TECHNICAL INFORMATION

# ILFOTEC RT RAPID

## FILM DEVELOPER AND REPLENISHER FOR THE ILFOLAB FP40, ROLLER TRANSPORT AND SHORT LEADER CARD FILM PROCESSORS

ILFORD ILFOTEC RT RAPID is a replenishable developer for machine processing all general purpose black and white films, it must be used in conjunction with ILFORD ILFOTEC RT RAPID STARTER solution. It is supplied as a two part liquid concentrate kit, part A and part B, that on dilution make up replenisher solution. The addition of ILFOTEC RT RAPID STARTER turns the working strength replenisher into working strength developer. ILFOTEC RT RAPID is specifically designed for replenished roller transport and short leader card process systems when very short development times or high temperatures are needed. It is the recommended developer for the ILFOLAB FP40.

It is not recommended for developing films in dip and dunk (hanger) or rotary tube or continuous long leader processors or deep tanks, spiral tanks and dishes (trays).

ILFOTEC RT RAPID has a long tank life and good resistance to contamination, reliably producing excellent results under a wide range of conditions. The recommended operating temperature range is 22–28°C, (72–82°F).

### MIXING

**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**

The standard ILFOTEC RT RAPID replenisher dilution for all applications is 1 part A + 1 part B + 2 parts water, however, if needed a modified replenisher dilution of 1+1+5 can be used. Do not directly mix part A with part B, always add some water to part A then add part B and make up to volume with water. When mixing process solutions always stir them thoroughly before use.

To make 1 litre of standard mix (1+1+2) replenisher, measure out 250 mls of part A and add 250 mls of water while stirring. Continue to stir and add 250 mls of part B, finally make up to 1 litre with 250 mls of water.

To make 1 litre of modified mix (1+1+5) replenisher the liquid volumes are 143 mls of part A plus 357 mls of water, plus 143 mls of part B and finally another 357 mls of water.

To make either standard or modified ILFOTEC RT RAPID developer ILFORD ILFOTEC RT RAPID STARTER must be added to the working strength replenisher.

To make 1 litre of standard mix (1+1+2) developer, take 920 ml of replenisher, add 11 ml of ILFOTEC RT RAPID STARTER, and 69 ml of additional water.

To make 1 litre of modified mix (1+1+5) developer, take 910 ml of replenisher, add 9 ml of ILFOTEC RT RAPID STARTER, and 81 ml of additional water.

### To Make Solutions for the ILFOLAB FP40 film processor

The ILFOLAB FP40 has a 10 litre development tank and a 10 litre replenishment tank.

To make 10 litres of standard (1+1+2) replenisher mix:-
2.5 litres part A + 2.5 litres of water + 2.5 litres part B + 2.5 litres of water

To make 10 litres of standard (1+1+2) developer mix:-
9.2 litres of replenisher + 110ml of ILFOTEC RT RAPID STARTER + 690ml of water

To make 10 litres of modified (1+1+5) replenisher mix:-
1.43 litres part A + 3.57 litres of water + 1.43 litres part B + 3.75 litres of water

To make 10 litres of modified (1+1+5) developer mix:-
9.1 litres of replenisher + 90ml of ILFOTEC RT RAPID STARTER + 810ml of water

**NB** It is very important to make sure that the correct amount of ILFOTEC RT RAPID STARTER is calculated for the amount of developer being made and that it is measured and dispensed accurately. Adding more or less than the amount required can significantly affect the development time recommendations.

Before mixing fresh batches of ILFOTEC RT RAPID ensure that the developer and replenisher tanks, connecting solution lines and any mixing vessels are thoroughly rinsed and cleaned, particularly if it is being used for the first time. When making solutions ensure that the mixing vessel is large enough for the volume of solution to be mixed and stirred.

