Basic Paper Reversal Processing Steps

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Reversal processing of regular, resin-coated (RC) graded enlarger paper shot directly in a large format camera is a very inexpensive method of producing a unique positive print. The process is similar in some ways to the wet plate collodion process. Both processes have comparable orthochromatic responses to light and similar slow ISO speeds (around film ISO 3). The processing time for each is also similar, although the chemistry is quite different.

Other alternatives are using Harmon or other direct positive paper. This paper is developed normally, but renders a positive print without additional processing steps. One could also shoot paper in-camera and develop as a paper negative. Digital post-processing allows such an image to be inverted to a positive easily. However, having a directly viewable print right from the darkroom has a certain charm and satisfaction associated with it.

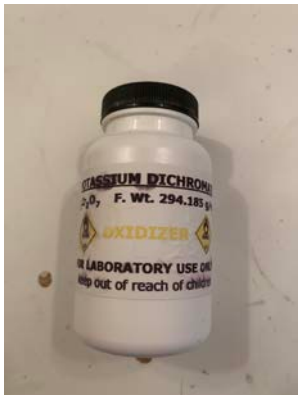
The process presented here is virtually identical to that used in the early black and white chemical photo booths. Processing in those machines typically took about 5 minutes, using a series of “dunk tanks”, just about the time needed here in the darkroom to produce a single 4x5 or larger positive print.

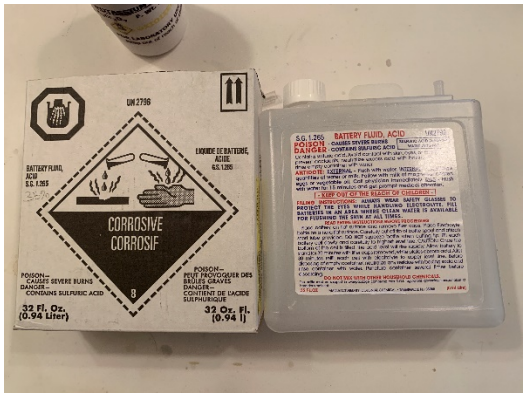
Materials:

- Arista EDU Graded #2 Resin-Coated paper, 5x7 cut to 4x5 under red safelight, pre-flashed per text for contrast control
- Standard dilution Dektol (1+2), Ilford Multigrade (1+9), or other general purpose print developer
- Potassium Dichromate powder for making Kodak R9 bleach
- Concentrated sulfuric acid, 35% battery acid, or dry "pH Reducer" pool chemical containing 100% sodium bisulfate, for R9 bleach
- Powdered sodium sulfite (different from sodium bisulfate, above!) for clearing solution to remove R9 bleach stain.
- Powdered "Iron Out" iron remover/cleaner, from hardware or grocery store.
- Distilled water

Prepare the paper developer per instructions on container.

Prepare the Kodak "R9" bleach:





The potassium dichromate is very toxic if the powder is inhaled, so wear a mask/respirator and weigh carefully to avoid getting dust airborne. Once in solution, it is safer, but still toxic. It can cause difficult-to-heal ulcerations if it comes in contact with skin or an open wound. When exhausted, mix with the sodium sulfite clearing solution. This will turn the bleach from bright orange to green, a less toxic form and safer for disposal. I was told by my village to simply discard down the drain as the treatment facility removes heavy metals from sewer waste before discharge to streams, and the quantities are very small. Wear gloves when handling!!! Kodak also marketed this stuff as "tray cleaner". I have had mixed success using it as a silver nitrate stain remover. The orange stain can make a bigger mess than the original stain.

- 700ml of distilled water
- 34ml 0f 35% sulfuric acid (1.265 Specific Gravity battery acid concentration) - ADD ACID TO WATER!!
- 9.5g potassium dichromate
- Add water to make 1000ml.

The formula using concentrated sulfuric acid is:

- 700ml of distilled water
- 12ml 0f concentrated sulfuric acid - ADD ACID TO WATER!!
- 9.5g potassium dichromate
- Add water to make 1000ml

An alternate formula that works as well, where sulfuric acid is unavailable

- 700ml of distilled water
- 65 grams of sodium bisulfate (sold as swimming pool/spa/hot tub "ph reducer" - ADD powder TO WATER!!
- 10g potassium dichromate
- Add water to make 1000ml.

