

STEP-BY-STEP GUIDE: COPPER-PLATE PHOTOGRAVURE FULL PROCESS SUMMARY

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MAKING THE DIGITAL FILM POSITIVE

- 1) To make a black and white digital film positive, see the notes for preparation of the digital file.
- 2) To learn how to make an appropriately colored digital film positive, go to Mark Nelson's website: <http://www.precisiondigitalnegatives.com>

MAKING THE TRADITIONAL FILM POSITIVE

- 1) To make a traditional film positive, use an enlarger or copy camera to enlarge or contact print the negative on to lith film such as Freestyle Arista APH film.
- 2) Select and clean the negative and determine correct orientation. (Usually emulsion side up in the enlarger.) Carefully clean all surfaces of dust, hairs and lint and avoid fingerprints.
- 3) For lith film, use Kodak Polymax Paper Developer, (dilute at 1:19) at 20° C (68° F), stop bath, rapid fix diluted for film, and wash water, all at or near 20° C (68° F). (Dektol at 1:10 can also be used, as can a low contrast developer in combination with Dektol.)
- 4) Make stepped test exposures on to a sheet of film to determine correct ratio of exposure time and development time. Start with normal development (about one minute) and adjust development time to correct contrast. (50 sec to almost 2 minutes) Agitate in the tray continuously. Use just enough fresh developer for each test or full sheet then discard.
- 5) Test the exposure and development times in order to produce a highlight detail density of 0.40 to 0.50 (Stouffer steps #3+ to #4), and a shadow detail density of 1.65 to 1.85 (steps <#12 to #13) and full black at 2.00 or slightly higher. Dry the test strips with a hair dryer before evaluation.
- 6) Process then wash final film positives for 5 to 10 minutes. Use a wetting agent in the final rinse (optional). Squeegee (optional) then hang to dry from one corner in a dust free environment. Handle carefully. (You can use a hair drier for the test strips to speed things along.) Read densities as you go.

SENSITIZING THE GELATIN TISSUE

- 1) Mix a 3.5% solution of potassium dichromate and distilled water for the normal contrast Autotype G35 tissue (5% for the lower contrast Autotype G25 tissue). Wear respirator/dust mask, face shield and gloves. Avoid any inhalation or skin contact. One liter of mixed solution can safely sensitize one square meter of tissue. The age of the sensitizer is even more important. Keep refrigerated (but not with food!!).
- 2) Cut a piece of gelatin tissue at least 3 cm (1 1/4 inch) larger than the image area (include allowance for the 21-step scale in the image area).
- 3) Immerse the tissue in sensitizer at 10° C to 13° C (50°-55° F). Wear gloves and face shield.
- 4) Once the tissue relaxes and begins to lie flat, brush lightly in all directions with a very soft, wide brush to remove air bubbles. Use the brush to hold it down under the solution until the curl completely relaxes and it flattens out.
- 5) Leave face up for first one and a half minutes and then flip over. Keep in for a total of 3 minutes.
- 6) Have new sheets of degreased Plexiglas or Perspex ready on a nearby firm support. (Cleaned in advance with 100% alcohol and then dusted with canned air.)
- 7) Drain the tissue onto the Plexiglas to form a puddle. This “lubricates” the surface for the next step, but be careful not to overdo it or the tissue will be too slippery when trying to position it.
- 8) Position the tissue so that its edges are parallel to the Plexiglas. Slide onto the Plexiglas and squeegee the tissue in place while holding one extreme edge. Repeat in all four directions from the center.
- 9) Lightly rub the backing dry with paper towels to remove the excess sensitizer from the front and back of the Plexiglas.
- 10) Place 2-3 inch wide strips of newsprint along all four edges, covering about 1” of the tissue. Tape the ends to the Plexiglas.
- 11) Lay the Plexiglas horizontally on a counter top in a 60% R.H., closed, light safe (dark) area.
- 12) Position a small fan to blow air up and away from the Plexiglas. We use speed #2.
- 13) Rotate and shuffle the Plexiglas every half hour for 2 hours, then move the fan so it skims across the surface of the row of Plexiglas sheets, but not directly on the tissue backs – reduce speed to #1. Reposition the plates every 15 minutes for another 1 to 2 hours.

- 14) After a total of approximately 4 hours since sensitizing, the tissue should start making little crackling noises when the Plexiglas is flexed. Once the tissue pops off or peels off without resistance, it should be peeled and laid face down on the Plexiglas to air-dry for another 30 minutes. Then it is ready for freezer-storage or use. Wrap it well in a lightproof plastic bag or envelope like that which photographic paper comes in.

