FUJIFILM

TECHNICAL BULLETIN

BLACK & WHITE

Photographic Chemicals

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I. Description

Film Developer

Negastar Pro Developer Replenisher is a single part developer, formulated to be used with general purpose black and white films processed in high volume Dip and Dunk type processors and continuous long leader processors. It is designed for development times of between 5 to 13 minutes at a recommended developer temperature of 24°C. **Negastar Pro** has a long working life and produces fine grain with high sharpness under a wide range of conditions. It can be used for push processing.

Negastar RT Developer Replenisher is a two-part developer, formulated to be used with general purpose black and white films processed in roller transport and minilab type processors with 40 to 180 seconds development time. **Negastar RT** has a long working life and is well buffered against under- or over-replenishment. It is also suitable for push processing.

Paper Developer

Printstar Pro Developer Replenisher is designed to be used with today's high quality PE/RC black and white papers. It is a single-part developer formulated for 15 to 45 seconds development time in roller transport and minilab type processors. It can be used at temperatures ranging between 20°C and 35°C.

Fixer

Starfix Fixer Replenisher is formulated to be used with all black and white films and papers. It is a non-hardening fixer suitable for use in all type of processors.

Modern films and paper do not require a hardener.

Where a hardener is needed, (for example - high temperature processing of film in a roller transport processor) the addition of **Starfix Hardener** is recommended. This additive also improves the film drying performance.

II. Process Parameters

Due to the variety of film and paper available and processing equipment used, it is difficult to standardise processing specifications. Tables 1 to 3 show recommended **starting points**, from which the process may be optimised. Both film developers can be used for push/pull processing. Please contact your FUJIFILM Europe representative for more information.

Table 1 : Process times for most common film types using Negastar Pro developer

Development times at 24°C for Dip and Dunk or deep tank processors with intermittent agitation of 2 seconds nitrogen burst every 10 seconds. Use sufficient pressure to raise surface level 1.5 cm. These times are starting points; it may be necessary to make adjustments to achieve optimum results. In continuous long leader processors the agitation is given by film movement. Processing time should be reduced by about 10-20%.

Film	ISO Rating	Developing Time
PAN F+	50	330 sec.
FP4+	125	510 sec.
SFX 200	200	510 sec.
HP5+	400	420 sec.
100 DELTA Pro	100	570 sec.
400 DELTA Pro	400	420 sec.
3200 Delta Pro	3200	630 sec
PLUS X 125	125	480 sec.
TRI X 400TX	400	450 sec.
TRI X 320TXP	320	500 sec.
Tmax 100	100	450 sec.
Tmax 400	400	510 sec.
Tmax P3200	3200	630 sec.
APX 100	100	750 sec.
APX 400	400	540 sec.
Fuji Neopan 100 Acros	100	540 sec.
Fuji Neopan 400	400	450 sec.
Fuji Neopan 1600	1600	360 sec.

Note : Negastar Pro Developer can be used at a developer temperature of 20 – 28°C. For a temperature below 24°C, increase the developer time by 10% for each 1°C temperature rise. For every 1°C above 24°C decrease developer time by 10%.

Table 2 : Process times for various film types using Negastar RT developer

Development times at 26°C. These times are starting values, it may be necessary to make adjustments to achieve optimum results.

Film	ISO Rating	1+1+2 dilution	1+1+5 dilution
PAN F	50	40 sec.	50 sec.
FP4+	125	45 sec.	65 sec.
SFX 200	200	55 sec.	65 sec.
HP5+	400	60 sec.	70 sec.
100 DELTA Pro	100	40 sec.	55 sec.
400 DELTA Pro	400	65 sec.	80 sec.
3200 DELTA Pro	3200	85 sec.	155 sec.
PLUS X	125	50 sec.	55 sec.
TRI X 400TX	400	65 sec.	75 sec.
TRI X 320TXP	320	90 sec.	105 sec.
Tmax 100	100	75 sec.	90 sec.
Tmax 400	400	90 sec.	100 sec.
Tmax 3200	3200	140 sec.	155 sec.
APX 100	100	60 sec.	80 sec.
APX 400	400	70 sec.	80 sec.
Fuji Neopan 100 Acros	100	50 sec.	75 sec.
Fuji Neopan 400	400	65 sec.	70 sec.
Fuji Neopan 1600	1600	50 sec.	60 sec.

Note : Negastar RT Developer can be used at a developer temperature of 20 – 28°C. For a temperature below 26°C, increase the developer time by 10% for each 1°C temperature rise. For every 1°C above 26°C decrease developer time by 10%.

Table 3 : Process times for paper using Printstar Pro developer

Temperature	Development Time
20°C	45 sec
25°C	32 sec
30°C	22 sec
35°C	15 sec

These are recommended starting values. The process should be modified to suit individual processors.

Table 4 : Fixing of film and paper using Starfix

Fixing times should be double the time needed to clear an undeveloped film (typically a B&W film) in a fresh fixer solution. This clearing time can change from film to film.

For most machines the fixer temperature and time is usually set at the same value as the developer (± 5°C). The times below are the minimum fixing times at 20°C for materials in fresh solution with and without hardener.

Material	Time without hardener	Time with hardener
Black & White film	120 sec – 300 sec	240 sec – 600 sec
Black & White RC paper	30 sec (*)	-

(*) When the fixer time is shorter, a much higher temperature (25 – 40°C) should be applied.

Table 5 Wash for paper and film

The recommended temperature is within 5°C of the developer temperature.

