

ZONE

IMAGING

TECHNICAL INFORMATION

510 PYRO

LIQUID CONCENTRATE ONE-SHOT USE DEVELOPER FOR LOW VOLUME BLACK AND WHITE FILM PROCESSING IN SPIRAL TANKS, DISHES, TRAYS AND ROTARY PROCESSORS

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OVERVIEW

510 Pyro, formulated by Jay DeFehr, is an extremely fine grained, high acutance, long shelf-life staining developer giving full film speed with most films and uniquely triple optimised for darkroom silver gelatine printing, alternative UV based printing and scanning with the same development time.

510 Pyro is specifically designed for both modern T-grain and the conventional emulsions.

510 Pyro is for maximising sharpness with minimal grain – solving the traditional paradox of a trade-off with sharpness and grain levels – full tonality particularly unrivalled highlight separation given by the inbuilt variable contrast filter obtained from the stain, high micro-contrast and exceptional enlargements exceeding x20.

510 Pyro is supplied as a liquid concentrate diluted for 1:100 one-shot use. However, it can be further diluted for economy though there will be a reduction in image quality and longer development times.

Note: an acidic stop bath and hypo clear must not be used with 510 Pyro developed negatives as they destroy the stain. A water stop bath is instead recommended.

MIXING INSTRUCTIONS

Note that 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. Note also that 510 Pyro, as a staining developer, will stain any surface so wipe and thoroughly rinse any spills immediately before the stain sets in. White vinegar or sodium hydroxide bleach helps wash away any stains.

Determine first either the tank size being used or the number of films to be processed. Pour the appropriate volume of water into a mixing vessel (a measuring jug or Paterson cylinder is recommended). Ensure it is at the right temperature.

Measure out the appropriate quantity of concentrate with an oral syringe. Due to the viscosity of 510 Pyro, a regular syringe is not suitable. Add the concentrate and stir thoroughly until you can visually see it has been completely mixed.

Thoroughly wash all utensils, measuring and mixing vessels after use. Do not reuse them for non-film development related activities. Do not contaminate the developer solution with fixer solution.

Table of Mixing Instructions

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

TANK SIZE (ML)	DILUTION 1:100 CONCENTRATE/WATER
300	3/300
400	4/400
450	4.5/450
500	5/500
600	6/600
1000	10/1000
2000	20/2000

1 litre = 33.81 US fluid ounces

3.8 litre = 1 US gallon

29.6 ml = 1 US fluid ounce.

Note: a minimum of 1ml of 510 Pyro is needed per 80 sq. inches of film. This is one 36 exp. 135, one 120, four 4x5 sheets or one 8x10 sheet.

pH and specific gravity

The following table gives the pH and specific gravity (SG) for a fresh solution of 510 Pyro 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)
510 Pyro	1+100	9.45-9.55	N/A

PROCESS SYSTEMS

Manual processing - spiral tanks

510 Pyro 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 18°-24°C (68°-75°F). The recommended development times must be reduced if higher temperatures or extended if lower temperatures are used. Care must be taken with the choice of 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 working solution 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 after the first minute of initial agitation.

We provide times for the standard *Ilford* agitation method, one minute continuous agitation followed by 10 seconds every minute, for beginner users familiar with the industry standard agitation scheme for hand developing with spiral tanks. However, the following agitation method, the *Rudiger Hartung semi-stand*, is best recommended when possible for spiral tank processing with 510 Pyro for most films with experienced users looking for optimal results, compensating for poor exposure and/or a simpler user experience: invert the tank continuously for a minute then ONE single agitation at the

10th, 20th and 30th minute mark etc if applicable. 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.

A few films require a *custom* method unique to them. Such films will be marked out in the following section “Development Times”.

Drain off the developer 5-10 seconds (depending on the size of the tank) before the end of the development time and then immediately fill the tank with the water bath to stop development.

Fix with a neutral or alkaline fixer – an acidic one like Ilford Rapid can be used but is not recommended as it negatively affects the stain slightly.

Dish (tray) processing – Sheet film format

510 Pyro developer can be used to process sheet film in dishes (trays) at the recommended temperature of 20-21°C (68-70°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 $\pm 1^\circ\text{C}$ (2°F) of the temperature being used.

When dish / tray processing continuous agitation is used, which is recommended, 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. 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 water 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. 510 Pyro developer can be used to process films in rotary processors using recommended dilutions at 20-24°C (68-75.2°F).

Follow any guidance given by the processor manufacturer. However, generally we do not recommend using a pre-soak unless stated as it can lead to uneven development.