PREPARING THE COPPER

Always wear gloves when using polishes, solvents, TSP, and brightener.

- 1) File to bevel the edges of a 16 to 20-gauge mirror-finished gravure copper or good quality roofing copper. Sand and burnish the bevel, round the corners and remove the burr on the back. Clean the back of the plate with naphtha.
- 2) Mirror-surfaced copper should simply be polished with Brasso to remove all tarnish in order to be ready for the degreasing and brightening step (#6).
- 3) Roofing copper: Scrape and burnish any major scratches on the plate. Rub with rottenstone and oil on a felt pad if there are a lot of fine scratches. If none, proceed to the next step.
- 4) Unless the copper plate is already mirror-surfaced, polish the plate to high gloss following the order listed below:
 - i- Wet/Dry automotive sand paper starting at 400, then 600, then 1000 or 1200 grit with water (depending on the condition of the copper).
 - ii- Use Brasso as the lubricant and move to 1500 grit, then 2000.
 - iii- Final polish with Brasso and a soft cloth.
- 5) If singular scratches are discovered at this point, use the burnisher with oil to flatten them, then repeat the Brasso polish with emphasis on the corrected areas.
- 6) Move the plate to a tray in the sink and degrease for a minute or two with a teaspoon of trisodium phosphate (TSP) and a cotton ball soaked with water. Rub gently with a cotton ball until the water no longer beads. Finally, be sure to rub down the edges and back of the plate.
- 7) Rinse well with water. Keep the plate under water to avoid tarnishing.
- 8) Immerse quickly into the brightener (brightener recipe: one part glacial acetic acid plus one part table salt per 8-10 parts distilled water)
- 9) Rinse well with water again.
- 10) Immediately submerge into the second tray of cool water at 10° – 15°C (50° – 60° F).
- 11) Store the plate under water while awaiting the exposed gelatin tissue. If there are tarnish marks, repeat from the last polishing with Brasso, step 4 (iii).

EXPOSING THE GELATIN TISSUE

- 1) If using an aquatint, proceed to the positive exposure in Step 3. Otherwise, sandwich the screen of choice with the sensitized gelatin tissue, emulsion side to emulsion side, in the vacuum frame. Depending on the density and nature of the screen and image, the screen exposure can vary from 90% to 130% of the calculated positive exposure time. Be especially careful of dust. Clean all surfaces before each exposure. To ensure tight contact, allow the vacuum to run for a couple of minutes at 25 psi before turning on the light. Don't forget to wear gloves (such as nitrile) when handling the tissue and do not touch its surface.
- 2) Expose to a high UV light source for the optimum time. Take appropriate precautions to protect eyes from dangerous UV light levels.
- 3) Remove the screen and carefully align the tissue with the marks on the positive— including a step scale. For a FILM POSITIVE, strip in a Stouffer 21-step scale. On a DIGITAL POSITIVE use a digital 0–100% greyscale stepscale or a digital 11-step scale with scale adjustment curve applied so it matches the increments of a Stouffer 21-step scale. Carefully remove all dust with compressed air. Allow the vacuum to run for a minute at 25 psi in order to ensure tight contact before turning on the UV light for the second exposure.
- 4) For DIGITAL POSITIVES: If the humidity is such that the positive sticks* to the tissue and make a peeling noise when removed or worse, leaves black specks on the tissue (carefully check the positive over a light to see if there are little holes in the image). If these flaws are seen you need to clean the face of the newly exposed tissue with 100% alcohol on a soft paper towel to remove inkjet residue before proceeding to the adhering stage.

** This can also happen if you use the positive too soon after it was printed. If you force-dry the positive under a warm fan, this effect is greatly reduced. This problem can be avoided by heat-setting the positive at 60° C for 10 minutes.*

ADHERING AND DEVELOPING THE GELATIN TISSUE

- 1) Prepare a degreased and brightened copper plate and set it aside in a tray of pre-boiled tap water at 12° C to 15° C (54°-59° F). Stale, distilled water can be used if air bubbles or residues are a problem. See Chapter Four of our book.
2. Have a 50% alcohol adhering solution (pure alcohol mixed 1:1 with distilled water) ready at 10° to 15° C (50°-59° F). Leave it in the bottle until after the exposure to prevent evaporation. If there is an underlying rosin aquatint, use a tray of chilled distilled water instead.
- 3) Wear gloves during this procedure. Place the freshly exposed tissue in the tray of 50% alcohol. Brush the surface to remove air bubbles and to hold it under the surface of the solution. Continue until just before a reverse curl begins. (Note:

Filter the alcohol bath after each use. This solution can be reused but watch for signs of alcohol mottle.)

