graduated pipette.

### pH and specific gravity

The following table gives the pH and specific gravity (SG) for a fresh solution of ILFOTEC DD-X developer. These figures were obtained under carefully controlled laboratory conditions and may differ slightly from measurements made by users in their own working areas. Users should make their own control measurements from their accurately mixed fresh solutions for later comparison. Ideally a pH meter should be used to measure solution pH, but if one is not available pH measurement sticks can be used. These are available in various pH ranges and those covering a range pH7 to pH10 are sufficient. SG can be measured by using a hydrometer and one covering the range from 1.000 to 1.200 is useful for a wide range of photographic process solutions.

Developer	Dilution	pH	SG at 20°C/68°F
ILFOTEC DD-X	1+4	8.45 - 8.55	1.070

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## PROCESS SYSTEMS

### Manual processing – Spiral Tanks

ILFOTEC DD-X developer can be used to process films in spiral tanks using the recommended dilutions. The recommended developing temperature is 20°C (68°F). It can be used in the temperature range of 20°-24°C (68°-75°F), but the recommended development times must be reduced if higher temperatures are used. Care must be taken with the choice of dilution and temperature as very short development times with some films may lead to uneven processing.

Before starting to process, prepare the appropriate volume of all the required solutions according to tank size and number of films to be processed together. The solution volume must be enough to cover all the spirals used. Check the temperature of all the processing solutions and adjust them to be +/- 1°C (2°F) of the temperature being used.

Add the developer to the processing tank. Tap the tank firmly on the work bench to dislodge any air bubbles which may be trapped in the processing spiral.

The following agitation is recommended for spiral tank processing with ILFORD chemicals; Invert the tank four times during the first 10 seconds. Repeat these four inversions during the first 10 seconds of each subsequent minute of development. At the end of each agitation sequence, tap the tank firmly on the work bench to dislodge any air bubbles which may be trapped in the processing spiral. This method of agitation should also be used with the fixer.

Drain off the developer 10 seconds before the end of the development time and then immediately fill the tank with the next process solution.

### Dish (tray) processing - Sheet film format

ILFOTEC DD-X developer can be used to process sheet film in dishes (trays) at the recommended temperature of 20°C (68°F) ±1°C(2°F). Higher temperatures are not recommended as the development times may become too short and lead to uneven processing.

Before starting to process, prepare the required volume of solutions according to dish (tray) size used and number of films to be processed. The solution volume must be enough to cover the sheet film completely during processing. Check the temperatures of all the process solutions and adjust them to be ±1°C(2°F) of the temperature being used.

When dish / tray processing continuous agitation is used, immerse the film completely in the developer and gently rock the dish from side to side taking care to avoid any spillage. This method of agitation is used for all subsequent processing steps. Continuous agitation reduces the recommended development times by about 15%.

Remove the film from the dish /tray 10 seconds before the end of the development time and allow developer to drain from its surface before placing it in the stop bath.

### Rotary tube processors

Rotary tube processors have very similar processing conditions to spiral tank processing by hand, except they process with small amounts of solution using continuous agitation and can be pre-programmed. ILFOTEC DD-X developer can be used to process films in rotary processors using recommended dilutions at 20°C (68°F).

Follow any guidance given by the processor manufacturer when adjusting process times for these types of processors. However, generally we do not recommend using a pre-rinse as it can lead to uneven development.

Without using a pre-rinse, the given development times will need to be reduced by around 15% to compensate for the continuous agitation.

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### DEVELOPMENT TIMES

The table of development times shown below gives an appropriate starting point for ILFOTEC DD-X developer when general purpose black and white camera films are being developed in spiral tanks with intermittent agitation.

The development times are for films rated at an appropriate EI rating for each developer and they should produce negatives of normal contrast, typically around a Gbar of 0.62. However, they are only a guide and may need to be adjusted to suit individual processing systems, working practices and preferences.

		20°C/68°F (MIN:SEC)	24°C/75°F (MIN:SEC)
<b>ILFORD FILMS</b>	<b>EI</b>	<b>1+4</b>	<b>1+4</b>
DELTA 100 PROFESSIONAL	50/18	8:00	5:30
	100/21	10:30	7:30
	200/24	12:00	9:00
DELTA 400 PROFESSIONAL	200/24	6:00	4:30
	400/27	8:00	6:00
	500/28	9:30	7:00
	800/30	10:30	7:30
	1600/33	13:30	9:00
	3200/36	18:00	13:00
DELTA 3200 PROFESSIONAL	400/27	6:00	
	800/30	7:00	5:00
	1600/33	8:00	6:00
	3200/36	9:30	7:00
	6400/39	12:30	9:00
	12800/42	17:00	12:00
PAN F PLUS	25/15	7:00	4:00
	50/18	8:00	5:00
FP4 PLUS	50/18	8:00	6:00
	125/22	10:00	8:00
	200/24	12:00	10:00
HP5 PLUS	400/27	9:00	7:00
	800/30	10:00	8:00
	1600/33	13:00	10:00
	3200/36	20:00	14:30
SFX 200	200/24	10:00	7:00
	400/27	14:00	10:00
ORTHO PLUS	80/20 (Daylight)	10:30	7:30
	40/17 (Tungsten)	10:30	7:30
<b>KENTMERE FILMS</b>			
KENTMERE PAN 100	50	8:30	6:30
	100	10:30	7:30
	200	12:30	9:00
KENTMERE PAN 400	400	11:30	8:30
	800	13:00	10:00