DEVELOPING TIMES

Spiral Tanks

The following tables of development times shown below give an approximate starting point for 510 Pyro when general purpose black and white camera films are being developed in spiral tanks with ***Ilford industry standard agitation*** (one minute continuous followed by 10 seconds every minute), ***Rudiger Hartung semi-stand agitation*** (see above), and ***custom agitation***.

The development times are for films rated at an appropriate EI rating, marked in bold, for the developer (please note the ones that are rated less than the box rating). They should produce negatives of normal contrast, typically around a Gbar of 0.62, and simultaneously lower for scanning and higher for alternative UV printing processes. However, they are only a guide and may need to be adjusted to suit individual processing systems, working practices and preferences.

If there is no time available for your film from below, we recommend *Iford industry standard agitation* with Kodak D76 stock times as a starting time.

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.

Iford Industry Standard Agitation @20°C (68°F)

Film	Measured speed (ISO)	Dilution	Time (minutes)
Adox CHM 100	100	1:100	11:40
Adox CHM 125	125	1:100	10:15
Adox CHM 400	400	1:100	11:00
Adox CHS 25	16	1:100	6:30
Adox CHS 100ii	100	1:100	8:00
Agfa APX 100	100	1:100	11:40
Agfa APX 400	400	1:100	11:00
Arista Professional	125	1:100	9:30
Bergger Pancro 400 (presoak for 6 minutes)	400	1:100	11:00
Cinestill BWXX - presoak	200	1:100	7:00
Catlabs X 80	32	1:100	13:00
Eastman Double X (5222) - presoak	200	1:100	7:00
Efke 25	16	1:100	6:30
Efke 100	100	1:100	7:45
Fuji Neopan Acros (II)	100	1:100	7:45
Fuji Neopan 400	400	1:100	9:45
Fuji Neopan 1600	1600	1:100	8:25
Iford Delta 100	100	1:100	10:00
Iford Delta 400	400	1:100	11:00

Iford Delta 3200	3200	1:100	13:30
Iford FP4+	125	1:100	10:00
Iford HP5+ (do +10% longer for 120)	400	1:100	8.15
Iford HP5+	800	1:100	13:30
Iford HP5+	1600	1:100	28:00
Iford Pan F+	50	1:100	7:30
Iford Ortho Plus	80	1:100	9:00
Iford SFX 200	200	1:100	11:30
Kentmere 100	100	1:100	11:40
Kentmere 400	400	1:100	11:00
Kodak Prof. Plus X	125	1:100	6:30
Kodak Prof. HIE High Speed Infrared	200	1:100	9:45
Kodak TMax 100	100	1:100	11:30
Kodak Tmax 400	400	1:100	9:00
Kodak TMax P3200	3200	1:100	17:30
Kodak Tri X	400	1:100	8:00
Kosmo Agent Shadow	400	1:100	11:00
Lomography Fantôme 8	8	1:100	7:30
Lomography Potsdam	100	1:100	5:15
Orwo UN54	100	1:100	5:15
Orwo UN54	400	1:100	14:00
Polypan	50	1:100	8:25
Rollei RPK 100	100	1:100	11:40
Rollei RPK 400	400	1:100	11:00
Ultrafine Xtreme 100	200	1:100	19:25

Custom @20°C (68°F)**Rollei RPX 25 @25**

Use 1:150, 1 minute initial agitation then once every minute for a total of 8:45 minutes.

Rollei Blackbird Creative @64

Use 1:300, 30 seconds initial agitation then for 10 seconds every 7 minutes after for total 22:45 minutes.

Catlabs X 80 @32

Use 1:100, 1 minute initial agitation then for 10 seconds every 3 minutes after for a total of 14 minutes.

Lomography Babylon 13 and Orwo DN21 @8

Use 1:50, 1 minute initial agitation then 10 seconds at 4th, 8th and 12th minute for a total of 14 minutes.

Ilford HP5+ @400

Use 1:100, 1 minute initial agitation then once every 5 minutes for a total of 13:45 minutes.

Rudiger Hartung's Semi-Stand Agitation @20°C (68°F) – one minute continuously initially, one single agitation at the 10th, 20th... minute mark for more experienced users

Films are ordered by their ISO rating for N development rather than alphabetical order.

Use Rudiger's times below or modified with the time conversion chart at the bottom if some are too long for your liking. Most films have times for N+/- development if such are required.

