Eastman Color Negative Motion Picture Process

ECN-2 motion picture processing involves a unique mechanical and chemical process intended for making motion picture negatives that print well on ECP-2 print film for projection and reproduction. True ECN-2 processing requires rem-jet removal equipment and safety measures that can't be taken at home. Proper motion picture processing machines use caustic chemicals such as lye and sulfuric acid, which can cause chemical burns from handling. The carryover of developer into the acidic stop bath also generates poisonous hydrogen sulfide and sulfur dioxide fumes, and stop carried over into the bleach can produce highly toxic cyanide gas that you wouldn't want in your home. Simply bypassing the stop bath will oxidize the color developer remaining in the film and cause severe fogging to the film. Additionally, bleach carryover into the separate fixer bath causes the film to be mottled with smears of color. None of these byproducts occur in the CineStill Process.

With the Eastman Color Negative process a Prebath step softens the rem-jet backing for removal. The removal must be done so that none of the backing material sticks to the emulsion surface, through the combined action of water jets and buffers contacting the base side, removing all of the backing and residual residue. The Color Developer agent reduces exposed silver halides in emulsion into metallic silver, oxidizing the dye couplers incorporated within each layer of the emulsion to produce color images. The Stop Bath halts development and prevents oxidation of the dye couplers when entering the bleach. Bleach converts metallic silver, formed during color development, to silver-halide compounds that can be removed by the fixer. Rapid Fixer then converts all silver-halide compounds to soluble silver thiosulfate complex salts that are removed from the film in the fixer and subsequent wash. The wash and Final Rinse removes residual soluble silver thiosulfate and fixer from the film, and prevents water spots and biological growths.

See more at, www.kodak.com/uploadedfiles/motion/h2407.pdf

Steps for ECN-2 "Eastman Color Negative" 6-Bath Process

STEPS	FORMULA	ACTIVE INGREDIENTS	TEMP	TIME
Prebath	PB-2	Borax, Lye	80ºF ±2	:10
Rem-Jet Removal	—	—	80 to 100ºF	—
Color Developer	SD-49	CD-3, Antifoggant, Anti-Cal.	106ºF	3:00
Stop Bath	SB-14	Sulfuric Acid	80 to 100ºF	:30
Wash	—	—	80 to 100ºF	:30
Bleach	SR-29 or SR-33	Potassium Ferricyanide or Chelating Agent (PDTA) & Ferric Nitrate	100ºF	3:00
Wash	—	—	80 to 100ºF	1:00
Rapid Fixer	F-34a	Ammonium Thiosulfate	100ºF	2:00
Wash	—	—	80 to 100ºF	2:00
Final Rinse	FR-1	Photoflo	80 to 100ºF	:10
Dryer	—	—	90 to 117ºF	5:00

Steps for CineStill Cn-2 "Cine Negative" 3-Bath Process

STEPS	FORMULA	ACTIVE INGREDIENTS	TEMP	TIME
Dev&Prebath	Cn2	CD-3, Antifoggant, Anti-Cal. DTPA	106ºF	3:30
Bleach+Stop	B96	Ammonium Nitrate, Ferric PDTA, Ammonium Acetate	95 to 106ºF	3:00
Wash	—	—	80 to 100ºF	2:00
Rapid Fixer	F96	Ammonium Thiosulfate	95 to 106ºF	2:00
Wash	—	—	80 to 100ºF	3:00
Dry	—	—	90 to 117ºF	—

Steps for CineStill Cs2 "Cine Simplified" 2-Bath Process

STEPS	FORMULA	ACTIVE INGREDIENTS	TEMP	TIME
Dev&Prebath	Cn2	CD-3, Antifoggant, Anti-Cal. DTPA	106ºF	3:30
Bleach&Fix+Stop	Bf2	Sodium Iron EDTA, PDTA, Ammonium Thiosulfate	90 to 104ºF	6:00
Wash	—	—	80 to 100ºF	3:00
Dry	—	—	90 to 117ºF	—