# ILFORD ILFOTEC DD-X FILM DEVELOPER

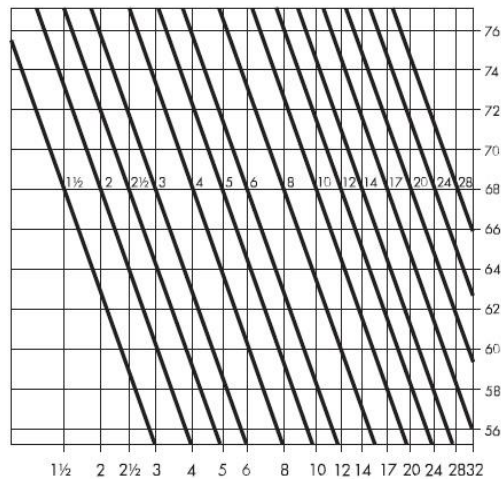
		20°C/68°F (MIN:SEC)	24°C/75°F (MIN:SEC)
<b>OTHER MANUFACTURERS FILMS</b>	<b>EI</b>	<b>1+4</b>	<b>1+4</b>
Kodak 100 Tmax	100/21	7:00	5:00
	200/24	9:00	7:00
Kodak 400 Tmax	200/24	7:00	5:00
	400/27	8:00	6:00
	800/30	10:00	8:00
	1600/33	13:00	10:00
Kodak 3200 Tmax	800/30	7:30	6:00
	1600/33	9:00	7:30
	3200/36	11:00	9:00
	6400/39	15:00	12:00
Kodak 400 Tx	200/24	6:30	4:30
	400/27	8:00	6:00
	800/30	10:00	8:00
	1600/33	14:00	11:00
Agfa APX 100	100/21	10:30	7:30
Agfa APX 400	400/27	11:30	8:30

\*Development times for other manufacturers films are provided as a guide only and cannot be guaranteed. Other manufacturers may change the specifications of their films over time without telling us.

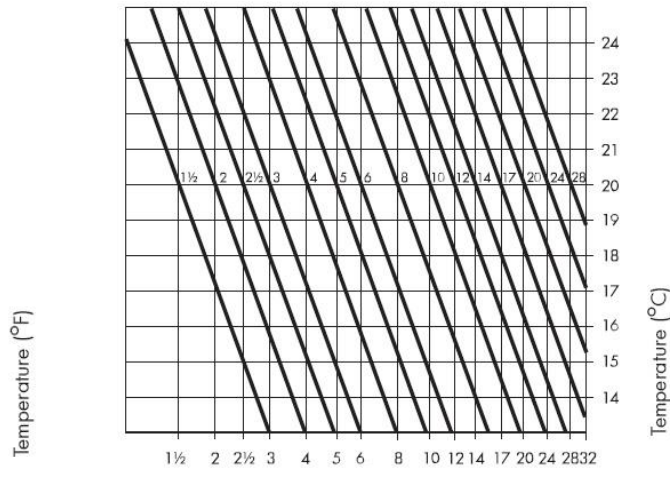
Higher or lower contrast negatives may be preferred by some to suit their individual requirements - adjust the recommended development times until the desired contrast level is obtained. ILFOTEC DD-X developer can be used in the temperature range of 20°-24°C (68°-75°F).

For processing at other temperatures, increase the given times by 10% for each 1°C drop in temperature and decrease the given development times by 10% for each 1°C rise in temperature.

Alternatively use the time temperature graphs below. For example, if 4 minutes at 20°C/68°F is recommended; the time at 23°C / 73°F will be 3 minutes and the time at 16°C / 61°F will be 6 minutes.



New development time (min)



New development time (min)

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## REUSING DEVELOPER

For the highest image quality ILFOTEC DD-X should be used as a one-shot developer, however for greater economy it can be reused to process either several films individually or multiple films in batches.

1 Litre of ILFOTEC DD-X 1+4 can process up to 10 x 135/36 or 120 roll films provided that the developer is reused.

As each film or batch of films is processed it releases halides and other by-products into the developer that act as a restrainer on the development of subsequent films. For this reason, development times will need some adjustment after each successive film or batch of films. To calculate the adjustment a tally must be kept of the number of films processed in the developer solution.

If a series of individual films is being developed in a spiral tank using 1 litre of ILFOTEC DD-X, compensate for the loss of developer activity after developing the first film by increasing the development time 10% for each successive film, (see table below). This method of time adjustment relies on the used developer, (250-300ml for one 135/36 film), being poured back into the working strength solution's storage bottle and mixed with the fresh unused part of the developer before processing the next film. When using spiral tanks this helps to give more consistent results by reducing the risks of problems due to solution losses and the restraining effect of the by-products.