Measured speed	ISO 32						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO				32			
Ilford Pan F+				11:30			
Measured speed	ISO 50						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO	16	20	32	50	80	125	160
Adox Silvermax	10:15	11:30	13:00	15:20	19:00	23:15	32:15

Measured speed	ISO 64						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO	20	25	40	64	100	160	200
Kodak Tmax 100	11:15	13:15	16:00	20:00	27:30	42:30	95:00
Measured speed	ISO 80						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO	25	32	50	80	125	200	250
Fomapan 100, Kosmo Foto Mono, Lomography Earl Grey, Arista EDU Ultra	06:45	08:20	09:15	10:30	13:30	18:30	26:30
Measured speed	ISO 100						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO	32	40	64	100	160	250	320
Adox CHS 100ii, Agfa APX 100, Kentmere 100, Adox CHM 100, Rollei RPX 100	09:45	11:00	12:45	15:00	18:00	22:45	30:30
Acros 100	10:00	11:30	13:15	15:30	19:00	24:45	35:15
Ilford Delta 100	09:15	10:30	12:00	14:30	18:00	23:45	34:45
Fomapan 200 @100, Arista EDU Ultra 200 @100	06:45	07:45	09:15	11:15	14:45	22:30	---
Orwo UN54, Silberra 45UN, Lomography Potsdam, Shanghai Pan GP3 100				12:30			
Washi F				25:00			
Measured speed	ISO 125						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO	40	50	80	125	200	320	400
Adox CHM 125, Ilford FP4+	10:35	12:30	14:40	17:15	21:00	25:40	31:20
Kodak Double XX, Cinestill BwXX (presoak for a few minutes prior)				16:00			
Measured speed	ISO 200						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO				200	300	400	

Fomapan 400, New Classic EZ 400, Lomography Lady Grey				17:00		23:00	
Tasma Type 25				12:00			
Measured speed	ISO 400						
Contrast adjustment	N-3	N-2	N-1	N	N+1	N+2	N+3
ISO	125	160	320	400	500	800	1250
Agfa APX 400, Kentmere 400, Adox CHM 400, Rollei RPX 400	12:00	14:15	16:45	20:30	27:30	43:15	---
Kodak Tmax 400	14:45	19:45	24:15	30:45	39:45	52:15	72:15
Iford Delta 400	13:15	15:00	17:45	22:00	28:00	39:15	62:15
Iford Super XP2				12:00			
Kodak Tri X	10:00	11:15	13:30	16:25	21:00	29:30	48:20
Rollei Retro 400s, JCP Streetpan 400, Maco Eagle				21:00			
Tasma Type 42				13:00			

Time conversion chart for shorter development times with RH's development technique:

Agitation technique: once every...	Factor
10 minutes	x1
5 minutes	x0.71
1 minute	x0.57
30 seconds	x0.5

Rotary Tube Processors/Tray (continuous agitation)

The following development times are for films rated at an appropriate EI rating, marked in bold, for the developer (please note the ones that are rated less than the box rating). They should produce negatives of normal contrast, typically around a Gbar of 0.62, and simultaneously lower for scanning and higher for alternative UV printing processes. However, they are only a guide and may need to be adjusted to suit individual processing systems, working practices and preferences.

Note: A few require pre-soaking for 3-5 minutes and are at the standard 1:100 dilution and such are marked below.

Film	Measured speed	Temperature (°C)	Dilution	Time (minutes)
Adox CHM 100	100	21	1:100	9:00
Adox CHM 100	200	21	1:100	12:30

Adox CHM 125	125	21	1:100	8:30
Adox CHM 400	400	21	1:100	8:30
Adox CHM 400	1600	21	1:100	19:00
Adox CHS 25	16	21	1:100	5:00
AgfaPhoto APX 100	100	21	1:100	9:00
AgfaPhoto APX 100	200	21	1:100	12:30
AgfaPhoto APX 400	400	21	1:100	8:30
AgfaPhoto APX 400	1600	21	1:100	19:00
Arista EDU Ultra 100 (presoak)	50	21	1:100	7:15
Arista EDU Ultra 200	200	21	1:100	6:00
Bergger Pancro 400 (presoak for 6 minutes)	400	21	1:100	8:30
Cinestill BWXX - presoak	200	21	1:100	6:30
CatLABS X 80	32	21	1:100	10:00
Eastman Double X (5222) - presoak	200	21	1:100	6:30
Efke 100	100	21	1:100	6:00
Efke 25	16	21	1:100	5:00
Fomapan 100 (presoak)	50	21	1:100	7:15
Fomapan 200	200	21	1:100	6:00
Fuji Neopan Acros (II)	100	21	1:100	6:00
Fuji Neopan 400	400	21	1:100	7:30
Fuji Neopan 400	800	21	1:100	10:00
Fuji Neopan 1600	1600	21	1:100	6:30
Iford Delta 100	100	21	1:100	8:30
Iford Delta 400	400	21	1:100	9:30

