On Damp Printing

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"Hand-made paper in the 'water leaf' (totally unsized), or even with a small amount of surface sizing, can be printed dry without hardship, but many of the hard sized papers defy the most ingenious pressman in an attempt to print the paper in its natural dry state."
Dard Hunter, *Hand-made Paper*, The Dolphin I (1933).

With the growing interest in the production of fine books over the past decade, many younger printers have been exposed to handmade paper for the first time. A paper suitable for use in books — that is, one thin enough to fold easily but lie flat when open, tough enough to withstand repeated handling, and smooth enough to allow legibility — may not be soft enough to accept ink well. A sheet of extremely soft handmade paper may print well but not have the durability needed in a book. Compromise must be reached either by damp printing a hard sheet or by the papermaker attempting contradictory goals– toughness and softness in the same paper.

The solution available to most printers is damp printing, which softens the paper giving a better impression with less ink on the rollers and consequently less ink on the shoulder of the type.[1] We damp print to minimize type wear as less pressure and therefore less packing is needed to achieve a good impression on handmade paper.

We learned to print on a Vandercook SP15 using very soft handmade paper which accepted ink and impression well when dry, but had barbells and schlubs because of its incomplete beating and total rag content. These hard bits of matter can damage even foundry type when a head-on collision occurs and are fatal to monotype, which is much softer. After tiring of type replacement with each book,[2] we tried to change our paper from a soft absorbent sheet to one with fewer knots and a smoother surface. The schlubs were greatly reduced but the resulting harder sheet created its own set of problems with inking. More time in the beater and the addition of linen to the furnish made a beautiful but impenetrable stainless steel paper resistant to scuffing but non-receptive to ink. We had purchased a few reams of Glenn Wark's Leaf paper in 1981 which proved to be even more difficult to print than our own handmade paper because of its hardness.[3]

We resorted to damp printing for the next three books[4] using both Leaf paper and our forty pound linen/cotton text paper. The results were gratifying in that the paper plumped up like a raisin; the ink wicked off the type with little or no splash onto the shoulder. With damp printing, inconsistencies in the weight and formation of individual handmade sheets made less of a difference. This helped to insure the same degree of color throughout the book.

Each printer seems to have his favorite method for dampening paper, but all have a common objective; the even distribution of just enough moisture through a quantity of paper to make it receptive to type and ink. There are two basic ways to do this: one uses blotters and the other does not. We prefer using a pack of blotters because the moisture level can be estimated before the paper is inserted.

The no-blotter methods involve spraying, sponging, or brushing water directly onto the sheets, then placing the paper into a humidor, a box lined with wet sponges with a hinged door. This eliminates the awkwardness of blotters, but adds the risk of damaging the paper surface, creating wrinkled sheets, or leaving brush hairs or bits of sponge on the paper, impairing printing.

The system for preparing the damp pack is as follows: Take a stack of acid-free blotters; dip every sixth one under water; hang it on a clothesline to drip off excess, then interleave it back into the pack of dry blotters; press overnight to percolate the moisture throughout. The next day interleave the paper cut to the correct size into the pack, placing approximately three sheets per blotter. (The number of leaves one can stack together is determined by the weight of the paper.) Place a heavy weight on this sandwich of paper and blotters for twenty-four hours, then, on what would be the third day from when you started moistening blotters, begin to print. Restack the printed leaves in the damp pack for subsequent runs. Off-setting problems are avoided by waiting a day before printing the flip-side.

Paper can be left in a cold damp pack for up to two weeks if a fungicide is added to the blotter moistening water.[5] Mildew and rot are more of a problem in warm environments so we do most of our damp printing in the winter months. Our best results have been in a cold studio with no central heat: the pack doesn't mildew, the paper doesn't rot and the ink stays stiff and open on the press.[6]

When paper is dampened it expands in all directions. The expansion in thickness is what helps the printer, but the change in length and width can be disastrous. If the sheet is unevenly dampened, it will be wavy or cockled, or if it isn't the same degree of dampness that it was on a previous press run, accurate registration will be impossible. Unfortunately, a fine book may have three to four press runs on a page. It is unlikely that the printer can complete all the work before rot or mildew begins in the paper, so it is best to gang all runs needing tight registration together.