Prepare a 5% by weight solution of sodium sulfite clearing solution (to remove orange bleach stain from print)

- Water 1000 cc
- Sodium Sulfite, Desiccated 50 grams
- Agitate for 1 minute

Prepare the “Iron Out” fogging developer just before use

Prepare the "Iron Out" developing solution immediately or less than 45 minutes before use. It MUST be prepared with distilled water or mineral contents in the water will deactivate the active ingredient (sodium dithionite) and cause a slow or failed second development or poor final print density. The developer is one-shot only, as it depletes after a single print. The Iron Out powder tends to get airborne easily. You don't want the dust floating around, as it will fog and darken any unexposed photographic film or paper on contact. Inhaling the dust will kill your sense of smell for hours. It is a pretty strong oxidizer. It tends to fizz a bit when water is added, so be careful of splashes from the fizzing. Be sure it is 100% dissolved before use, as undissolved particles may cause dark spots on the print.

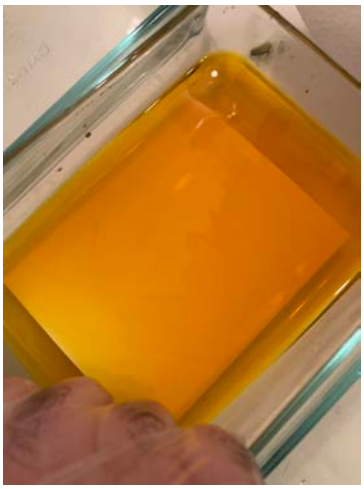
- About 1 heaping tablespoon (not critical) dissolved in 250ml of distilled water

Setup

Arrange three trays (I use Pyrex glass trays with plastic covers) for development and add about 300 ml of chemical to each tray in the order of Dektol, bleach, clearing solution. Reserve a fourth tray for the final Iron Out fogging development, but don't add the developer yet. It is poured over the top of the print. Fill one additional large (8x10) tray with tap water for rinsing.

The development process

1. Remove the exposed film from the holder under a red safelight and develop in Dektol or other standard paper developer for 90 seconds, to completion. DO NOT TRY TO ADJUST THE RESULTS BY VARYING THE FIRST DEVELOPMENT TIME!! ALL EXPOSED SILVER MUST BE COMPLETELY DEVELOPED OR SPLOTCHES AND DARK PATCHES WILL APPEAR ON YOUR FINAL REVERSED PRINT. Use 90 seconds, every time. If the exposure is correct, you will have a very, very dark negative image, nearly black. This is OK. A normal looking paper negative density will not reverse properly and turn out nearly black once reversed.
2. Rinse the print in the tap water tray for 30 seconds to stop development. It is OK to turn on the normal room lights after this step, but begin bleaching immediately.
3. Immerse the negative image in the orange bleach for twice the time needed for the image to vanish completely, leaving a white paper. This is generally 30 seconds.

4. Remove the print and rinse for 60 seconds in the water tray to remove as much of the orange stain as possible. The emulsion is softened by the high acidity of the bleach, so rinse carefully to avoid marks and scratches.
5. Place the print face-up in the 5% sodium sulfite clearing solution. Apply gentle rocking agitation for 60 seconds or until the paper appears free of residual orange stain.

6. CHANGE THE RINSE WATER and rinse the print face-up for at least 30 seconds.
7. Place the print face-up in the empty final development tray and pour half of the 250ml of prepared Iron Out over the top of the apparently-blank print. Immediately agitate with gentle rocking. The positive image will appear immediately. Continue development until no further density changes are evident. This development must also be done to completion. DO NOT TRY TO ADJUST THE PRINT QUALITY BY REDUCING DEVELOPMENT TIME. The process is much like slide film, with a narrow range of acceptable exposure. The only controls are the pre-flashing time and the exposure time.
8. Rinse the print in the tray for 30-45 seconds. No fixing is required, as all silver has either been bleached away or developed completely. A short wash is enough to remove residual traces of Iron Out.
9. Hang to dry, ready to scan in 30 minutes or so. RC paper dries quickly.

Notes on Exposure

Graded paper is used to avoid the subject coloration or light color temperature from affecting the contrast of multi-grade paper, although you may get acceptable results with it. I haven't tried it.