After filling a processor with any fresh tank solution, switch it on and allow it to get up to temperature and circulate the solutions. After the working temperature is reached leave it recirculating for at least 10 minutes to ensure the fresh chemicals are thoroughly mixed before attempting to process any film. Always replace the tank covers on the process and replenishment solutions. The processor is now ready to use.

Wash out the mixing vessel.

### pH and specific gravity

The following table gives the pH and specific gravity (SG) for fresh, working strength ILFOTEC RT RAPID developer and replenisher. 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 own 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 from pH 7 to pH 10 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.

| Dilution | pH | SG (20°C/68°F) |
|---|---|---|
| 1+1+2 developer | 9.50 | 1.120–1.130 |
| 1+1+2 replenisher | 9.70 | ——— |
| 1+1+5 developer | 9.50 | 1.060–1.070 |
| 1+1+5 replenisher | 9.70 | ——— |

## PROCESSORS

### ILFORD ILFOLAB FP40

ILFOTEC RT RAPID is specifically recommended for use in the ILFORD ILFOLAB FP40 film processor, it can be used at either dilution. The recommended process temperature for both dilutions is 26°C (79°F). Agitation is given by the film passing through the developer and the action of the processor's re-circulation system. The ILFOLAB FP40 film processor is an automatic short leader processor with daylight loading designed for processing black and white 35mm films. The ILFOLAB FP40 also has a wide range of optional accessories that make it able to process 120 and 220 roll film and long lengths of 16mm and 35mm film, 125 micron (0.005 inch) thick up to 30.5m (100 ft) and 75 micron (0.003 inch) thick to 61m (200 ft).

### Short leader film processors

There are other short leader processors designed specifically for black and white film processing but many of those used are converted colour film processors. These machines can operate in a wide temperature range but for black and white processing temperatures in the range of 22–28°C (72–82°F) should be used. ILFOTEC RT RAPID at 26°C (79°F) is the recommended developer for all of these processors but it can be used at other temperatures with appropriate modification of the development times.

### Roller transport film processors

Roller transport film processors for black and white film come in many different design configurations. ILFOTEC RT RAPID is recommended for film roller transport processors when either short development times or high temperatures are needed. Typically the temperature used in a film roller transport processors is 26–30°C (79–86°F). The recommended process temperature for ILFOTEC RT RAPID is 26°C (79°F) but it can be used at other temperatures with appropriate modification of the development times.

## DEVELOPMENT TIMES

The table of development times given here is for seasoned replenished ILFOTEC RT RAPID developer with ILFOTEC RT RAPID STARTER at 26°C (79°F) in an ILFOLAB FP40 processor. They can also be used as a starting point for other short leader processors and roller transport processors at 26°C (79°F). The times given are for films rated at their nominal EI rating and should produce negatives of normal contrast, the aim is for 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. 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 RT RAPID can be used in the temperature range of 22–28°C (72–82°F). For temperatures below 26°C (79°F) increase the given development times by 10% for each 1°C (2°F) drop in temperature. For temperatures above 26°C (79°F) decrease the given development times by 10% for each 1°C (2°F) rise in temperature.

In some processors the development time is controlled by the machine's speed. Please refer to the technical information of the machine's manufacturer to convert development time to machine speed.

