TECHNICAL INFORMATION

B&W PAPER DEVELOPERS

DEVELOPERS FOR THE DISH/TRAY PROCESSING OF BLACK AND WHITE PHOTOGRAPHIC PAPERS

ILFORD MULTIGRADE developer

MULTIGRADE is a rapid liquid concentrate dimezone-s/hydroquinone developer suitable for the dish/tray developing of all black and white photographic papers both resin coated, RC, and traditional fibre based, FB ones. It is usually used at a dilution of 1+9 but for greater development control and economy it can be used at 1+14. MULTIGRADE developer is clean working, has excellent keeping properties and gives a neutral image tone with most papers. MULTIGRADE developer is designed for use at ambient room temperatures, nominally 20°C/68°F. We do not recommend its use for high temperature or machine processing applications. It is not suitable for developing films.

ILFORD PQ UNIVERSAL developer

PQ UNIVERSAL is a liquid concentrate dimezone-s/hydroquinone developer suitable for the dish/tray developing of all RC and FB black and white photographic papers. Used at a dilution of 1+9 it is clean working and has excellent keeping properties. It gives a slightly warm of neutral image tone with most papers.

In addition PQ UNIVERSAL can be used to dish/tray process ILFORD and some other technical films. It is also suitable for dish/tray developing of general purpose sheet films when a fast working, high contrast developer is needed and a high degree of enlargement is not required. For film processing applications it is diluted either 1+9 (high contrast) or 1+19 (pictorial contrast). PQ UNIVERSAL is not recommended for processing general purpose 35mm and roll film formats.

PQ UNIVERSAL developer is designed for use at ambient room temperatures, nominally 20°C/68°F. We do not recommend its use for high temperature or machine processing applications

ILFORD BROMOPHEN developer

BROMOPHEN is a phenidone/hydroquinone developer supplied in powder form. It is suitable for dish/tray developing all RC and FB black and white photographic papers. It is made into a stock solution that is diluted 1+3 for use. It is economical, clean working and has good keeping properties. It gives a slightly warm of neutral image tone with most papers. It is particularly recommended for dish/tray developing MULTIGRADE Warmtone RC and FB papers to get the warmest image tone.

BROMOPHEN developer is designed for use at ambient room temperatures, nominally 20°C/68°F. We do not recommend its use for high temperature or machine processing applications. It is not suitable for developing films.

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**

Preparing MULTIGRADE and PQ UNIVERSAL developer

MULTIGRADE and PQ UNIVERSAL liquid concentrates are mixed with water for use. MULTIGRADE can be used at a dilution of either 1+9 or 1+14. PQ UNIVERSAL is used at a dilution of 1+9 for paper or 1+9/1+19 for technical films and sheet films.

Prepare the working strength solutions of MULTIGRADE and PQ UNIVERSAL developers directly before they are needed. Determine the amount of solution needed for the processing session, making sure that it is a least enough to fill the developing dish/tray to a depth of about half full. Measure out the appropriate amount of concentrate using the smallest measuring cylinder appropriate to the liquid volume: it is easier and more accurate to measure 100 ml of solution in a 100 ml cylinder than a 1000 ml 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. Using an appropriately sized measuring cylinder, measure out the required dilution water using hot and cold water to get to the solution's working temperature, 20°C/68°F. Rinse out the measuring cylinder used for the concentrate into the mixing vessel with some of the dilution water. Finally add the remainder of the dilution water to make up to the final working volume and stir the solution thoroughly. The developer is then ready to use.

Preparing BROMOPHEN stock developer

BROMOPHEN cartons contain two parts, A and B that must be dissolved in water for use. Always make up the developer stock solution to the volume stated on the carton, do not attempt to prepare smaller solution quantities by using fractional parts of each powder, however larger stock solution quantities can be prepared by using multiples of whole packs.

To prepare stock developer, dissolve the contents of part A (the smaller bag) in about three-quarters of the total solution volume (see carton) of warm water at about 40°C/104°F. Stir until most of the part A powder has dissolved, continue to stir while gradually adding the contents of part B (the larger bag). Keep stirring until no more powder dissolves. NB, it is normal for a few grains of powder to remain un-dissolved. Add cold water to make up to the final volume (see carton) and stir. Allow to cool to room temperature, nominally 20°C/68°F. Store in a tightly capped bottle until needed for use.

Preparing working strength BROMOPHEN.

To use BROMOPHEN the stock solution is diluted 1+3 with water to make a working strength solution. Prepare the working strength solution from the stock solution directly before it is needed. Treat the BROMOPHEN stock solution as if it were a liquid concentrate and use the mixing method and information given above in the section called "Preparing MULTIGRADE and PQ UNIVERSAL developer".

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.

pH and specific gravity

The following table gives the pH and specific gravity (SG) for fresh solutions of MULTIGRADE, PQ UNIVERSAL and BROMOPHEN developers. 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.