C-41 vs ECN-2 Film Processing

Both processes were formulated around the mid-1970s, just for different purposes. The C-41 process was designed to produce a contrast and density that is complimentary to printing photographs on RA-4 color paper. ECN-2 negatives were designed to be thinner for quick printing on high contrast ECP-2 film, with short exposure duration to save time and money. C-41 processed films would take up to 8x as long to print or scan, and time is money when printing 24 frames per second. ECN-2 processed film has an optical density range of around 1.6 (6 stops), but C-41 processed film is about 2.2 (8 stops). This is a result of the process not the emulsion itself. That equals a 30%+ increase in tonal and contrast range. The target contrast gamma of C-41 processed films is between .6 to .65, but the target for ECN-2 is only .45 to .55. Films processed in ECN-2 exhibit much lower color contrast, with muddy whites and blacks when printed on RA-4 color paper. Conversely, any film processed in C-41 would have too much contrast and density range to be compatible with motion picture printing. Cross-printing is more of an issue than cross-processing.

Both can be scanned with a density range suited for the respective process, but ECN-2 negatives require added contrast and care. Film scanners have a range of density of 3 to 4, to capture the density range of positive films from about 3.2 to 3.6. A logarithmic scan (with a density range below 2.0) of an ECN-2 processed negative and further color grading is recommended to create a pleasing still photograph. Negative film is very forgiving, but the process of creating a positive is less so.

The color developer controls the contrast curves but leaves the dynamic range of the film unaffected, because the density range is increased with the contrast. The difference between C-41 and ECN-2 processed films is the contrast curves produced in development, not the color quality or the halides. Contrary to misinformation found on the internet, there is no incompatibility between the silver halides and dye couplers. The dye couplers are incorporated within each layer of the emulsion, not in the chemistry. So you can't mismatch halides and couplers, because they are already matched in the coatings. Processing temperature affects density and shifts color from cooler to warmer, because when temperature increases (from 102 to 106ºF) so does the activity and depth of the developer into the green and red sensitive layers of the emulsion. Temperature color shifts and density can be corrected in printing or scanning.

Trouble Shooting

PROBLEM	PROBABLE CAUSE	REMEDY
Thin negatives or yellow green negatives	• Low development temperature • Under exposure in camera • Developer exhausted	Reread and follow all instructions carefully on temperature control, solution, capacity, etc.
Images look too warm	• Developer too warm or pH high	Adjust temperature control.
Images look too cool	• Developer too cool or pH low	Adjust and maintain temperature control.
Higher density near sprocket holes	• Overly vigorous agitation in tank	Use only agitation methods prescribed.
Black "dirt" specks on negatives which print as white spots.	• Rem-jet embedded in emulsion from ecn-2 motion picture film	Replace contaminated chemicals and remove ALL rem-jet carbon backing prior to processing.
Negatives look OK but images are too flat.	• Too little development	Increase development time.
Negatives look OK but contrast is too high.	• Too much development	Decrease development time.

CINESTILL INC, 100 Latona Road,
Rochester, NY 14652

CineStill Cs2

CINE SIMPLIFIED

ECN 2-BATH PROCESS

Low-Contrast Color Negatives For ECP & Scanning

MOTION PICTURE COLOR NEGATIVE PROCESSING INSTRUCTIONS:

The original 10+ Step ECN-2 chemical process is reduced to only 2 chemical baths! Our Cn2 "COLOR NEGATIVE" developer is combined with the prebath accelerant, to produce proper ECN-2 density. The bleach and fixer baths are combined with the stop and wash baths in our single Bf2 "BLEACH&FIX+STOP" bath, to reduce risks to health & safety and processing defects caused from chemical carryover. After a final washing of your film you will have CineStill negatives that match the characteristic curves of true motion picture processing.

You may use this kit to process any color negative print, ECN or C-41 compatible film. It will also process Chromogenic B&W films. These instructions will show you how to process the film and how to reuse the chemicals for extended life.

**Not intend for RA-4 chromogenic printing*
**If rem-jet is present, it can be manually removed under running water, after development.*

EQUIPMENT NOT INCLUDED IN YOUR KIT

- A processing tank and reels or a rotary-tube type processor.
- Two empty chemical storage bottles.
- A graduated pitcher.
- TCS-1000 temperature control system, or
- A timer, an accurate thermometer and a tempered water bath.