**ILFORD FILMS at 26°C (79°F)**

| | Meter setting | seconds | seconds |
|---|---|---|---|
| | | dilution 1+1+2 | dilution 1+1+5 |
| ILFORD 100DELTA | EI 50/18 | – | 40 |
| | EI 100/21 | 40 | 56 |
| | EI 200/24 | 50 | 75 |
| ILFORD DELTA400 | EI 200/24 | 54 | 65 |
| | EI 400/27 | 65 | 78 |
| | EI 800/30 | 71 | 104 |
| | EI 1600/33 | 84 | 127 |
| | EI 3200/36 | 104 | 166 |
| ILFORD DELTA3200 | EI 400/27 | 54 | 95 |
| | EI 800/30 | 65 | 108 |
| | EI 1600/33 | 73 | 120 |
| | EI 3200/36 | 84 | 153 |
| | EI 6400 /39 | 104 | 176 |
| ILFORD PANF Plus | EI 25/15 | – | 45 |
| | EI 50/18 | 40 | 50 |
| | EI 100/21 | 45 | 71 |
| ILFORD FP4 Plus | EI 50/18 | 40 | 55 |
| | EI 125/22 | 45 | 65 |
| | EI 200 /24 | 54 | 84 |
| ILFORD HP5 Plus | EI 200/24 | 50 | 54 |
| | EI 400/27 | 60 | 71 |
| | EI 800/30 | 75 | 95 |
| | EI 1600/33 | 91 | 120 |
| | EI 3200/36 | 108 | 166 |
| ILFORD SFX200 | EI 200/24 | 54 | 65 |
| | EI 400/27 | 65 | 91 |
| | EI 800/30 | 88 | 120 |
| ILFORD ORTHO PLUS | EI 80/20 Daylight | | |
| Pictorial Contrast | Normal | 65 | 78 |
| | High | 127 | 153 |
| | EI 40/17 Tungsten | | |
| | Normal | 65 | 78 |
| | High | 127 | 153 |

## NON ILFORD FILMS at 26°C (79°F)

| | Meter setting | seconds | seconds |
|---|---|---|---|
| | | dilution 1+1+2 | dilution 1+1+5 |
| Kodak Tmax 100 | EI 50/18 | 68 | 78 |
| | EI 100/21 | 75 | 90 |
| | EI 200/24 | 91 | 108 |
| Kodak Tmax 400 | EI 400/27 | 91 | 100 |
| | EI 800/30 | 100 | 108 |
| | EI 1600/33 | 115 | 127 |
| | EI 3200/36 | 127 | 142 |
| Kodak Tmax 3200 | EI 400/27 | 108 | 120 |
| | EI 800/30 | 120 | 134 |
| | EI 1600/33 | 134 | 142 |
| | EI 3200/36 | 142 | 153 |
| Kodak Plus X | EI 50/18 | 40 | 45 |
| | EI 125/22 | 50 | 54 |
| | EI 200/24 | 54 | 65 |
| Kodak Tri X | EI 400/27 | 65 | 75 |
| | EI 800/30 | 78 | 88 |
| | EI 1600/33 | 100 | 108 |
| | EI 3200/36 | 115 | 127 |
| Agfa APX 100 | EI 50/18 | 50 | 61 |
| | EI 100/21 | 60 | 78 |
| | EI 200/24 | 71 | 95 |
| Agfa APX 400 | EI 400/27 | 68 | 81 |
| | EI 800/30 | 81 | 100 |
| | EI 1600/33 | 104 | 134 |
| | EI 3200/36 | 120 | 166 |
| Fuji 100 Acros | EI 50/18 | 45 | 63 |
| | EI 100/21 | 50 | 73 |
| | EI 200/24 | 58 | 88 |
| Fuji Neopan 400 | EI 400/27 | 65 | 71 |
| | EI 800/30 | 81 | 88 |
| | EI 1600/33 | 95 | 108 |
| | EI 3200/36 | 108 | 127 |
| Fuji Neopan 1600 | EI 400/27 | – | 45 |
| | EI 800/30 | 45 | 50 |
| | EI 1600/33 | 50 | 60 |
| | EI 3200/36 | 60 | 71 |

The development times for other manufacturers' films are a general guide. The specification of these products may have changed over time and as a result these development times may need to be adjusted. If necessary the given times should be adjusted to give the result required.