- 4) Remove the tissue from the solution and slide it gelatin side down above the copper plate which is submerged in a shallow tray of cool pre-boiled water.
- 5) Float the tissue above the copper until in position. Pin the middle of one edge against the plate.
- 6) Tilt the tray, with the pinned edge high, to allow the water to run out from under the tissue as you lightly brush the back of the tissue with the back of your gloved fingers.
- 7) Lift out the plate and tissue and place onto a firm support.
- 8) Squeegee from the pinned edge across the tissue using one smooth stroke. Repeat in each direction from the middle being careful not to trap air beneath the tissue.
- 9) After squeegeeing, lightly rub the back of the tissue dry with paper towels. Press the edges firmly and check for air blisters or edge frills.
- 10) Put the plate in a splash-free environment.
- 11) Fill a large tray with water at 32°C (90°F). Set the timer for 20 minutes.
- 12) Quickly immerse the plate, tissue side up. During the first minute, periodically add hot water to raise the temperature to 43°C (110°F) and maintain this temperature. Play the water over the back of the plate or agitate the tray.
- 13) As soon as you see signs of gelatin oozing along the edges (3 to 4 minutes when the screen exposure is from a diffused light source, less if collimated), peel off the paper backing. There should be slight resistance—but no tearing or lifting—as you remove the paper.
- 14) Develop by vigorously and continuously rocking the tray and rotating the plate 90° every 20 to 30 seconds. Continue to maintain the water temperature at 43°-45°C (110°-113°F) throughout. Be very careful not to touch the gelatin surface. Do not exceed 47°C (117°F) or all of the gelatin could melt.
- 15) Once the water remains completely clear, development is done. Development time after the paper backing is removed should be between 8 to 12 minutes.
- 16) Cool by gradually lowering the water temperature to 20° C (68° F).
- 17) Remove the plate and soak in an 80% alcohol bath (pure alcohol mixed 4:1 with distilled water) at room temperature for 5 minutes—except if using an underlying rosin aquatint. Agitate briefly. Add a “squirt” of 100% alcohol to the solution as you filter it back into its storage bottle.

- 18) Remove the plate from the alcohol bath after a total of five minutes and drain while rotating the plate at a steep angle.
- 19) Absorb the excess alcohol by holding the plate almost vertically and wiping the edges with a folded paper towel. Do not touch or scrape the image area. Rotate the plate and wipe all four edges in succession more than once.
- 20) Once the resist seems to have lost most of its sheen of liquid alcohol, quickly dry it with a hair dryer set on cool.
- 21) Allow an extended drying time for moisture content and relative humidity to attain equilibrium. (overnight)

THE DRY LAY-DOWN METHOD OF ADHERING GELATIN TISSUE TO THE PLATE

- 1) Prepare a degreased and brightened copper plate and place it face up on a blotter resting on a firm flat surface. If the plate has had an asphaltum aquatint ground applied to it, it should be brightened and dried just before this stage. (It is not advisable to use the dry lay-down technique on a plate with a rosin aquatint because of the use of the alcohol bath that follows.)
- 2) Place the freshly exposed tissue face down on the clean copper plate and tape down the back of the top edge to the copper surface.
- 3) With the plate positioned on a firm flat surface, lift the tissue by the leading edge and pour a small quantity of 20°-21° C (68°-70° F) distilled water along the taped edge and over the first third of the plate, edge to edge.
- 4) Firmly draw a squeegee or roller from the taped edge over the entire back surface as the tissue is lowered into contact with the copper.
- 5) After quickly squeegeeing firmly in several directions, rub the surface and pat the edges dry with paper towels.
- 6) Submerge for 2 minutes in an 80 or 100% alcohol bath. Omit this step if there is a rosin aquatint.
- 7) Fill a tray with 43°C (110°F) water. Set the timer for 15 to 20 minutes.
- 8) Quickly immerse the plate and proceed as per standard development (above).

PREPARING THE FERRIC CHLORIDE

- 1) Start with 8 to 10 liters (2 gallons) of the stock 48° Baumé ferric chloride at about 20°-22° C (68°-72° F).