Developer	dilution	pH	SG at 20°C
MULTIGRADE	1+9 1+14	10.45–10.55	1.022 1.011
PQ UNIVERSAL	1+9 1+19	10.48– 10.58	1.022 1.011
BROMOPHEN	stock 1+3	10.30–10.50	1.106 1.025

PROCESSING PAPER

Dish/tray processing

MULTIGRADE, PQ UNIVERSAL and BROMOPHEN working strength developer solutions should be used in a dish/tray at ambient room temperature. The recommended developing temperature is 20°C (68°F) ±1°C (2°F). Slightly lower temperatures can be used but development would need to be extended slightly. Slightly higher temperatures can also be used but development times would need to be reduced. These developers are not designed for high temperature processing. High temperatures will reduce the effective solution life considerably and may give very short development times that can lead to uneven processing being seen.

Before starting to process prepare the require volume of all the process solutions according to dish/tray size used and number of sheets of paper to be processed. The solution volume should be enough to fill the processing dish/tray to a depth of about half full, it must be enough to cover the paper 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 intermittent agitation is used. For a single sheet immerse the paper 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.

When developing multiple sheets of paper at once, intermittent agitation is given by interleaving them. To interleave paper, slip the sheets into the solution one at a time, emulsion side down. When all the sheets are in the solution, pull the sheet from the bottom and place it on the top of the pile of sheets in the dish/tray. Continue this process of moving the bottom sheet to the top until the process time is complete. Use this method of agitation for all subsequent processing steps.

The number of sheets that can be interleaved at one time is up to the individual, however do take care as too many sheets with too little agitation can lead to uneven processing. FB papers are more difficult to interleave than the waterproof RC based papers that remain rigid when wet. The traditional FB papers absorb far more liquid than RC ones and when they are wet they go rather limp and without careful handling they are more prone to damage.

Remove the paper(s) from the dish/tray 10 seconds before the end of the development time and allow developer to drain before placing it the stop bath.

Development times

RC paper

ILFORD developer	Dilution	°C/°F	Time (min:sec)
Liquids			
MULTIGRADE	1+9	20/68	1:00
MULTIGRADE	1+14	20/68	1:30
PQ UNIVERSAL	1+9	20/68	2:00
Powder			
BROMOPHEN	1+3	20/68	2:00

Approximately double these times are recommended with MULTIGRADE RC COOLTONE paper to obtain the coolest image colour – see the MULTIGRADE RC COOLTONE fact sheet.

FB paper

ILFORD developer	Dilution	°C/°F	Time (min) Recom-mended	Range
Liquids				
MULTIGRADE	1+9	20/68	2	1 1/2–3
	1+14	20/68	3	2–5
PQ UNIVERSAL	1+9	20/68	2	1 1/2–3
Powder				
BROMOPHEN	1+3	20/68	2	1 1/2–3

On correctly exposed FB prints, the image will begin to appear after 35 seconds with these developers. Development may be extended to 6 minutes without any noticeable change in contrast or fog.

To maintain print to print consistency when batch processing a large number of either RC or FB prints, it may be advantageous to reduce exposure slightly and extend development.

Developer capacities

The following table gives the developing capacity of 1 litre of working strength developer.

ILFORD developer	Dilution	20·3x25·4cm (8x10 inch) ILFORD prints RC paper	20·3x25·4cm (8x10 inch) ILFORD prints FB paper
Liquids			
MULTIGRADE	1+9	100	50
MULTIGRADE	1+14	70	40
PQ UNIVERSAL	1+9	70	45
Powder			
BROMOPHEN	1+3	70	45

Approximately half these capacities are achieved if only MULTIGRADE RC COOLTONE is processed. This is because of the longer development times recommended with MULTIGRADE RC COOLTONE paper.

Stop

ILFORD stop bath	Dilution	°C/°F	Time (sec)
Liquid			
ILFOSTOP	1+19	18–24/64–75	10
ILFOSTOP PRO	1+19	18–24/64–75	10

Fix

ILFORD non-hardening FIXER	Dilution	°C/°F	RC time (min)	FB time (min)
Liquids				
ILFORD RAPID	1+4	18–24/64–75	1/2	1
FIXER	1+9	18–24/64–75	1	2
HYPAM	1+4	18–24/64–75	1/2	1
	1+9	18–24/64–75	1	2
Powder				
ILFOFIX II	stock	18–24/64–75	2	3

Washing RC paper

	Temperature (°C/°F)	Time (sec)
Fresh, running water	Above 5/41	120

When it is important to obtain a print in the shortest possible time, vigorously wash ILFORD resin coated papers for 30 seconds in running water.

Prolonged immersion in water can cause edge penetration and print curl with resin coated papers: for this reason, avoid wet times longer than 15 minutes.

Washing FB paper

Fresh, running water	°C/°F	Time (min)
Double weight	Above 5/41	60

Do not wash ILFORD papers with some non-ILFORD papers which 'yellow' on prolonged washing, because this can cause the papers to have a bloom or haze over the black areas on the prints.

A washing aid is not needed when conventionally processing fibre base papers, but its use does reduce the final wash times, thus saving time and water. If a hardening fixer has been used, a washing aid is recommended as hardened prints take longer to wash. When using ILFORD WASHAID, wash prints for at least 5 minutes in running water before using the washing aid, then wash prints in running water for 20 minutes.