## 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 it is recommended that films are rinsed in an acid stop bath such as ILFORD ILFOSTOP (with indicator dye) or ILFOSTOP PRO (without indicator dye). ILFOSTOP PRO is recommended for all machine processing applications. When tanks of process solutions are in use a stop bath stops development immediately. It also reduces the carry over of excess developer into the fixer bath and so helps to maintain the activity and prolong the life of the fixer solution.

| ILFORD Stop Bath | ILFOSTOP | ILFOSTOP PRO |
|---|---|---|
| Dilution | 1+19 | 1+19 |
| Temperature range | 18–24°C (64–75°F) | 18–24°C (64–75°F) |
| Time (seconds) at 20°C (68°F) | 10 | 10 |
| Capacity films/litre (unreplenished) | 15 (135–36) | 22 (135–36) |

The process time given is the minimum required. Due to the configuration of some processing machines a longer stop bath time may be given automatically but this should not cause any process problems. The design of some processing machines means that a stop bath cannot be included, provided that the fixer activity is monitored and adequate fixer replenishment rates used there should be no process problems.

### Fixer

The recommended fixers are ILFORD RAPID FIXER or ILFORD HYPAM fixer both are non-hardening fixers.

| ILFORD Fixer | ILFORD HYPAM | ILFORD RAPID FIXER |
|---|---|---|
| Dilution | 1+4 | 1+4 |
| Temperature range | 18–24°C (65–75°F) | 18–24°C (65–75°F) |
| Time (mins) at 20°C (68°F) | 2–5 | 2–5 |
| Capacity films/litre (unreplenished) | 24 (135–36) | 24 (135–36) |

The fixing time given is the minimum required. Due to the configuration of some processing machines a longer fixing time may be given automatically but this should not cause any process problems.

### Wash

When a non-hardening fixer has been used wash the films in running water for 5–10 minutes. The water temperature should be above 5°C (41°F), ideally within 5°C (9°F) of the developer temperature.

### Rinse

For a final rinse ILFORD ILFOTOL wetting agent is recommended as it helps films to dry 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, the type of processor and drying method. Too little or too much wetting agent can lead to uneven drying.

## FIX HARDENER

ILFORD RAPID FIXER must not be used with fix hardeners as it is not compatible with them. If a fix hardener is required then only ILFORD HYPAM fixer can be used. Add ILFORD HYPAM HARDENER to HYPAM to turn it into a hardening fixer

Generally for most applications modern camera films are sufficiently hardened at manufacture. Therefore additional hardening from a fixer hardener is not usually needed or recommended in the FP40 or other short leader processors, unless the processing temperature is above 30°C (86°F) or poor drying performance is being experienced. A fixer hardener may be needed when using roller transport film processors to minimise the risk of physical damage.

Using a fix hardener will require the recommended fix and wash times to be extended. Depending on the film and processing conditions the fix plus hardener time will be between 4 and 10 minutes and the subsequent wash time 10–20 minutes.

The amount of HYPAM HARDENER that can be added to the fixer is dependent on the film and process conditions used. In some processors the full amount of hardener cannot be used as the fix and wash times cannot be extended adequately. In these circumstances we recommend starting with the minimum amount of hardener to have some effect. This is around 3–6 mls per litre of working strength HYPAM in use. It increases the film hardness slightly but has a negligible effect on the fix and wash efficiency. When fix and wash times are restricted the maximum amount of HYPAM HARDENER recommended is 10–20 mls. This higher amount gives a definite increase to the hardness of the films processed and while fixing and washing efficiency are reduced the films will be adequately fixed and washed for most purposes.

When fix and wash times can be extended the maximum amount of HYPAM HARDENER needed to achieve fully hardened films is 1 part to 40 parts working strength HYPAM i.e. 24mls per litre.

## REPLENISHMENT

The optimum developer replenishment rate for a particular process system can be found by using a process control system. For your processor please refer to the machine manufacturer's technical information to calibrate it for replenishment.