Safety Notes

WARNING This kit contains chemicals that may be hazardous if misused. Always wear safety glasses, rubber gloves and protective clothing, such as a lab coat or plastic apron, when working with chemicals. While the hazard rating of this kit is low, caution should be exercised. Do not allow children to use this kit without adult supervision.

COLOR NEGATIVE DEV&PREBATH

Contains: Sodium Carbonate, 3-Nitrobenzene Sulfonic Acid, CD3, Sodium Sulfite, DTPA, Sodium Bicarbonate. May cause irritation. Avoid skin contact. In case of contact, flush with water. DO NOT ALLOW EYE CONTACT. In case of eye contact, flush with water for 15 minutes and contact a physician immediately! DO NOT TAKE INTERNALLY. **If swallowed, Rinse mouth. Call a POISON CENTER or doctor/physician if you feel unwell.**

BEACH&FIX+STOP

Contains: Ammonium Thiosulfate, Sodium Iron EDTA, PDTA. May cause irritation. Avoid skin contact. In case of contact, flush with water and wash with a non-alkaline soap. DO NOT ALLOW EYE CONTACT. In case of eye contact, flush with water for 15 minutes and contact a physician immediately! DO NOT TAKE INTERNALLY. **If swallowed, INDUCE VOMITING. Call a POISON CENTER or doctor/physician!**

MSDS (Material Safety Data Sheets) for this kit are available by written request.

CINESTILL INC,
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Rochester, NY 14652

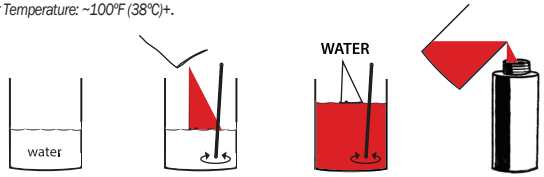
Rev 8/20

Mixing Chemicals†

C^2_N COLOR NEGATIVE DEV&PREBATH

- Place 600-700ml of water* into a clean glass or plastic pitcher.
- Use a clean plastic stir stick or the TCS-1000 to circulate the liquid.
- While circulating, add the contents of the packet marked **Color Negative**. Stir well.
- Top off solution with water* to make 1000ml. Circulate for 10 min. until dissolved.

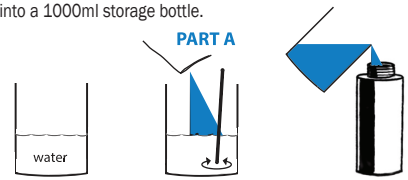
**Water Temperature: ~100ºF (38ºC)+.*



Store mixed solution in a tightly capped, completely filled storage container for 2-6 weeks.

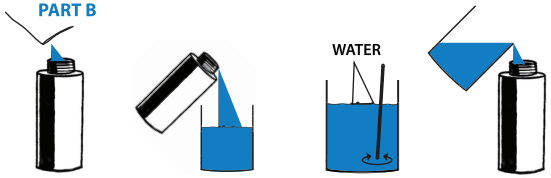
B^2_f BLEACH&FIX+STOP

- Place 600-700ml of water* into a clean glass or plastic pitcher.
- Use a clean plastic stir stick or the TCS-1000 to circulate the liquid.
- While circulating, add the contents of the packet marked **Part A**. Stir well.
- Pour solution into a 1000ml storage bottle.



- Add **Part B** to the same bottle. Combining creates an endothermic reaction. ~5 min.
- Pour solution back and forth between the pitcher and bottle.
- While circulating, Top off solution with water* to make 1000ml.

**Water Temperature: ~100ºF (38ºC)+.*



Store mixed solution in a tightly capped, completely filled storage container for 8-12 weeks.

Stabilizer/Final Rinse Bath (Optional)

- A "Final Rinse" of distilled water, Hexamine (fungicide) and/or Photo-flo (surfactant) may be used.
- Modern color films have "Stabilizers" in the emulsion, released through the 2-bath process.
- Film more than 20 years old may require a formalin or formaldehyde based Stabilizer preservative.

Mixing Notes

- Use water at the temperature you want to use to develop your film. This allows for shorter warm-up time.
- Stir continuously while mixing.
- Keep everything very clean. A few drops of Blix, soap or other contaminates can destroy the developers.
- Mark your containers clearly. This will prevent confusion and processing out of order.
- Use safety glasses and rubber gloves while working with chemicals. Also wear a lab coat or other protective clothing. Do not allow children to use this kit without adult supervision.