Washing aid

ILFORD washing aid	Dilution	°C/°F	Time (min)
Liquid ILFORD WASHAID	1+4	18–24/64–75	10

PROCESSING SHEET FILM

FP4 Plus, HP5 Plus, DELTA 100 Professional and ORTHO Copy Plus Sheet films can all be developed in a dish/tray using PQ UNIVERSAL developer 1+9 or 1+19 at 20°C/68°F. Development with dilution at 1+9 gives higher contrast but also an increase in granularity. Dilution 1+19 is recommended for pictorial contrast, Gbar 0.62, and lower grain but there is some loss of film speed and so for exposure a lower EI rating must be used.

PQ UNIVERSAL can also be used to develop the technical and sheet films of other manufacturers. Do not use PQ UNIVERSAL to process general purpose 35mm and roll film formats.

To develop sheet film formats in a dish/tray with PQ UNIVERSAL developer use the same techniques described above for dish/tray development of paper. We do not recommend the interleaving method for processing multiple sheets of film, even if great care is taken it may cause damage to the emulsion.

Film Development times

The development times given here are intended only as a guide and may be adjusted to suit individual preferences for density and contrast.

	EI	Time (min:sec)	Gbar
PQ UNIVERSAL 1+19 20°C/68°F			
FP4 Plus	64	4:00	0.62
HP5 Plus	320	4:30	0.62
Delta 100	80	4:00	0.62
ORTHO Copy Plus			
Daylight	25	4:00	0.62
Tungsten	12.5	4:00	0.62
PQ UNIVERSAL 1+9 20°C/68°F			
FP4 Plus	125–200	4:00–8:00	0.85–1.00
HP5 Plus	400–800	4:00–8:00	0.90–1.00
100 Delta	125–200	4:00–8:00	0.80–1.00
ORTHO Copy Plus			
Daylight	50–80	4:00–12:00	080–1.00
Tungsten	25–40	4:00–12:00	0.80–1.00

Developer Capacity for film

The following table gives the developing capacity of 1 litre of working strength developer.

	Dilution	20.3x25.4cm (8x10in) sheet film
PQ UNIVERSAL	1+9	10
	1+19	5

Stop

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) or ILFOSTOP PRO (without indicator dye). 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.

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 x 20.3x25.4cm (8x10in)	22 x 20.3x25.4cm (8x10in)

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 and ILFORD HYPAM liquid fixers and ILFORD ILFOFIX II powder fixer,all are non-hardening fixers.

ILFORD Fixer	ILFORD HYPAM & ILFORD RAPID FIXER	ILFORD ILFOFIX II
Dilution	1+4	stock
Temperature range	18–24°C (64–75°F)	18–24°C (64–75°F)
Time (mins) at 20°C (68°F)	2–5	4–8
Capacity films/litre (unreplenished)	24 x 20.3x25.4cm (8x10in)	24 x 20.3x25.4cm (8x10in)

Wash
When a non-hardening fixer has been used wash the films in running water for 5–10 minutes at a temperature within 5°C (9°F) of the process temperature.

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.

WORKING SOLUTION LIFE
BROMOPHEN stock solution should last for up to:-
6 months in full capped containers
3 month in a half full tightly capped container.

Working strength MULTIGRADE developer, PQ UNIVERSAL and BROMOPHEN left in an open dish should not be kept for more than one working day. If stored in a tightly capped bottle they may last up to 24 hours.

STORAGE
Full unopened bottles of MULTIGRADE and PQ UNIVERSAL developer concentrates stored in cool conditions, 5–20°C, (41–68°F), will keep for 2 years. Once opened use the concentrate completely within six months and keep all bottles tightly sealed until used.

Unopened packets of BROMOPHEN powder stored in cool and dry conditions, 5–20°C, (41–68°F), will keep indefinitely. Once opened prepare the stock solution immediately.

AVAILABILITY AND CAPACITY
MULTIGRADE developer is available in bottles of 500ml, 1 litre, 2.5 litres, and 5 litres as well as a 10 litres "bag in box" carton.

A 1 litre bottle of MULTIGRADE developer makes enough working strength solution at 1+9 to process 1000 20.3x25.4cm (8x10in) sheets of RC paper or 500 20.3x25.4cm (8x10in) sheets of FB paper.

PQ UNIVERSAL is available in bottles of 500ml, 1 litre, and 5 litres.

A 1 litre bottle of PQ UNIVERSAL developer makes enough working strength solution at 1+9 to process 700 20.3x25.4cm (8x10in) sheets of RC paper or 450 20.3x25.4cm (8x10in) sheets of FB paper or 100 20.3x25.4cm (8x10in) sheet films.

BROMOPHEN is available in cartons of 1 and 5 litres.

A 1 litre carton of BROMOPHEN developer makes enough working strength solution at 1+3 to process 700 20.3x25.4cm (8x10in) sheets of RC paper or 450 20.3x25.4cm (8x10in) sheets of FB paper.

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