- 2) Clean five to seven plastic 1.5 to 2-litre bottles.
- 3) Starting with 48° Bé, fill one bottle 3/4 full and mark "48° Bé".
- 4) Fill a second bottle less than 3/4 full with 48° Bé stock and reduce the Baumé by adding a tiny measured amount of water. Measure the Baumé using a hydrometer to see how much it has lowered. Extrapolate from this to determine how much more or less water is required.
- 5) Repeat step four until you have 8-9 bottles of mordant at 48°, 45°, 44°, 43°, 42°, 41°, 40° and 39° Bé. You might also want to have a 38° or 37° Bé. Measure the Baumé of all mixes at the same temperature. The more steps you use, the smoother the etch seems to progress, although one can certainly etch with 4-5 steps (45°, 43°, 41°, 39° etc.).
- 6) Add small measured quantities of ferric hydroxide sludge to each the Baumés where a lot of water was added or if there is suspicion of excessive free acid. Adding small fragments of copper will also help to reduce free acid and season the bath.
- 7) After a rest period of 24 hours or more, check the Baumé readings at 20°-22° C (68°-72° F) again. Re-adjust if necessary by inter-mixing.

STAGEING THE PLATE

- 1) Cut a piece of self-adhesive contact paper about 2.5 cm (1") larger than the plate. Peel off the backing and spread out face up on the counter top. Carefully center and drop the plate on to it (face up of course). Alternatively, use a ruler under the contact paper to bring it up in contact with the back of the plate in a smooth progression from one end to the other. (Figure 7-3). If your copper has a backing on it such as engraver's copper, this step is not necessary.
- 2) Define the image and step scale edge with a fine-tipped, permanent black Lumocolor pen. Be careful not to mark the image surface beyond this line. With a digital positive, the clear line around the positive will provide you with a guiding line.
- 3) Use long strips of 3M Magic Tape to cover the area outside the image. Cover the pen line with the tape. Surround the step scale. Extend the tape over the edge and lap the contact paper backing about 1.5 cm (1/2").
- 4) Burnish the edge of the tape with a burnisher or a bone folder. Pay special attention to the intersection where tape laps over tape.
- 5) Spot out pinholes and tiny flaws with a fine permanent marker.
- 6) Attach strong tape handles across the back and long enough so as not to fall into the trays of ferric chloride.

- 7) Put the plate aside, far away from any risk of being splashed while you prepare the etching trays and sink area.

ETCHING THE PLATE

- 1) Set up 2 to 4 trays of ferric chloride solutions depending on available space in the sink. Check the Baumés and adjust if necessary. Stabilize the working temperature of the solutions and the room to somewhere between 20° C to 22° C (68° F to 72° F). Keep the temperature consistent throughout the entire etch.
- 2) Set up a blank copy of the etching chart (Appendix H) and a pencil in a convenient spot where ferric chloride drips will not be a problem.
- 3) Start the timer with the 48° Bé bath. We now usually start with the 45 Bé bath. Immerse the plate and immediately go over the surface very gently with a cotton ball soaked in ferric chloride to dislodge air bubbles. Leave in this bath for 2 minutes agitating every 15 seconds.
- 4) Move to the 45° (or 44°) Bé bath and continue regular agitation.

For plates made using analogue lith film positives:

- a) Remain in this bath until steps #21, #20, #19 all the way to step #15 have begun to etch slowly. For B&W digital positives, the steps go from 0 – 100%. The first signs of etching should not take longer than 15 to 20 minutes. If it appears to be slow starting, move along to the 44° Bé for a couple of minutes, returning to the 45° Bé if the etch begins rather quickly. Depending on the density of the resist, the 48° Bé may serve only as the conditioning bath. Use 45° Bé, 44° Bé and 43° Bé to etch the blacks and shadows. Digital positives tend to produce resists that etch more quickly.
- b) As the etching slows down, begin to use the 43° Bé bath. Move back and forth between the 44° Bé and the 43° Bé ONLY if it is necessary to control (advance or slow down) the speed of the appearance of the next step (#12, then #11, etc.). Once again, you may need the 42° Bé or 41° Bé at this stage to restart a stalled etch. The alternate procedure is to use a 42° Bé next, but don't go back. You then move on to the 41° Bé etc. as needed. If you move forward one degree at a time, there should be no need to ever go backwards.
- c) Use successively lower Baumés, down to 39° Bé, to etch the increasingly dense areas of resist
- d) The aim is to have an even progression of etching from step to step on the Stouffer Scale, ideally 2 to 2.5 minutes between steps for a lith film image. The time for steps with a digital positive may be shorter. Once the

shadow detail step has begun to etch (an average density for shadow detail) the timing of the remainder of the etch should be completed in approximately 20 to 25 more minutes. The entire etch should take approximately 30 to 50 minutes. Longer total times will run the risk of open biting the darkest areas, especially in fresher mordant.