† FINAL VOLUMES MAY VARY SLIGHTLY WITH NO ADVERSE EFFECTS IN PROCESSING.

Cine Simplified Color Negative Processing

Standard Processing Steps For Rotation or Inversion Methods

For processing with a Paterson® or JOBO® type plastic tank or Nikkor® stainless tank with rotation or inversion agitation, or open tank with lift rod agitation. Rotation tanks and chemicals should be tempered in a water bath with the TCS-1000 to maintain solution temperatures. ‡*Add 2ºF to the developer before using inversions without a bath.*

STEP	TIME	TEMP‡	AGITATION †
Optional Pre-Soak	1 min	Developer Temp	None
C^2_N Dev&Prebath	3.5 min	106ºF (41ºC)‡	Continuous for first 10 sec., then 4 lifts or 4 inversion cycles* every 30 sec. thereafter
B^2_f Blix&StopBath	6 min.	90ºF - 104ºF (32ºC - 40ºC)	Same as above
THE REMAINING STEPS MAY BE PERFORMED IN ROOM LIGHT WITH THE TANK LID OFF			
Wash	3 min.	75ºF - 105ºF (24ºC - 40ºC)	Running water or fill and empty tank 7 times
Final Rinse/ Rewash (Optional)	½ to 1 min.	Room	Agitate for first 15 sec.
Dry	n/a	< 140ºF (60ºC)	n/a

* 1 inversion cycle = 1 back and forth rotation and/or inversion while changing direction as shown in the graphic

† Use recommended agitation or rotary drum constant agitation may be used at recommended temperature with lower chemical volumes

‡ When not using a temperature control bath, add +2ºF(1ºC) to the developer with the TCS-1000 before processing.

ECN-2 Color Motion Picture Film With Rem-Jet

Rem-jet backed motion picture film is designed for motion picture lab machine processing and will contaminate chemistry if the rem-jet is not fully removed. The alkaline Prebath step is combined with Color Development to produce proper ECN-2 density. If rem-jet is present, it can be manually removed under running water after development. Stop bath and bleach will re-adhere rem-jet to the film, but it can still be manually removed. A rewash may be necessary to fully remove rem-jet backing after processing. Because of the presence of residual backing material and the chemical by-products it liberates, ONE SHOT PROCESSING IS RECOMMENDED. DO NOT PROCESS REM-JET FILMS IN THE SAME SOLUTIONS WITH OTHER FILMS.

If removal is attempted prior to development, by soaking film in a borax or baking/washing soda bath (at pH ~10) and washing the rem-jet off by hand under running water (DO NOT RUB EMULSION SIDE), it must be done in the dark. Even with an added alkaline prebath step, the rem-jet adhesive wax will not be fully dissolved without mechanical or manual removal. Attempting rem-jet removal manually in the dark may result in insufficient removal, contamination of the emulsion and premature exhaustion of developer.

CineStill films are made with Kodak Vision3 motion picture emulsions, but have undergone our proprietary "premoval" process which converts them to be safe and compatible with at home processing. CineStill films do not require any of the above and are perfectly safe to process in any color chemistry with other films.

Push Processing Notes

All color negative films can be underexposed and processed for higher than normal film speeds by extending the development time (push processing). As a rule, pushing should be done only when necessary (i.e. when higher film speed is needed) because negative quality does suffer somewhat. When pushing is required, start with the highest speed film available. In other words, pushing an ISO 50 film four stops to ISO 800 offers no benefit since an 800 ISO film is already available.

When Exposure Change Is:	ISO Speed	Increase Development Time:
1 stop under	2x normal	1.30x (i.e. 3.5 min. x 1.30 = 4.55 min.)
2 stops under	4x normal	1.75x (i.e. 3.5 min. x 1.75 = 6.13 min.)
3 stops under	8x normal	2.50x (i.e. 3.5 min. x 2.50 = 8.75 min.)

Solution Capacities

The solution capacities given in the chart below show how many films we recommend you can reliably process in various volumes of working solutions. If you feel you are interested in extracting more capacity from the solutions, please read the statements under the heading "More Chemistry Capacity."

