Film Developing and Printing Workshop
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2017 revision

Introduction

The following notes cover the basics of black and white film developing and printing. They are intended to be an introduction, and are by no means comprehensive. Much of the material was taken from existing sources, especially from the websites of Kodak and Ilford. I have made a few editorial changes to facilitate the workshop, or in a few cases, to reflect my opinions.

There are three keys to success in the darkroom:

1. **Read the instructions!**

For every darkroom material or chemical, there are variables. Almost every photographic material (film, paper and chemical) comes with data sheets and instructions in the packaging. Likewise, each manufacturer publishes detailed data and instructions on the internet. **Read and follow the instructions.** You may vary from them once you have mastered the material, but it is recommended to stay with the manufacturers' directions until you gain experience.

2. **Use the best tools you can get.**

Although "photography is not for the faint of wallet", chemical photography has never been cheaper. Film, paper and chemicals may seem expensive, but in adjusted dollars usually cost no more than decades ago. Equipment is less expensive than it has ever been, due to almost all photographers having converted to digital in the last 10-15 years. Much lab equipment, including enlargers, is still being thrown away since the market value is so low. **The use of the proper tools will make darkroom work easier and more pleasant, which will in turn increase your productivity and the quality of your work.**

3. **Read a book!**

There have been dozens of basic, but comprehensive darkroom manuals published over the last few decades; one as recently as 2010. I will recommend a few titles. They are available used, at Half-Price Books locally, or on Amazon and other online sources. A few are available as e-books.

The following pages are a summary of what is covered in my beginning darkroom workshop. The illustrations on specific processing steps are from the Ilford publications. The complete publications are in the links on my webpage.[1] The links also include a good deal of other information. Don't be overwhelmed. But, keep in mind that the Ilford instructions are British and use a few terms that are different, and they assume that it is always cold in your darkroom.

[1] silverdarkroom.net

Processing Film

Even if you have never developed film before, you should not find it difficult. Processing is a simple routine with three chemical steps. It does not take long, about 30-45 minutes depending on a few variables. After approximately the first 15 minutes you can open the tank and look at the film. But you will still need to wash the negatives in tap water to remove waste chemicals before you can dry and print them.

This list of darkroom equipment covers the essentials and some luxuries, but is not necessarily complete. I like to think of darkroom equipment in three categories: 1. absolutely essential, 2. nice to have, and 3. luxuries.

Absolutely Essential

- Developing tank and reels (critical)
- Accurate thermometer [2] (critical)
- A completely dark room OR a changing bag (critical)
- Film cap remover (for 35mm) [3]
- Measuring cylinders and beakers
- Chemical storage bottles
- Funnel
- Clock or timer
- Film clips [4]

Nice to Have

- Scissors
- Negative storage sleeves
- Stirring rod (for mixing chemicals)

Luxuries

- Temperature controlled water bath
- Mechanized processor

Developing Tank and Reels

The developing tank and reels are the most important. The tank keeps the film in total darkness, yet its top incorporates channels through which you can fill it with processing solutions. Inside, a spiral reel ensures the solutions reach every part of the film surface.

Thermometer and Temperature Control

During development, temperature control is **critical**, and you must use an **accurate** thermometer to make sure the developer is not too hot or too cold. Temperature is not as important with the remaining steps, or during washing, but should be within 9ºF/5ºC of the developer temperature.

[2] Does not need to be expensive, just accurate.
[3] There are specialty products sold for this, but a good old-fashioned "church key" bottle opener works.
[4] There are specialty products sold for this, but clothespins work.

Most instructions are for a processing temperature of 68ºF/20°C, and this should be followed if possible. However, you can process film at other temperatures within a given range, and there are manufacturer charts which gives the necessary adjustment in development time.

The Dark Room

You do not need a specially-built darkroom to process film. Any room will do provided it can be "blacked out" to stop **any and all** light entering it while the film is loaded into the developing tank.[5] Alternately, a light-tight changing bag can be used. Once the film is loaded into the tank, the rest of the process takes place in daylight or room lighting.

The processing can be done anywhere, such as a bath, laundry or kitchen. You do not need running water even for washing film, if you use the alternate Ilford wash method. However, running water, and especially a drain, will make this procedure a lot more enjoyable.

Make sure you clean up thoroughly after processing film or paper. This is important in a dedicated darkroom, but essential is using a bath or kitchen. Not optional!

The film should be hung to dry in a **clean** area. This is also critical.