For plates made using a B&W digital film positive:

- a) A digital positive will necessitate a slight shortening of the overall etch time compared to a lith film positive. From the time when the shadow **detail** (80 – 90% is typically the shadow detail) etching begins, attempt to complete the etch within 18 to 20 minutes. It is also important to ensure that there is good separation between the etching of 100% and 90% steps, so try to keep 2.5 to 3 minutes between the etch start of each of these steps and then gradually diminish the etch time between steps as it progresses.
 - b) Be careful not to over etch the 10% step, we find a one minute etch for this step is usually sufficient. 0% Step should not etch. If it begins to etch, stop the etch immediately or your spectral whites will be etched. We include a 5% step on our stepscale as a safety gauge.
 - c) Once the .5% step is just starting to etch, we know it is time to immediately stop the etch. (see the following step, #5)
- 5) Once the highlight detail fully etches, be prepared to remove the plate from the mordant quickly. Immediately rinse well under running. Remove all traces of ferric chloride and do not let any ferric chloride drip onto the surface of the plate. The gelatin resist should rinse off at this point or can be helped along with a quick rinse in 1:9 muriatic acid (purchased as hydrochloric acid at 20° Bé/31.45% industrial strength and mixed 1:9 with distilled water) to remove any stubborn resist and to brighten the plate.
 - 6) Lightly polish the plate with Brasso. Remember that firm polishing will lighten some tones, so be gentle at first. Now, you can proof it!

THE PRINTING PROCESS

- 1) Make sure the edges of the plate are properly beveled and burnished.
- 2) Have the printing paper prepared—torn to size and pre-soaked.
- 3) Have the cheesecloth or very well softened tarlatan prepared—cut to size and balled up.
- 4) Prepare the ink, mixing it to the right consistency.
- 5) Set the pressure of the press slightly higher than for standard intaglio printing.

- 6) Warm the plate on the hot-plate for a warm wipe (38°C or 100°F).
- 7) Squeegee or roll the ink onto the plate. Work the ink into the recesses using a well-inked cheesecloth.
- 8) Continue with the well-inked cheesecloth or soft tarlatan and begin wiping the plate in gentle circular sweeping motions. Be careful not to stop and lift ink from the surface of the plate.
- 9) Once the excess ink is removed, change to a slightly cleaner cheesecloth.
- 10) Use the cleanest cheesecloth for the final stage of wiping. Be sure to use very little pressure—NO scrubbing—and move the cheesecloth in continuous motions over the plate. Rotate the plate as you wipe.
- 11) Do a *brisk* but thorough hand-wipe for the final clean up. Magnesium carbonate can be used when hand wiping in order to brighten the plate tone.
- 12) Clean the borders, edges and plate bevel with a rag or soft paper.
- 13) Re-warm the plate on the hot-plate for a “warm” print.
- 14) Use newsprint and an acetate or Mylar registration sheet on the press bed to aid in positioning the plate.
- 15) Blot the wet paper between clean blotters or a white cotton towel to remove all the water from the surface. Brush in both directions with a clean drafting brush to remove stray lint, dust, and hairs from both sides.
- 16) Lay the blotted printing paper, good side down, over the plate.
- 17) Cover with the printing blankets. A better method is to have the blankets *captured* under the roller, and pulled back over the roller tightly. Have an assistant pull them back against the roller as you print the plate. Watch for fingers!!
- 18) Roll slowly through the press in an even and steady manner without stopping.
- 19) Carefully lift the blankets one at a time and stretch them back over the roller.
- 20) Gently pull the paper away from the plate. If there is resistance, move together to the hot-plate to warm slightly before continuing to pull the paper away from the plate.
- 21) Inspect for printing problems then set aside between clean blotters to dry. Add weight to keep flat. Change the blotters every 6-12 hours to speed drying. An alternative forced-air print-drying set-up or pinning to a wall shortens this process considerably.