The recommended replenishment rates of ILFOTEC RT RAPID are:-

| Film Format | mls | US fluid oz |
|---|---|---|
| 135-12 | 6 | 1/5 |
| 135-24 | 12 | 2/5 |
| 135-36 | 18 | 3/5 |
| 120 | 18 | 3/5 |
| 220 | 36 | 1 1/5 |
| 10.2x12.7cm(4x5") | 5 | 1/5 |
| 12.7x17.8cm (5x7") | 14 | 1/2 |
| 20.3x25.4cm (8x10") | 18 | 3/5 |
| 6.5x9cm | 3 | 1/10 |
| 9x12cm | 4 | 1/10 |
| 10 x 15cm | 6 | 1/5 |
| 13 x18cm | 14 | 1/2 |

## PROCESSING WITH REPLENISHED DEVELOPER

### The effect of use on a replenished developer system

The reaction that takes place during the film development releases by-products (halides) into the developer, uses up developing agents and changes the developer's pH. These combine to reduce the activity of the developer and without replenishment the developer gradually ceases to function adequately and eventually becomes exhausted.

Replenishment has two key funtions. It replaces the active ingredients used during development and dilutes the by-products that have been formed.

A replenished developer is said to be fully "seasoned" when the addition of the replenisher compensates exactly for the new by-products produced by development. At this point the concentration of halides and active ingredients have reached an equilibrium or steady state.

It is maintaining this equilibrium that gives a machine developer performance consistency. Provided that the developer is used regularly, replenishment continues and all other factors remain the same, i.e. the concentration of the active ingredients, the by-products, etc., then the developer should perform consistently for a long period of time.

### Fresh versus seasoned developer and the function of a starter solution

A tank of freshly made working strength developer is more active than a tank of "seasoned" replenished developer. If the same process time is used in both cases then a small loss in film speed and contrast will be seen using the seasoned developer. The change in performance from fresh to seasoned is gradual with each film processed until the equilibrium point is reached.

In a replenished process system where a starter solution is used, the starter solution is there to minimise the performance difference between fresh and seasoned developer.

The time taken to reach equilibrium from fresh depends on the developer and replenisher formula, tank size, the amount of film processed and their type and replenishment rate. When ILFOTEC RT RAPID STARTER is used it with ILFOTEC RT RAPID replenished at the recommended rate the difference in performance between fresh and seasoned developer is negligible so there is no appreciable "seasoning" period and no adjustments to the development times are required.

## PROCESS CONTROL

To process film to a consistent standard, it is essential to use a method to monitor the condition and activity of the process solutions. Valuable aids ensuring consistent film processing quality are ILFORD FP4 Plus CONTROL STRIPS and the ILFORD FILM PROCESS CONTROL MANUAL (FPC manual).

FP4 Plus CONTROL STRIPS are supplied pre-exposed on to a 30.5m (100 ft) roll of 35mm film. Each strip consists of four density patches, Dmin, LD, HD and Dmax. When needed individual strips are cut from the roll for process monitoring.

The FPC manual contains information about process control methods and equipment, and a fault finding and correction guide. It also contains useful tools such as process control charts and user data record sheets.

### Process control method, aims and tolerances

FP4 Plus CONTROL STRIPS should be regularly processed at the development time usually used for FP4 Plus film. The frequency of processing control strips is for the user to decide based on your workload and work patterns but we suggest that at least one control strip is processed per working session. After processing, measure the density of the patches using a calibrated transmission densitometer and record the results for Dmin, LD and HD–LD on a process control chart. A visual assessment of density cannot be relied upon.

Before starting process control it is important to ensure that the developer is at equilibrium and producing satisfactory negatives. If it is, then process three FP4 Plus CONTROL STRIPS, measure and record the density patches on each one and calculate HD–LD. Average the results for Dmin,LD and HD–LD and use these as your aim values for future measurements. The process is considered in control provided that the measurements from subsequent strips are within +/–0.06 units of the established aim values.