FILM SIZE	110 (20 exp.)	126	135 (24 exp.)	135 (36 exp.)	120	220	4 x 5 (sheet)	8 x 10 (sheet)
Rolls or sheets/ 1000 ml (34 oz.)	36	16	12	8	8	4	32	8
Rolls or sheets/ 500 ml (17 oz.)	18	8	6	4	4	2	16	4
Rolls or sheets/ 250 ml (8.5 oz.)	9	4	3	2	2	1	8	2

More Chemistry Capacity

One is always concerned about chemistry life and capacity, quality of results and economy when processing multiple rolls in a batch of chemistry. From the user's viewpoint it may seem that chemistry manufacturers are somewhat arbitrary about the number of films which can be processed before the chemistry must be dis- carded. This stems from the manufacturer not knowing - only guessing - four essential things: how many films will be processed in freshly mixed chemistry; in what manner and how long will the chemistry be stored before processing again; what contaminants have entered the system from either the water supply or from unintentional chemical intermixing; and how far can the results deviate from ideal before the user deems them unacceptable. All developers start on an inexorable downhill exhaustion path the moment they are mixed, and exhaust faster in the presence of air, contaminants and high temperature, and suffer superimposed stepwise exhaustion with each use. We can offer some observations on extended chemical capacity:

- If you accept the role as the final arbiter of acceptable results it is easily possible to process 25%, 50%, or even more rolls of film than those listed in the capacity charts above by following the instructions below for "Chemical Reuse - Processing with Weakened Developer Solution", so long as all processing takes place within a few days after mixing the chemicals. There is only one rule in this exercise: process film until you no longer like the results. The safeguard in this procedure is that results generally will not plummet precipitously from "good" to "bad", but will change gradually.
- If you take full responsibility for quality of results, it is possible to process more film over a much longer time span. This procedure is somewhat risky unless you process some film every day or so to monitor chemistry performance. Otherwise, partially used working solutions left untouched for a week or more might have changed so significantly that you would suffer a dramatic decline in results. If you choose to operate under these conditions, our best advice would be to process a small piece of test film, and on the basis of these results, decide whether or not to commit valuable pictures to the chemistry.

Chemical Reuse - Processing with Weakened Developer Solution

Using a volume of chemicals once will not destroy its ability to develop film. However, extra time must be added to the processing to compensate for the weakened developer. Whenever reusing developer, combine all used developer with unused developer to make 1000ml of Weakened Developer Solution and add 3% to the recommended development time for each 135/120 roll, 8x10 sheet and every four sheets of 4x5 previously processed.

For example, you just developed 4 rolls of film at 106ºF. You have several more rolls to process. To process the next 4 rolls at 106ºF, combine used chemicals with unused chemicals to make 1000ml, multiply 3.5 (3:30 min:sec) by 1.12 (12% increase). 3.5 x 1.12 = 3.92, so you process the next 4 rolls at 106ºF for ~4 min. The time for the next 4 rolls used in the same 1000ml remixed developer is calculated in a similar manner, except the recommended development time must be increased by 24% (3% for each roll previously processed). 3.5 x 1.24 = 4.34 or 4:20 minutes.

The same is true when mixing weakened developer solutions in 500ml and 2 Liters volumes, except development time increase will differ. Weakened Developer Solution instructions for 500ml, 1000ml, and 2 Liters mixtures are listed below.

500ml: Combine all used developer with unused developer to make 500ml Weakened Developer Solution. Increase recommended development time by 6% for each roll/8x10 sheet/4x5(4) sheets previously processed.

1000ml: Combine all used developer with unused developer to make 1000ml Weakened Developer Solution. Increase recommended development time by 3% for each roll/8x10 sheet/4x5(4) sheets previously processed.

2 Liters: Combine all used developer with unused developer to make 2 Liters Weakened Developer Solution. Increase recommended development time by 1.5% for each roll/8x10 sheet/4x5(4) sheets previously processed.

Use the above formula for the Developer ONLY. Optimal results are obtained when chemicals are used only once. See "More Chemistry Capacity" section above for details. Mixing weakened developer solution is not recommend for push processing and is less effective at lower processing temperatures. Reusing the Blix does not affect the processing time.