Beakers, Storage Bottles and Funnels

Chemicals for processing have to be mixed and stored. Beakers, measuring cups, mason jars, etc. can be used. At least some of the utensils need to be graduated, as measurements are necessary. It is not necessary to buy special photographic utensils for all purposes. However, whatever is used should be resistant to chemicals and easy to clean. Glass and stainless steel are ideal, however, glass is fragile and stainless is expensive. Plastic is the alternative of choice, but be sure it is plastic that is resistant to chemicals and easy to clean. Glass is better than plastic.

Storage bottles also can be non-photographic specific. However, proper plastic photo jugs are readily available and are not expensive. Likewise, gallon size and smaller glass jugs are available. (try a beer making supplier) I recommended that developers be stored in opaque plastic or at least dark amber glass containers. Developers are somewhat sensitive to light and will oxidize in the containers a lot faster if exposed to light.

After doing this one time without a good funnel, the need for that tool will become obvious.

DO NOT use photographic chemistry utensils and storage bottles for anything else, especially not for eating, drinking, or food preparation.

Clock or Timer

Each step in processing film must be timed. The developer time is critical. The remaining steps are not as critical as long as the minimum times are observed. An analog clock – especially with a second hand – can be used, but a timer will be more efficient. Even the timer function on a smart phone will do.[6] Used GraLab 300 "clock face" timers are plentiful and with patience, can be had for little money.

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[5] Film packaging is often labeled with a phrase such as "open in total darkness". "Total" darkness means just that – there is no "How dark is enough?" 100% dark. Any light can expose film.

[6] … if you don't mind getting photo chemicals on your phone.

Using Chemicals

Note: Photographic chemicals are generally not hazardous when used correctly. Common sense will go a long way. It is recommended that gloves, eye protection, and an apron or overalls are worn when handling and mixing any chemicals. Many household cleaning products or garden chemicals are more toxic or dangerous than most common photo chemicals.

Always follow the specific health and safety recommendations on the chemical packaging. Photochemical material safety data sheets (MSDS) containing full details for the safe handling, disposal and transportation of chemicals are available directly from the manufacturers or their websites.

Do not use utensils otherwise used for food preparation to make up and store photo chemicals. Keep all foodstuffs away from areas where photographic chemicals are being prepared and used. Always label containers clearly, and store them safely, out of reach of children. Label beakers and storage containers carefully. Even a trace of fixer can contaminate the developer, and possibly ruin your next film.

Film Chemistry

- film developer,
- stop bath,
- fixer,
- wetting agent.

Developer makes the image appear on the film. At first, mix up only as much developer as you need to completely cover the reel in the developing tank with solution: you pour the used solution down the drain after processing your film.[7]

Stop bath brings development to an end, and prolongs the life of the fixer. The amount of solution used must completely cover the processing reel. Stop bath works quickly, and after processing you can store it to use again. "Indicator" stop bath will *indicate* (turn purple) when it is exhausted.

Fixer makes the developed image permanent. The amount of solution used must completely cover the processing reel. After processing you can store it to use again. Product data sheets will state the capacity of the fixer.

"Hypo clearing agent" will help neutralize the fixer and save washing time, but is not necessary with film if washing is sufficient.

Using a **wetting agent** after washing the film ensures that the film dries quickly and evenly, and without water spots. Do not do additional washing after the wetting agent.

[7] Developer can be re-used and replenished if you are doing a large volume of processing. For consistency in small amounts, "one-shot" is recommended.

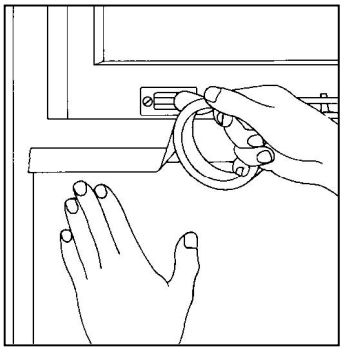
Processing Black and White Film

Processing a film is easy: just carefully follow the step-by step instructions given here, along with the instructions and data supplied with your film and chemicals, and you are virtually certain to get it right. Even so, it is a good idea to start with film that is not critical, rather than an important film of a wedding, or unrepeatable holiday pictures.

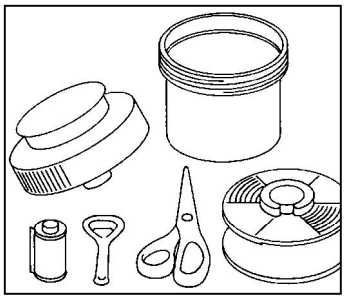
Often the most difficult part of processing is getting the film into the reel. For ease of loading it is important to ensure that the reel is completely dry. The grooves of the reel hold the different parts of the film away from one another, so that the developer can circulate freely. If the film is not loaded correctly, uneven development causes spoiled pictures. Practice loading a reel in daylight (using an old or wasted film) until you can thread it in easily. Then practice with your eyes closed, before finally attempting it in the dark with a real film.