### Number of films and Development time compensation when re-using developer

1 Litre of	N	N+10%	N+20%	N+30%	N+40%	N+90%
ILFOTEC DD-X	1	2	3	4	5	10

N = Std Development Time

When larger quantities of developer are in use; increase the number of films that can be processed proportionally with the volume of working strength developer being used, e.g. if 5 litres of stock ILFOTEC DD-X 1+4 are being used then increase the development times by 10% after processing every batch of 5 films

Reusing stock developer solutions can make more economical use of them but it is not without its drawbacks particularly when small volumes are being used. More inconsistencies will be seen by reusing a developer than by using a fresh developer solution on each occasion. The time compensation can only approximate a range of circumstances such as film and negative types, solution losses and its age, etc. For example, if your negatives are night shots which will be relatively clear when developed then little of the developing agents will have been used in processing them. At the other extreme if the negatives are well blackened after development because they are of beach scenes in bright sunlight then more developing agent will have been used.

Overall reusing developer lowers image quality slightly and increases the risk of physical damage. As the developer oxidises with reuse and storage, the risk of contamination is increased, precipitates may be formed and tiny particles of emulsion from the films processed previously may be held in suspension. In addition, there is also a risk of miss counting the number of films that have been processed by a batch of developer.

"One-shot" processing using ILFOTEC DD-X 1+4 eliminates or greatly reduces these problems. One-shot processing is recommended when image quality, reliability and consistency are more important than economy.

We do not recommend push processing using reused developers.

## WORKING SOLUTION LIFE

ILFOTEC DD-X working strength solutions should not be kept for more than 24 hours. Make up fresh developer each time it is needed and discard it after the processing session.

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## STOP, FIX, WASH and RINSE

For best results it is recommended that all process solutions are kept at the same temperature or at least within 5°C (9°F) of the developer temperature.

### Stop Bath

After development the film can be rinsed in water, but we recommend that an acid stop bath is used such as ILFORD ILFOSTOP (with indicator dye). ILFOSTOP is also recommended for all machine processing applications. When tanks or dishes (trays) of process solutions are in use a stop bath immediately stops development and reduces carry over of excess developer into the fixer bath. This helps to maintain the activity and prolong the life of the fixer solution.

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ILFORD ILFOSTOP	
Dilution	1+19
Temperature Range	18–24°C (64–75°F)
Time (sec) at 20°C (68°F)	10
Capacity (films per litre, unrefilled)	15x (135-36)

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The process time given is the minimum required, if necessary, a longer time may be used and should not cause any process problems provided it is not excessive.

### Fix

The recommended fixers are ILFORD RAPID FIXER or ILFORD HYPAM FIXER.

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ILFORD RAPID OR HYPAM FIXERS	
Dilution	1+4
Temperature Range	18–24°C (64–75°F)
Time (mins) at 20°C (68°F)	2-5
Capacity (films per litre, unrefilled)	24x (135-36)

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### Wash

Wash the films in running water for 5–10 minutes at a temperature within 5°C (9°F) of the process temperature. Or see note below for greater economy when using spiral tanks.

**Note:** For spiral tank use, the following method of washing is recommended. This method of washing is faster, uses less water yet still gives negatives suitable for long term storage.

After fixing, fill the spiral tank with water at the same temperature, +/- 5°C (9°F), as the processing solutions and invert it five times. Drain the water away and refill. Invert the tank ten times. Once more drain the water away and refill. Finally, invert the tank twenty times and drain the water away.

### Rinse

For a final rinse use ILFORD ILFOTOL wetting agent added to water, it helps the film to dry rapidly and evenly. Start by using 5ml per litre of rinse water (1+200), however the amount of ILFOTOL used may need some adjustment depending on the local water quality and drying method. Too little or too much wetting agent can lead to uneven drying. Remove excess rinse solution from the film before drying.

### Drying

To avoid drying marks, use a clean squeegee or chamois cloth to wipe the film before hanging it to dry. Dry at 30–40°C/86–104°F in a drying cabinet or at room temperature in a clean dust-free area.

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### **STORAGE**

Always store chemicals in their original containers and away from unsupervised children and pets. In cool, dry conditions, 4–20°C (44–68°F) ILFOTEC DD-X developer concentrate should keep in good condition for:  
24 months in full tightly capped bottles.  
4 months in half full tightly capped bottles.

### **AVAILABILITY AND CAPACITY**

ILFOTEC DD-X is available in 1 litre bottles world-wide.  
Used at 1+4 for one shot processing it will develop 16x 135/36 films.  
If reuse techniques are used, it will develop up to 50x 135/36 or 120 films.

A wide range of technical information is available which describes and gives guidance on using ILFORD PHOTO products. Some products in this data sheet might not be available in your country.

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