Iford Delta 3200	3200	21	1:100	10:30
Iford FP4+	125	21	1:100	8:30
Iford HP5+	400	21	1:100	7:30
Iford HP5+	800	21	1:100	10:20
Iford HP5+	1600	21	1:100	21:15
Iford Pan F+	50	21	1:100	6:30
Iford Ortho Plus	80	21	1:100	8:00
Iford SFX	200	21	1:100	10:00
Kentmere 100	100	21	1:100	9:00
Kentmere 400	400	21	1:100	8:30
Kentmere 400	1600	21	1:100	19:00
Kodak Prof. Plus X	125	21	1:100	5:00
Kodak Prof. HIE High Speed Infrared	200	21	1:100	7:30
Kodak TMax 100	100	21	1:100	8:50
Kodak TMax 400	400	21	1:100	7:00
Kodak TMax P3200	3200	21	1:100	13:30
Kodak Tri X	400	21	1:100	6:15
Kodak Tri X (presoak)	800	21	1:100	10:00
Kodak Tri X (presoak)	1600	21	1:100	16:15
Kosmo Foto Mono (presoak)	50	21	1:100	7:15
Lomography Earl Grey (presoak)	50	21	1:100	7:15
Lomography Fantôme 8	8	21	1:100	5:45
Lomography Potsdam	100	21	1:100	4:00
Orwo UN54	100	21	1:100	4:00

Orwo UN54	400	21	1:100	10:45
Polypan F	50	21	1:100	6:30
Rollei RPX 100	100	21	1:100	9:00
Rollei RPX 400	400	21	1:100	8:30
Rollei RPX 400	1600	21	1:100	19:00
Ultrafine Xtreme 100	200	21	1:100	15:00

REUSING DEVELOPER AND WORKING SOLUTION LIFE

510 Pyro working strength solutions should not be reused. Use once and discard.

The working strength solution should not be kept for more than 2 hours in open trays or containers. The working strength solution should not be kept for more than 3 hours in closed containers that are mostly full to full.

Make up fresh developer each time it is needed and discard it after the processing session.

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.

Water Stop Bath

After development, acidic stop bath must not be used as it destroys the stain; water is recommended to be used in place. Agitate continuously in water for a minute. If you wish to minimise the pyro stain colouring the fixer, you may give a second short rinse but the stain will not affect the fixer ability to function.

Fixer

Acidic fixers can be used but are not recommended as it slightly negatively affects stain. Neutral fixers and alkaline fixers are instead recommended – alkaline being specifically designed for pyro staining developers for more stain formation.

Neutral fixers include Bellini Eco Fix FX100, Bergger BerFix, Fotospeed FX30, LegacyPro EcoPro, Rollei RXN, Tetenal Superfix. Alkaline fixers include Photographers' Formulary TF4, TF5 and Moersch ATS.

Please follow the fixing instructions by the manufacturers of each respective fixer.

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 Ilford Optimum Permanence 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 (leave to stand for 5 minutes). Drain the water away and refill. Invert the tank ten times (leave to stand for 5 minutes). Once more drain the water away and refill. Finally, invert the tank twenty times (leave to stand for 5 minutes) and drain the water away. The part in brackets is optional but was put forward by Ilford's engineer that came up with this method as more archival, but it was written out for simplicity.

Rinse

For a final rinse use ILFORD ILFOTOL (or of another brand of choice) 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 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.

STORAGE AND SAFETY

Storage

Moisture is most damaging to 510 Pyro shelf life. Always store chemicals in their original containers and away from unsupervised children and pets. In cool, dry conditions, 7–20°C (44–68°F) 510 Pyro developer concentrate should keep in good condition for:

10 years in full tightly capped bottles.

5-6 years in half full tightly capped bottles.

510 Pyro darkens with age to a deep dark brown, this does not affect the developer.

Safety

510 Pyro contains pyrogallol which is a toxic product for the health causing kidney, liver and circulatory disorders. Pyrogallol is toxic by inhalation, skin contact or ingestion. It is also a phenol and thus can cause chemical burns. Use gloves and clean all equipment with water. Brief skin contact may cause a dark, non-scalding stain. Prolonged skin contact may cause a chemical burn that is very similar to a heat burn.

In case of contact with the product, rinse thoroughly with water. In case of more extensive contact or contact in the eyes, consult a pharmacist. In case of inhalation or ingestion, inform a doctor.

510 Pyro is biodegradable.

Full information can be found on the Safety Data Sheet at www.zoneimaging-photochemicals.co.uk

AVAILABILITY AND CAPACITY

510 Pyro is available in 100ml and 500ml bottles and is manufactured and distributed by Zone Imaging Ltd. Third party 510 Pyro distributors and their links can be found at www.zoneimaging-photochemicals.co.uk.

Used at 1+100 for one shot processing in a Paterson spiral tank, a 100ml bottle will develop 30x 135/36 films.