	After fixer without hardener	After fixer with hardener
B&W film	5 – 10 min.	10 – 20 min.
B&W RC paper	0.5 – 2 min.	/

The shortest wash time can be used with running water at 6 L/min.

III. Mixing Instructions

Negastar PRO	Water	Replenisher	Concentrate	Starter
Tank	797 ml	/	199 ml	4 ml
Replenisher	800 ml	/	200 ml	/
Tank from Replenisher	/	996 ml	/	4 ml

Negastar RT 1+1+2 dilution (*)	Water	Replenisher	Part A	Part B	Starter
Tank	529 ml	/	230 ml	230 ml	11 ml
Replenisher	500 ml	/	250 ml	250 ml	/
Tank from Replenisher	69 ml	920 ml	/	/	11 ml

Negastar RT 1+1+5 dilution (*)	Water	Replenisher	Part A	Part B	Starter
Tank	730 ml	/	130 ml	130 ml	9 ml
Replenisher	714 ml	/	143 ml	143 ml	/
Tank from Replenisher	81 ml	910 ml	/	/	9 ml

(*) : To prolong the developer time, this more diluted developer and replenisher can be used.

Printstar Pro	Water	Concentrate
Tank and replenisher	800 ml	200 ml

Starfix Fixer for film & paper	Water	Concentrate
Tank and replenisher	800 ml	200 ml

If a hardening fixer is needed for film to prevent surface scratching and to improve drying, add one part hardener to 40 parts of working strength fixer.

IV. Replenishment

Depending on processor type and processing conditions, its use and the product processed, the amount of replenisher required may vary.

For developer, the replenishment has to compensate for aerial oxidation, carry-over losses and exhaustion by throughput.

For fixer, the replenishment has to compensate for exhaustion by throughput, increase of silver and halide concentrations, solution carried in from the preceding bath and carry-over to the wash.

It is advisable to use a 2% acetic acid stop-bath between developer and fix bath to prevent developer carry-over into the fixer. This will prolong the life of the fixer and reduces the amount of fixer replenisher required. Fixer replenishment can be reduced by continuous in-line electrolytic desilvering.

Silver levels (up to 8 – 10 g/L) can be tolerated without seriously affecting the fixing capacity For RC paper, the limit is 4 - 6 g/L.

Table 6 : Replenishment for film processing

Film format	Negastar Pro	Negastar RT(*)	Starfix not desilvered no stop bath	Starfix desilvered + stop bath
135 - 12	17 ml	6.0 ml	16.0 ml	8.0 – 12 ml
135 - 24	36 ml	13.0 ml	32.5 ml	16.0 – 24 ml
135 - 36	50 ml	18.0 ml	45.0 ml	22.5 – 34 ml
120	50 ml	18.0 ml	45.0 ml	22.5 – 34 ml
220	100 ml	36.0 ml	89.0 ml	44.5 – 68 ml
4” x 5”	13 ml	5.0 ml	11.0 ml	5.5 – 9 ml
5” x 7”	22 ml	8.0 ml	20.0 ml	10.0 – 15 ml

(*) Replenishment rate for 1+1+2 and 1+1+5 dilution.

In replenished systems, according to individual processor types and processing conditions, the amount of replenisher required may vary. The figures quoted are good starting points, but the replenishment should be adjusted according to process control results.

Table 7 : Replenishment for paper processing

Size RC/PE paper	Printstar Pro	Starfix not desilvered no stop bath	Starfix desilvered + stop bath
1 m^2	150 - 200 ml	300 - 450 ml	150 - 225 ml

V. pH and Density Specifications

Table 8 : pH and density specifications of fresh solutions

	TANK		REPLENISHER	
	pH (25°C)	Density (20°C)	pH (25°C)	Density (20°C)
Negastar Pro	8.50 ± 0.05	1.068 ± 0.003	8.50 ± 0.05	1.068 ± 0.003
Negastar RT (1+1+2) (1)	9.50 ± 0.05	1.110± 0.003	9.70 ± 0.05	1.120± 0.003
Negastar RT (1+1+5) (1)	9.45 ± 0.05	1.065 ± 0.003	9.70 ± 0.05	1.070 ± 0.003
Printstar Pro	10.40 ± 0.05	1.050 ± 0.003	10.40 ± 0.05	1.050 ± 0.003
Starfix (2) without hardener	5.20 ± 0.10	1.085 ± 0.003	5.20 ± 0.10	1.085 ± 0.003
Starfix (2) with hardener	4.70 ± 0.20	1.088 ± 0.003	4.70 ± 0.20	1.088 ± 0.003

(1) To prolong the developer time a more diluted developer and replenisher can be used.

(2) If the pH of the seasoned tank solution is too high due to carry-over from developer, a few ml. of 50% Acetic Acid may be added. The use of an acid stop bath will help prevent this rise in pH.

VI. Washing

To prevent drying marks on film, FUJIFILM Europe Starflow, a wetting agent can be used in the final rinse. Usually a solution made with 3 to 6 ml Starflow per litre of water will be sufficient to prevent marking.

VII. Chemical Handling

Developers and fixers can cause harmful effects when brought in contact with human tissue. Always wear solution resistant gloves and effective eye protection. In case of accidental contact with the developer, wash the affected area with plenty of cold running water. Wash with a pH-neutral soap and rinse thoroughly with water.

Important

Carefully read information on bottle before starting the mixing procedure and the MSDS (Material Safety Data Sheet). MSDS's are available on request if you do not have a copy.

VIII. Chemical Storage

Developers and fixers should be stored above 5°C to prevent crystallisation. Storage temperature above 25°C will cause premature ageing.