1. Setting up your darkroom

Whichever room you choose as your darkroom (kitchen, bathroom, etc), it needs to be *completely* blacked out to stop light from entering. For windows use thick card cut to shape and held in place with black tape. For doors, use tape or black cloth or canvas to seal the edges. When finished, spend 5-10 minutes in the dark to check that it really is light-tight. Alternately, use a black changing bag available from photographic dealers.



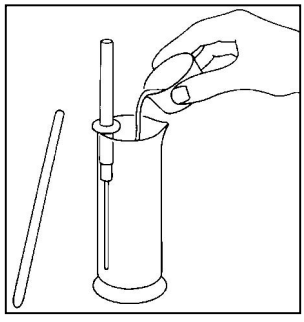
2. Preparing your equipment



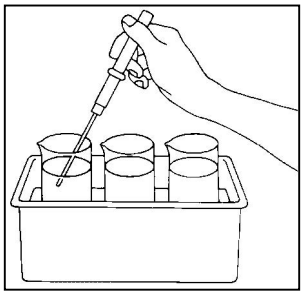
Set out the film and equipment in a logical order, so that you will be able to find them in the dark. You need only the equipment to get the film out of the cassette and into the light-tight developing tank.

3. **Mixing your chemicals**

To process one 35mm film, mix the developer for the amount needed to fill the tank that you are using. Mix hot and cold so the solution is at about 20°C/68ºF.



4. Adjusting and maintaining solution temperature

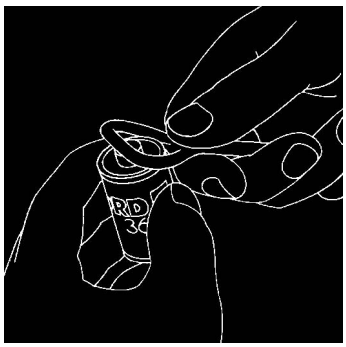


If you have three cylinders or plastic containers, mix up the stop bath and fixer as well.

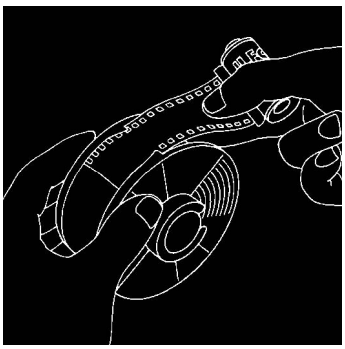
If possible, stand the three containers in a bath of water that is at the chosen working temperature of 20°C/68ºF. This is not critical as long as the temperature of the developer is controlled.

5. Preparing the film for loading

Take hold of the cassette and your end cap remover and turn out the light. Lever the cap off the cassette, and slide the film spool out. Cut off the shaped part of the leader so that the square end can be started on the reel. For plastic reels, this is more critical. For steel reels, the shaped leader can often just be torn off and the torn end can be attached to the clip in the center of the reel.



6. Loading the reel

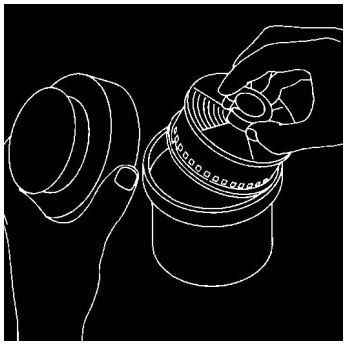


(plastic reels) Pick up the reel and find the projecting lugs which mark the film entry point. Have these lined up and pointing towards you. Pull about 5cm/2in into the first channel between the lugs. Rotate the sides of the reel back and forth to wind the film into the reel.

(steel reels) Attach the end of the film into the clip at the center of the reel and rotate the reel so that the film feeds into the spirals. Take care that the film feeds evenly.

7. Loading the development tank

Place the reel into the developing tank with its plastic sealing ring (if needed), and screw on the tank lid. The film is now sealed inside a light tight container, so you can switch on the room lights.

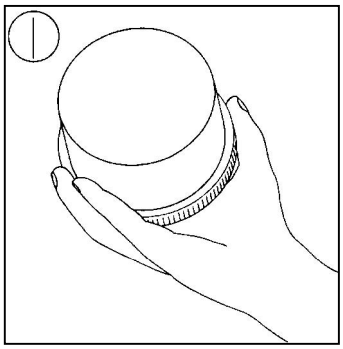


8. Start development

Start the development by pouring the developer solution smoothly, but as quickly as possible, into the tank.

Start your timer when you finish pouring.