The theme of imposition[7] or perfecting the sheet recurs in all the literature on damp printing. Most printers avoid registration problems front to back by using a printing technique called work-and-turn, where the damp sheet is fed through the press once, then immediately flipped over to print the back side of the leaf. Two side guides are needed on the feed board as well as a mylar tympan because the ink, if it's still open, has a tendency to offset onto a paper tympan.[8] Slip sheets can be used to protect the original side from smearing the tympan as it is fed through the press a second time.

Paper expands to varying degrees when wet, depending on the amount of moisture added to the pack as well as the fiber content and the processing of the sheet.[9] The use of a paper drier[10] reduces shrinkage problems, mildew, and extends the time one can work on a folio, because the expansion and contraction of a given paper becomes predictable. We noted an expansion of about .25 percent when both our paper used in *Tree Sequence* and Leaf paper were dampened for printing. They returned to their original sizes when dried under restraint. Registration of subsequent press runs was made easier by keeping the sheets in the damp pack between times. We have also dried the sheets and gone back to redamp and print with no problems, but it is more time-consuming.

By applying the water to the blotters rather than the paper, the risk of some sheets becoming abraded or too wet to print is avoided. The ink looks spotty and light if the paper has been over-dampened. Unfortunately, the empirical approach is the only way to gauge the correct amount of moisture for any given handmade paper.

The hurried pace of work-and-turn printing is a direct result of difficulties incurred drying and redamping the paper without the benefit of a paper drier. Some printers avoid tight registration altogether when damp printing, while others suggest measuring the text block for expansion then matching it by adjusting the level of moisture in the pack. The drying methods we've seen or heard about include: boards hung with marble clips which grip the dampened sheets; trouser hangers that do the same thing; and paper simply stacked in piles of ten and then reshuffled. The problem with these systems is that all require removing the cockling after the paper has dried. We find the forced air drier an advantage when damp printing, but understand that most printers will not want to invest in a piece of equipment meant for a production paper mill.[11]

What follows is a general outline for a dry printing paper that can be printed damp as well.[12] The all-cotton furnish consists of colored rags cut into small squares to minimize knots, unbleached Cheney half-stuff, and linters in the following proportions: ½kg rag to ½kg linter to 2 kg half-stuff.[13]

Photographs are of "pho" in palatino italic twelve point.

1. Glenn Wark's paper printed dry

2. Glenn Wark's paper printed damp

3. Neal Bonham's paper (sized) printed dry

4. Neal Bonham's paper (sized) printed damp

5. Neal Bonham's green paper printed dry

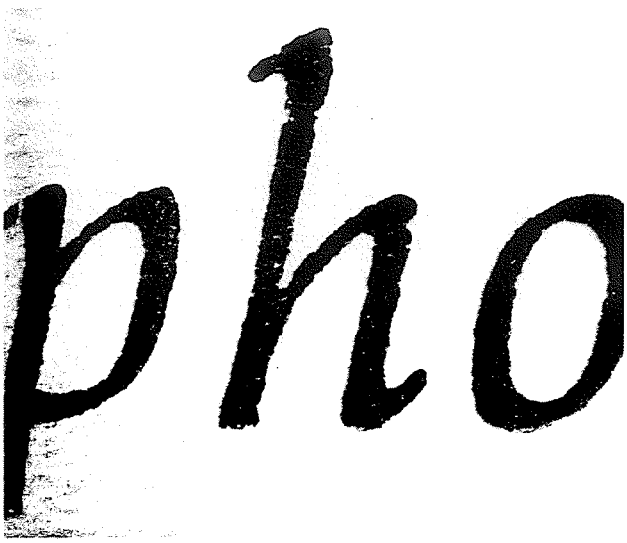
6. Neal Bonham's green paper printed damp

Notes on photographs:
Samples numbers 1, 2, 5, and 6 are waterleaf.