The orthochromatic Arista EDU graded #2 paper is rated at "ISO P400". To obtain an equivalent film ISO rating, the generally accepted formula is to divide the "P" rating by 80. This would give a rough film ISO equivalent of 5 or 6. The nature of the reversal process requires a very dense negative image with an over-exposure of from 2-3 stops. The paper is orthochromatic, so light meters do not work very well for measuring exposure, but I find a meter is still useful as a guideline.

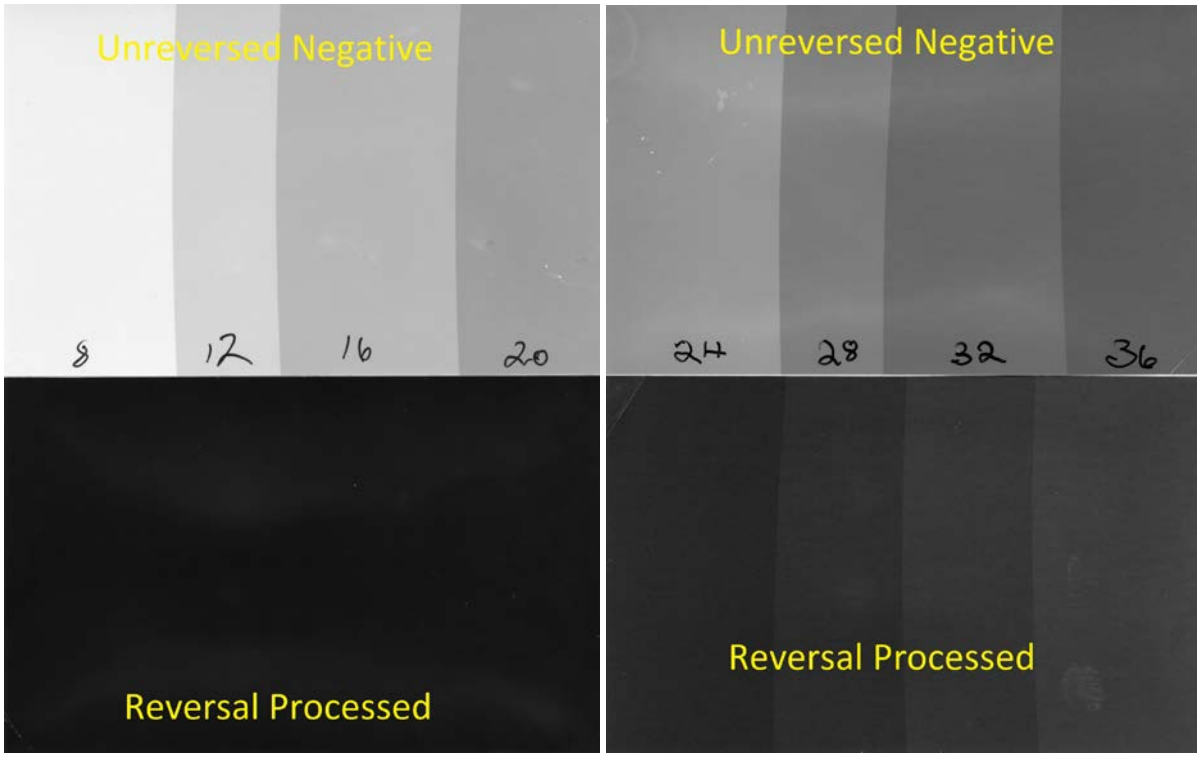
I set my meter to ISO 3 and typically double the indicated times at my selected aperture for bright sun, rich in UV. I typically add another stop for indirect indoor light, and another bellows extension stop for close-ups where the (4x5, 210mm lens) bellows is extended to a foot or so. Artificial light may require more or less adjustment to dial-in the exposure. One trial print is usually enough to allow an acceptable exposure on the next attempt. The speed of the development process is a plus here!

Spectral sensitivity, speed and results are very similar to wet plate collodion, except with more grain and dynamic range. The left image (below) is a tintype, the right image a reversal print.

The nature of the reversal process is very high contrast. With a good exposure, the excessive contrast results in a loss of shadow detail in the final print. The best way to get back the added shadow detail is to "pre-flash" the paper for a brief period under an enlarger with an empty negative carrier.