9. Agitation

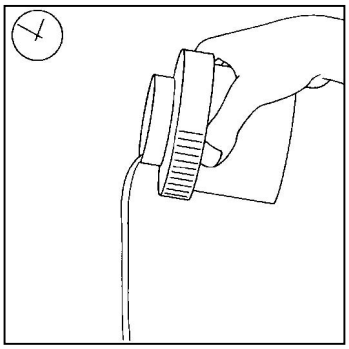


Fit the sealing cap and turn the tank upside down several times during the first 30 seconds and again for 10 seconds at the start of every further minute to agitate the developer. (Or, 5 seconds every 30 seconds.) **Each time you agitate the tank tap it on the bench to dislodge any air bubbles which may have formed on the film.**

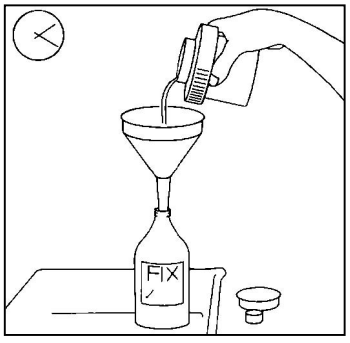
10. End development

10 or 15 seconds before the end mark is reached, start to pour the developer out of the tank.

This developer solution will not be used again, so it can be poured straight down the sink. The timer should come to the end of the specified time just as you finish pouring.



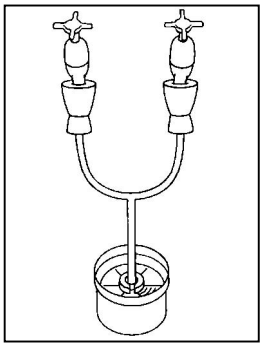
11. Stop bath and fixer



Pour the stop bath solution (at 20°C/68ºF) into the tank. Agitate by turning the tank upside down twice. After 10-30 seconds, pour it out. The time in the stop bath is not critical. It must be at least 10 seconds. Zero the timer and pour in the fixer solution (also at 20°C/68ºF).

Start the clock as you finish pouring, and then agitate, as during development, until fixation is complete. Once again the time is not critical provided it is over the minimum specified in the instructions for the film and fixer combination.

12. Wash



Now the film is fixed you can remove the tank lid. If you have running water at about 20°C/68ºF, use a piece of rubber tubing to feed this down the center of the reel to the bottom of the tank. Wash the film in running water for about 5 to 10 minutes.

OR

Fill the tank with water at the same temperature, +/– 5ºC (9ºF), as the processing solutions and invert it five times. Drain the water away and refill. Invert the tank ten times. Once more drain the water away and refill. Finally, invert the tank twenty times and drain the water away. (5-10-20)

13. Rinse and prepare for drying

Rinse the film in wetting agent, stir briefly, and then lift the film reel out of the tank. Pull the end of the film out of the reel, and securely attach a film clip to it.

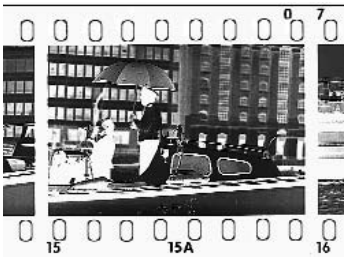
14. Squeegee

In spite of the Ilford directions, DO NOT squeegee film! Wet film emulsion is soft! Nothing will scratch film faster than running an object, even your fingers, the length of freshly processed film!

15. Drying

Attach a weighted film clip to the bottom end of the film, with a developing dish or tray under it for drips. Leave it to dry in a still, dust-free atmosphere. Do not use heat such as a hair dryer.

16. Examining the negative



When dry, examine the negatives. The film edges (rebates) should be clear, with legible frame numbers along the bottom. A correctly exposed and processed negative should have a full range of tones, with some parts almost clear (like the rebates) and other parts so dense you can only just read print through them. Handle your negatives by the edges only.

17. Storage

Count the negatives: a 36-exposure film may give 37 or 38 pictures. The best way to store them is in filing sheets which take six or seven strips of six negatives, so try to cut them up in this way. (You may be able to drop a blank shot or bad exposure to do this.) Date and label the filing sheet, and they are ready for making prints.

Printing

Processing a black and white print on resin coated (RC) paper is a quick and simple process. Two or three minutes after exposing the paper you can turn on the light and admire your print as it washes in running water. After another two minutes you can hang it up to dry. By using filters, 12 contrast grades can be achieved from 00 (very soft) to 5 (very hard), enabling a wide range of negative types to be printed.