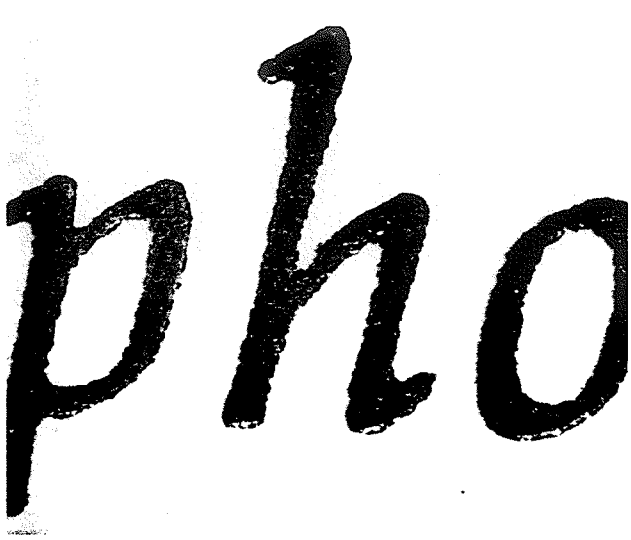
Sizing for numbers 3 and 4 is rabbit skin glue surface sized in a tub.

All samples were printed during one summer afternoon with the same amount of ink on the rollers; this accounts for the slight over-inking of the shoulder on numbers 2 and 6, which were printed damp.

Note the stippling in the dry samples.



1



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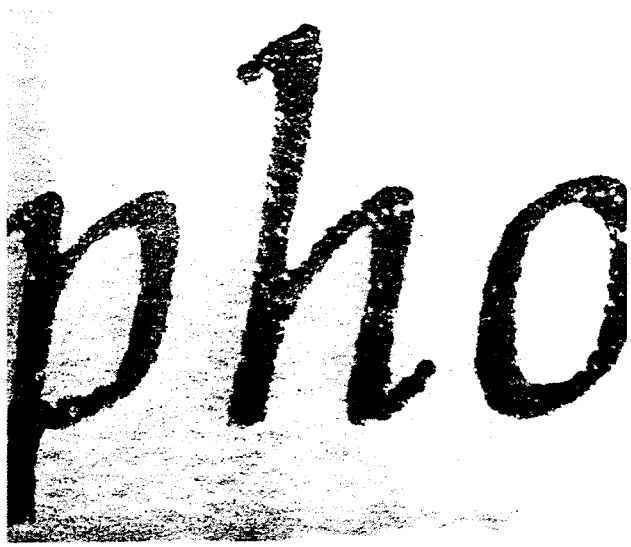
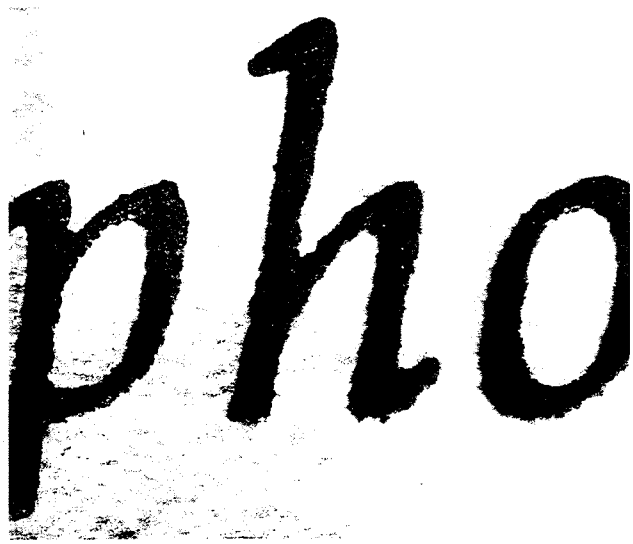
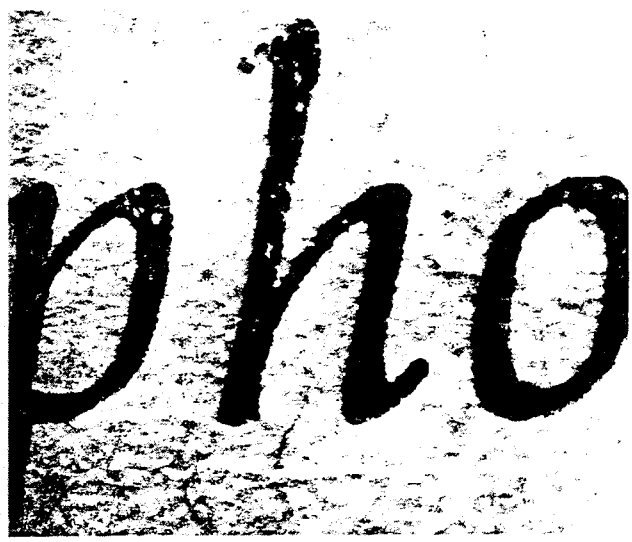