The following FP4 Plus CONTROL STRIP density patch values are typical for seasoned ILFOTEC RT RAPID in good condition. They are given only as a guide and are not absolute values that must be achieved, do not attempt to adjust your process to obtain identical values. The most important thing is that the quality of the negatives produced is satisfactory.

| | Seasoned 1+1+2 | Seasoned 1+1+5 |
|---|---|---|
| Dmin | 0.35 | 0.35 |
| LD | 0.54 | 0.41 |
| HD–LD | 0.80 | 0.80 |

### Dealing with process variations

Properly replenished ILFOTEC RT RAPID developer in regular use should have a long tank life. Any large process variations seen are most likely to be caused by an external change. If a sudden and significant process variation has occurred it is most important to identify the cause, so that the appropriate corrective action can be taken.

### Identifying a problem

First, look for the obvious. The cause of the process change may be something visible such as low solution levels, blocked/leaking pipes, no replenishment, poor agitation, etc. Check the solution temperatures, SG and pH as well as solution recirculation. Run the processor with some test films and check that it triggers all the correct machine functions, e.g. agitation, replenishment, etc.

Check for any obvious sign of developer contamination e.g. cloudiness of the developer or an unusual odour.

Check the machine settings, e.g temperatures, development times and replenishment rate as they may have been changed from normal.

**Regaining control of the process** Once the cause of the problem has been found and corrected then some action will probably be needed to get the process back within limits. It might happen automatically, for example if the temperature has been returned to the correct setting. If the problem was caused by low replenishment then removing a few litres of developer and replacing it with replenisher may bring the process back in control. In the extreme case to get back inside the limits may need all of the developer solution replacing with fresh developer.

If the reason for poor performance is contamination of the developer by stop bath or fixer then remove all the developer, flush out pumps and pipes, clean the tank and change the solution filter before replacing with a fresh solution.

**Regaining control of the process** Once the cause of the problem has been found and corrected then some action will probably be needed to get the process back within limits. It might happen automatically, for example if the temperature has been returned to the correct setting. If the problem was caused by low replenishment then removing a few litres of developer and replacing it with replenisher may bring the process back in control. In the extreme case to get back inside the limits may need all of the developer solution replacing with fresh developer.

If the reason for poor performance is contamination of the developer by stop bath or fixer then remove all the developer, flush out pumps and pipes, clean the tank and change the solution filter before replacing with a fresh solution.

## WORKING SOLUTION LIFE

The life of a solution in a replenished system is dependent on film throughput, replenishment rates, processing temperature and film types. The only sure way of always knowing that the activity of the developer is adequate is to use a process control system. As a general guide, replenished ILFOTEC RT RAPID developer should be replaced after 6–12 months in the process tank.

Unreplenished ILFOTEC RT RAPID working strength solutions should last for up to:-
6 months in full tightly capped bottles
2 months in a tank with a floating lid
1 month in a half full tightly capped bottle.

## STORAGE

Full, unopened bottles of ILFOTEC RT RAPID concentrate stored in cool conditions, 5–20°C (41–68°F), will keep for two years. Once opened use completely within three months and keep all bottles tightly sealed until used.

If stored in cool conditions 5–20°C (41–68°F), ILFOTEC RT RAPID STARTER will keep indefinitely in tightly capped bottles.

## AVAILABILITY AND CAPACITY

ILFOTEC RT is available as a kit containing two 5 litre bottles, one bottle of part A and one bottle of part B.

This makes into 20 litres of 1+1+2 working strength solution and is replenishment for 1100 135–36 films.

This makes into 35 litres of 1+1+5 working strength solution and is replenishment for 1925 135–36 films.

ILFOTEC RT RAPID STARTER is available in 1 litre bottles.
1 litre of starter with 6.2 litres of water will turn 82.8 litres of 1+1+2 replenisher into 90 litres of 1+1+2 developer
or
1 litre of starter with 9 litres of water will turn 101 litres of 1+1+5 replenisher into 111 litres of 1+1+5 developer.

A wide range of fact sheets is available which describe and give guidance on using ILFORD products. Some products in this fact sheet might not be available in your country

**HARMAN technology Limited**, Ilford Way, Mobberley, Knutsford, Cheshire WA16 7JL, England
**www.ilfordphoto.com**