Printing Equipment

Absolutely Essential

- A dark room (see below)
- Adequate ventilation [8]
- Electricity
- Trash can
- An enlarger for smaller negatives, and/or a contact printer for larger negatives
- Contrast filters for the enlarger (or an enlarger with a dichroic "color" head)
- A clock or timer with an easily seen (under safelight) second hand or numerical readout
- Trays for chemicals (at least 4, plus a washer tray.)
- Print tongs (or gloves)
- A safelight and filter. The Ilford 902 safelight filter is recommended for all Ilford printing papers. The Kodak "OC" is the commonly available USA equivalent
- Print easel to hold and mask the paper [9]

Nice to Have

- A dark room with running water [10]
- Heat and air conditioning
- 4 blade easel
- A focusing aid (grain focuser)
- Mechanical or electronic enlarger timer
- A separate print development timer
- Paper trimmer (one that can be used safely in dim light)
- Paper safes
- Drying racks
- Microwave (fiber paper only) or hair dryer (for paper – NOT film)
- Clean, camel-hair brush, and/or a puffer brush for removing dust from negatives

Luxuries

- Stereo or radio with all lights and dials shielded from the room[11]
- Vertical ("archival") print washer
- Programmable (multi-step) and/or "f-stop" enlarging timer
- Clean (filtered) compressed air for dusting negatives
- Light box for viewing negatives
- Large sinks to hold all your trays and print washers

[8] Make a room light-tight and the air's going to get stale. The ventilation, of course, must be dark proofed, too.
[9] Technically, you can print, especially on RC paper, without an easel.
[10] It may not be in your darkroom, but you'll need water somewhere.
[11] But NOT a television or a computer with a red gel over the screen

The Darkroom

A photographic darkroom is a room from which you can exclude **ALL** light.[12] If possible, it should have running water and a drain, because you will need to wash your paper. Washing can be done at another location, but you will have to devise a method of getting a wet print to the wash area.[13] Either way, you'll want a water-proof place to place your trays and deal with splashes.[14]

Room lights should be incandescent or LED and NOT fluorescent (compact or otherwise). Fluorescent bulbs may have a faint afterglow that can expose film or paper.[15] There should be NO devices in your darkroom emitting light. Typical are glowing faces on watches, clocks, or timers; or LEDs on stereos and appliances, etc. If you sit in the room for 5-10 minutes to let your eyes adjust fully (it takes longer than you think to fully adjust), you should absolutely NOT be able to see your hands at any distance, or any stray light from outside the room.

Above all, the darkroom should be adequately equipped and comfortable to work in, otherwise you will not enjoy being there and your printing will suffer. Darkroom design and building could be a whole workshop in itself. There are recommended books and websites we'll supply for you.

Safelight

This is a relatively dim, specifically color-filtered light that will not expose the paper but allows you to see what you're doing so that you do not have to work in total darkness. Printing papers are sensitive to specific frequencies on the light spectrum. Safelight filters work by blocking those frequencies and transmitting light frequencies that the paper is not sensitive to *in small amounts*. For this reason, it is recommended to use a proper safelight and filter, and not a generic "red light bulb", or untested LEDs. There is no assurance that a red light bulb is not emitting other frequencies in the visible light spectrum that can't be seen by the naked eye, but can be "seen" by the paper.

The safelight should be at least four feet away from the paper at all times. **You should test any safelight**. I recommend the Kodak test method as outlined in document Kodak K4. (see link at end) **No** safelights lights are totally "safe". Even safelights that test "safe" for a specific period of time will eventually fog paper if enough exposure time is reached.

Trays

Trays hold your chemistry for processing the paper. You need one each for developer, stop bath and fixer, preferably with two more for clearing the fixer and washing. Trays come in all sizes depending on the size of the paper you are processing. Buy a good set. Kept clean, a set of good print trays should last decades.

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[12] Paper packaging used to be labeled with a phrase such as "open in photographic darkroom only". This means under proper safelight. "Total" darkness means just that – there is no "How dark is enough?" 100% dark. Any light can potentially expose paper.

[13] Classic case: printing in a closet (easy to make dark) and washing in the kitchen or bathroom.

[14] None of this stuff is likely to harm you if used properly, but it almost all stains to one degree or another.

[15] Honestly, this is debatable, and there is a school of thought that newer fluorescents do not exhibit this phenomenon. However, I've seen it, and it can happen.

Tongs

Use print tongs. If not, wear surgical or similar gloves. After using gloves long enough, you can pay for a set of print tongs. Some individuals exhibit allergies to some of components in photo processing chemicals. Typical is mild contact dermatitis from some developers.[16]

Thermometer

You will need a thermometer in printing mainly for mixing chemicals, primarily the developer. Temperature control for the chemicals in the print trays is not critical within certain ranges. The temperature range for RC paper is 68–86ºF/20–30ºC. A range of 68-77ºF/20C-25ºC is better. Read the tech data for your paper (included with every package of paper and also available on the internet).