3



4



5

6

We beat these fibers separately to control fiber length, which we gauge by 'curd size'. If the curd size is too small the ensuing sheet will be extremely hard to print on dry; if the curd is too large the pulp will yield cloudy or wild sheets. A short fiber length, however, is important for good formation.

The unbleached grade of half-stuff we use must be beaten in a sharp Hollander with good contact across the bedplate.[14] If there is poor contact across the mating surfaces it takes longer to cut down the fiber length. We cook rag lightly in soda ash before processing in the Hollander to remove any residual starch, dirt, or detergent. After rinsing until the water is clear, the rag is loaded into the beater at a consistent rate to assure reproducible results, then the roll is brought closer to the bedplate.

The appropriate beating time for a good printing paper will depend on many factors, including the furnish, the fiber to water ratio, flybar sharpness, and roll pressure. One to two hours of beating suffices for most rags (less time being needed for old rag rather than new), and for most of the half-stuff as well, but a two hour beat is too much for most grades of linters.[15]

As the wetness of a pulp is largely determined by the beating time, we try to limit the time each fiber is in the beater. The longer the beating time, the wetter the pulp and the harder the paper. A free pulp retains less water and drains quickly on the surface of a mould. With experience, the hardness of a sheet can be estimated by the freeness of the pulp.

We exert 100 psi (pounds per square inch) for the first pressing of the post, with felts, and 50 psi for the second, without felts.[16] These relative amounts of pressure have a direct effect on the bonding of the fibers and therefore the hardness of the sheet. The paper drier runs at approximately 38 degrees celsius for twenty-four hours, yielding flat paper.

When everything is going well with a press run, it sounds and feels distinctly different to roll a sheet of dampened handmade paper across a form of type in the bed of a cylinder press. A slight hissing occurs as the ink is wicked off the type. The entire process involves three times the work, however, and it introduces registration problems. This method should not be used simply as a dogmatic response to handmade paper, soft or hard, sized or unsized.

Whether to print damp or dry is strictly dependent on the nature of the paper and the patience of the printer. Damp printing works well as a solution to reconciling the type with the resistant sheet; as a three dimensional rather than a two dimensional process, it is more interesting; and as a way to achieve attractive and consistent inking throughout a book, it is successful. While the necessity for it can largely be done away with through the papermaker's careful attention to the furnish, the processing of the fiber, and the avoidance of sizing, damp printing remains a useful means of printing in letterpress on handmade paper.

Notes

1. "On those rare and happy occasions when time and cost are secondary and where the finest possible finished product is desired, printing on damped paper, if skillfully done, will produce a result superior to ordinary dry printing. The punching of types into the softened paper raises printing from a two to three dimensional medium, and the slight halo or highlight created around the recessed letters gives life and sparkle to the page." Bruce Rogers, *Allen Press Bibliography*, n.d., 10.

2. "And of course you can use those same types over and over when they're foundry cast in hard metal; there isn't much wear when printing on damped paper." Lewis Allen, *Printing as a Performing Art*, (San Francisco: Book Club of California, 1970), 68.