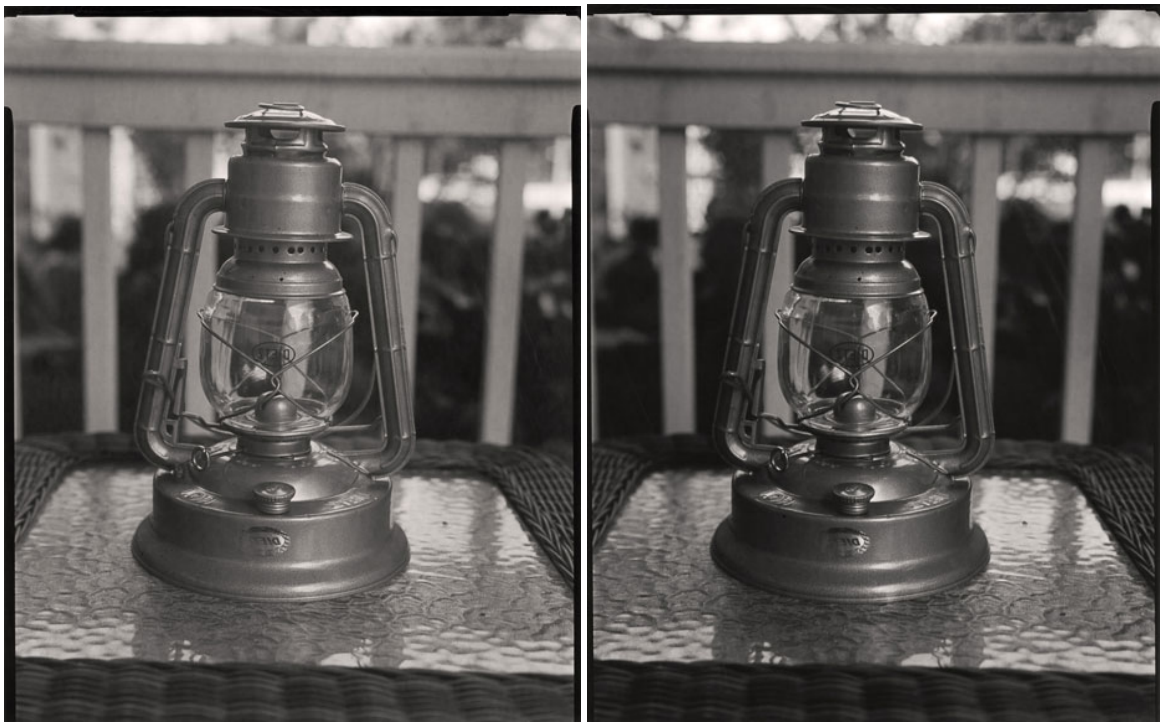
It is necessary to run a few test strips to determine the smallest exposure required to obtain a discernible change toward brightening in the maximum density of the reversal processed test strip. The enlarger settings (lens, aperture, distance from lens to table, and exposure time) should be recorded and may be used to quickly prepare a set of papers for loading into film holders.

The image below shows the changes in both the negative image before bleaching and the final reversal print for the indicated times and settings described below. Between 24 and 28 seconds produced the first discernible change in the reversal print, although changes in the negative image begin much earlier.



For example, I have found that with my Beseler 23 C II enlarger with Dual-Dichro head, I set the Dual-Dichro filter controls to 30-30-30, the 50mm lens to f/16, the 35mm negative carrier and condenser installed, and a height adjustment of "22". A 24 second pre-flash time just gives a noticeable change to Dmax in the reversal-processed test strip with these settings.

The improvement pre-flashing makes in the final print is dramatic. Left image is pre-flashed, the right image is not.



One caution is the minimum density achievable with the process is less than could be obtained with actual direct positive paper. This is because the "white" in the final image is the bleached developed silver from the negative, slightly stained by the dichromate bleach. This is not as "white" as the unexposed and fixed paper would be in a normal print. The scanning process easily compensates for this, but the actually prints can appear dim, especially going for a low-key effect that I like.

Of course, the image is mirror-imaged, just like a tintype. I usually leave it as is, but the image can easily be horizontally flipped in the scanner or post-processing.