If room temperature is within these ranges and you let the water (for the developer) reach room temperature, you don't need to worry about temperature control for prints.

NOTE: This includes wash water. Ilford recommends no more than a 9ºF/5ºC temperature difference for film. Paper is more tolerant. Ilford says that RC paper can be washed at temperatures down to 41ºF/5ºC. But, it's probably not a good idea to have all the tray temps at 68ºF, and then wash in 88ºF water. For fiber based paper, Ilford recommends 65–75ºF/18–24ºC *including wash water* for "optimum permanence".

Enlarger

An enlarger is a projector: it projects an image of the negative onto the paper. You can use any enlarger to make prints. However, will need a lens and negative carrier to suit the size of negative you're printing. An enlarger designed for up to 4x5 film will likely be sturdier, which means sharper prints due to reduced vibration. There are sturdy medium format enlargers, of course, but there are also a lot of amateur enlargers that were sold that are little better than toys – the equivalent of "Brownie" box cameras.

You can use a "color" enlarger, with adjustable dichroic filters, or a standard condenser enlarger (often called a "black and white" enlarger).[17] If you have a condenser enlarger, you will need contrast filters for it. One of the Ilford Multigrade filter sets, above or below the lens, is likely to fit your model.

If your enlarger is of the condenser type (has big lenses between the negative and light bulb), you need to make sure that these are in the correct location. They're generally adjustable by film-format.[18] If set wrong, you may have light falloff in the corners of the prints because of uneven illumination. If the condensers are set for a larger negative than you are printing, this probably will not happen, but you may have to use slightly longer exposure times than at the correct setting.

NOTE: There are a number of very fine enlargers that were, and in some cases, are still made. Durst, for instance, is a fine brand from Italy. However, finding parts and accessories can be difficult, and expensive. Therefore, I recommend Beseler and Omega. Both brands are readily

[16] It is not serious (usually) and can be cleared up, but who wants a rash?
[17] Color can be printed with a condenser enlarger (with filters), and black and white can be printed on a dichroic enlarger. There are other enlarger light source types, but we will not discuss them in this document. Google is your friend.
[18] The mechanism varies, you may need the manual for your machine.

available on the used market, as well as parts and accessories (lens boards and negative carriers, for instance).

In the Beseler line, all of the 4x5 "M" enlarger chassis are virtually interchangeable except for the newer (and more expensive) 45 V-XL. The condenser and dichroic heads are also interchangeable on any Beseler chassis. If using a Beseler dichroic, I recommend the 45S head. For medium format, the Beseler 23C models will print anything up to 6x9 (120 roll film).

Any of the Omega "D" models will be serviceable. I especially recommend the D5. The Omega "B" models: the B22 condenser and the Chromega B (dichroic) are both good and share the same negative carriers and lens boards. The Chromega C is basically the same as the B, but will print 6x7 120 negatives, whereas the B and B22 only go up to 6x6. The disadvantage to the C (for smaller than 6x7) is that it uses its own specific negative carriers (harder to find) .

Enlarging lenses

There are optimal focal lengths of enlarging lenses for any given negative size. A longer-than-necessary lens will often have more uniform illumination and maybe better sharpness but your maximum enlargement will be a bit constrained.

Recommended focal lengths for enlarger lenses:

Lens Focal Length	Max. Negative Coverage
50mm	35mm
75mm	6x6cm
80mm	6x6cm
90mm	6x7cm
105mm	6x9cm
135mm	4"x5"
150mm	4"x5"

Notes about enlarging lens quality: Enlarging lenses on the used market are still fairly reasonable. Buy the best you can afford. The consensus of opinion is that Rodenstock Rodagon, Schneider Componon, and EL-Nikkor are the three best. Each made lesser lenses: Rodenstock Roganar, Schneider Companar, and the Nikkor 50mm F4 and 75mm. Generally, the Rodagons, Componons and Nikkors (except the two listed) are top quality 6-element lenses, while the Roganar, Companar, and the 50mm F4 and 75mm EL-Nikkors are 4 element lenses. They work, and many swear by them, but the better lenses are readily available and don't cost much more (or often any more).

There are others that are good, such as the old Minolta CE enlarging lenses (harder to find) and some Fuji lenses, etc.

Enlarger Timer

The density of a print is controlled by how long you expose the paper (just like film). Enlargers do not have shutters, however. The time of exposure is generally achieved by having a timer

turn the enlarger on and off, although it can be done manually.[19] The spectrum of timer solutions:

- a loud clock or metronome to count seconds [20] and manual switching (bare minimum)[21]
- a mechanical timer (essential if you really want to do it well) ("Time-o-light")
- an electronic timer (nice to have) (Gralab 450 or Kearsarge)
- a programmable f/stop timer (luxury, but really very nice!)