3. Glenn Wark's paper is perfectly uniform, almost imperceptibly off-white, and totally free of knots, imperfections, and varying thickness. Made from 10% linen yardage and 90% unbleached Cheney half-stuff, the furnish is beaten from 2½ to 4 hours, resulting in a short-fibered pulp of great strength. The sheets (43 × 58 cm) are about 85 kg ream weight.

4. David Ferry, *A Letter, and Some Photographs*, (Seattle: Sea Pen Press & Paper Mill, 1981); Charles O. Hartman, *Gravitation*, (Seattle, Sea Pen Press & Paper Mill, 1982); and Leslie Norris, *A Tree Sequence*, (Seattle: Sea Pen Press & Paper Mill, 1984).

5. We use Zephiran, which is effective against fungus as well as bacteria, in the following proportions: 1 part Zephiran to 750 parts water. The concentrated 17% solution is available in most pharmacies and is relatively non-toxic. Zephiran (Benzalkonium Chloride) is a germicide commonly used in contact lens solutions as well as eyedrops. Other more dangerous substances have been used in the past such as Phenol which is acidic and formaldehyde which is volatile and considered unsafe when inhaled. Phenol, however, is recommended for use in damp pack in *The Tamarind Book of Lithography*. [Garo Z. Antreasian with Clinton Adams, (Los Angeles: Tamarind Lithography Workshop Inc., & New York: Harry N. Abrams, Inc., 1971), 417.]

6. "Printing depends on climate. For instance, if you print something on wet paper and the weather is dry, the paper dries while you're printing and curls up. You've got to keep it uniformly damp. And the San Francisco weather, the damp air, keeps the paper in the correct condition." Edwin Grabhorn, *Printing as a Performing Art*, (San Francisco: Book Club of California, 1970), 68.

7. This method of printing assumes that a printed sheet of paper will be used in more than one book. Each page is printed on sections of the paper which are not back to back. The printed sheet of paper will end up in different copies of the book.

8. Another disadvantage to a paper tympan is that it will cockle after repeated contact with damp paper. In addition, a mylar tympan can be cleaned more easily.

9. "If you can devise a way to guarantee damping each sheet with exactly the same amount of moisture you will solve the problem (of uneven expansion thus bad registration). I am sure this could be done with some simple machine, but you reach a point where you become tired of building things and just want to print your book." Henry Morris, *Omnibus*, (Pennsylvania: Bird & Bull Press, 1967), 111-113.

10. Glenn Wark designed and built our paper drier which operates using forced warm air channelled through a pack mounted vertically over the heat source. The restrained paper dries in twenty-four hours.

11. We discovered, however, that the drier we use tends to press out the type's impression which we work so hard to get.

12. Here is the recipe for *Tree Sequence* papers, which had to be printed damp because of the linen content. We used 10% linen (new Polish yardage), 25% old colored cotton rag, and 65% Cheney half-stuff (cotton); no linters were used. The cotton rags and linen were cut into

small squares leaving no strings. The linen and rag were cooked separately, each in a solution of 8 liters water to 15 ml soda ash to 1 kg of dry fiber. Each mixture was boiled for one hour, cooled to lukewarm, then rinsed three times using a hydropulper, changing the water with each rinse.

The fibers were beaten separately, although a portion of the half-stuff in with the linen seemed to help avoid clogging. The rag was beaten for 1½ hours while the linen and half-stuff were beaten for about 2 hours each.

13. By themselves linters are too fragile for book paper, having poor folding and tearing strength and no wet strength. We include them in the furnish as they help soften the other fibers.

14. This can be checked with carbon paper and a sheet of bond inserted between the bedplate and the roll.

15. Half-stuff, being made from new material, is far stronger than old rags. The same treatment that would make good pulp from half-stuff would reduce rags to worthless soup. Linters start out short and thus cannot stand heavy beating.

16. Our empirical knowledge about appropriate pressure was recently confirmed when speaking with John Koller, who presses his paper first at 150 psi, with felts, and then without felts at 75 psi.