The clock option can be effective, though tedious. You can't time anything reliably for short periods (under a few seconds) and your prints may vary a bit, but it will work.

A mechanical timer is repeatable once set, but is also inaccurate for short exposures and may not be accurately repeatable between settings for any exposure under 4 or 5 seconds. Still, a workable solution.

An electronic timer (in good condition) is perfectly repeatable and reliable. Some have the ability to time multiple steps (for dodging and burning)

An f/stop timer is a programmable device that varies exposure geometrically (like camera exposure) instead of linearly; and some let you program in multiple exposure steps for dodging and burning.

Printing Chemistry

- paper developer,
- stop bath,
- fixer,
- Hypo, or fixer clearing agent.

Developer turns the exposed silver halide in the paper emulsion (light sensitive coating) into metallic silver in proportion to the amount of light (exposure) that the emulsion has received.

Which you choose doesn't really matter at this stage. Ilford Multigrade or PQ Universal are both good and can be mixed from the concentrate as you use it. Kodak Dektol is also recommended, although it comes only in a powder form and must be mixed all at once [22]. Kodak Polymax T is liquid and is very similar to Dektol in use, but can be mixed like the Ilford developers.

Stop bath is a dilute solution of acetic or citric acid. The main purpose is to stop development and prevent developer carried over on the paper from polluting the fixer. It helps to maintain the activity and prolong the life of the fixer solution by reducing carry over of excess developer (alkaline) into the fixer bath (acidic). It can be mixed from "glacial" acetic acid, but I recommend using either Ilford Indicator Stop Bath (Ilfostop) or the Kodak equivalent. Both

[19] Amateur enlargers often had on/off line switches on their cords. Most professional machines do not as it is assumed they will be controlled by a timer.
[20] Yes, you can use your iPhone. There are metronome apps, as well as timer apps.
[21] If you search the internet, you'll eventually find someone who swears they can simply count, but this is demonstrably un-repeatable.
[22] Dektol is often considered the "standard". In this respect, it is a good choice to start. However, its packaging can be an issue for occasional printers. Generally, you will find a 1-gallon package; but other sizes are available. One gallon is "stock" solution, usually diluted 1:2 for use. So, a package will make 3 gallons of working solution. Good if you're doing a lot of work, but it will go bad in the bottle over time. Also, once diluted, don't mix back into the stock solution. Throw it out or store separately.

contain an indicator dye that is pH sensitive and changes color from yellow to purple as the stop bath becomes exhausted.

Fixer stabilizes the image, removing the unexposed silver halide remaining on the photographic film or photographic paper, leaving behind the reduced metallic silver that forms the image, making it insensitive to further action by light. Without fixing, the remaining silver halide would quickly darken and cause fogging of the image. The most common salts used are sodium thiosulfate — commonly called *hypo* — and ammonium thiosulfate — commonly used in modern rapid fixer formulae.

"Hypo clearing agent" (named after the hypo in fixer) will help neutralize the fixer and save washing time. Highly recommended, especially with fiber based paper.

Negatives

Your negatives need to be standard, silver B&W negatives. You can't print orange-masked C41 color negatives onto B&W paper; the contrast will be all wrong, resulting in very "muddy" prints. However, Ilford XP2 Super (also a C41 film) can be used because it has no mask. Color slides are a whole other problem.

Paper

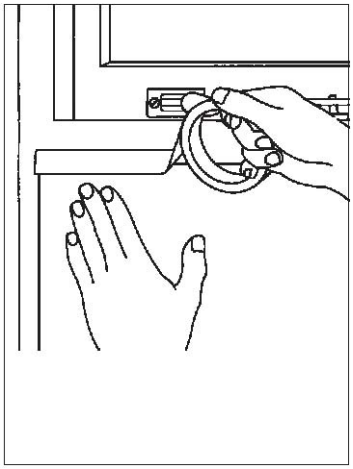
Fiber-based (FB) paper (or baryta paper) is often preferred by advanced printers. Although processed basically the same (times are longer), it's much harder to work with both during and especially after processing (washing, drying, flattening, mounting). Just handling wet FB paper during processing is more difficult, especially in large sizes. This document covers resin-coated papers (RC) for simplicity. Also, this assumes variable contrast (VC) paper. Pick a finish you like (Pearl/Lustre is a good start, Gloss gives deeper blacks, Matte is very flat). Use fresh paper when you're beginning, you really don't want to try to diagnose problems from bad paper at this stage.

In terms of brand, they're all good and subtly different - you could equally well use one brand forever and not miss anything, or you could decide you like a particular type over all others. Ilford seems universally available and it is at least as good as any other so makes a good starting point but there are certainly cheaper options that work well.

Paper is like a B&W photographic negative, except that it's on paper instead of plastic, and it has a few layers that permit contrast control through filtration of light color. That means it's light-sensitive and you should only open the box in a darkroom; keep it taped closed at all other times. If exposed to normal light before being processed, the paper will be fogged - anywhere from having dull grey highlights to being completely black depending on how much light reached it. It's not sensitive to safelight in small amounts.

How To Make Your First Black And White Print

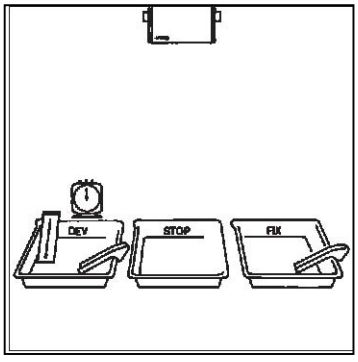
1. Setting up your darkroom



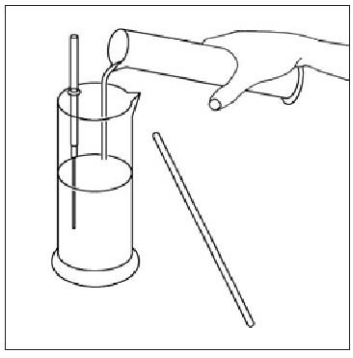
Kitchens, bathrooms, lofts, attic, cellars and basements and spare rooms have been used as either temporary or permanent darkrooms. The room you have chosen for your darkroom needs to be **completely** blacked out to stop light from entering. For windows use thick card cut to shape and held in place with black canvas tape. For doors use tape or black cloth or canvas to seal the edges.

2. Setting up your safelights and equipment

Set up your safelight at least 1.2m/4ft from the developing dish. Lay out three processing trays, label them DEV, STOP, and FIX, two (or three) pairs of print tongs, and a clock or timer for timing development. Then mix up the processing chemicals. The aim is to process at a working temperature of 20°C/68ºF +/– 1ºC/2ºF.

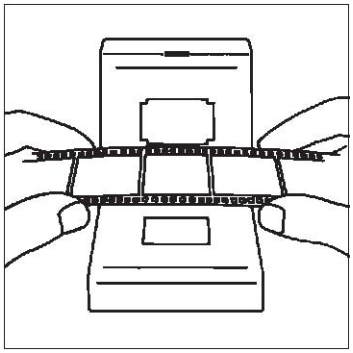


3 Mixing your chemicals



Mix the chemicals according to the manufacturer's directions.

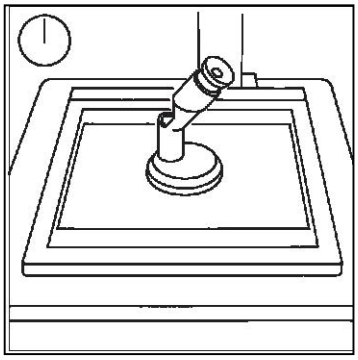
4. Choosing your negative



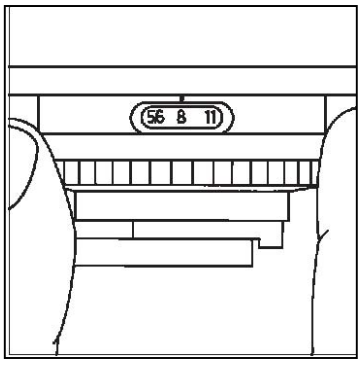
Choose the negative for printing, and make sure it is clean. Remove any dust with a puffer brush. Hold the negatives so you can read the edge numbers, then turn the negatives round (not over) so the numbers are furthest away from you. Place the negatives in the negative carrier of the enlarger. Slide the negative carrier into place. Switch on the safelight and switch off the room lights.

5. Focusing your image

With the lens at full aperture, turn on the enlarger. Place an easel on the baseboard. Move the enlarger head to frame and focus the image. You can use a grain focuser placed in the center of the image to focus on the negative grain for the sharpest possible image.

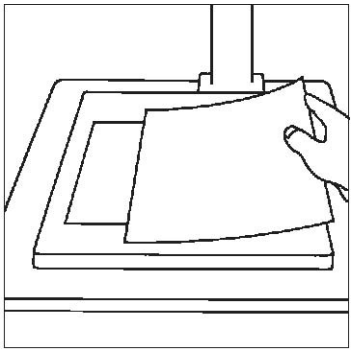


6. Setting the aperture (f stop)



Turn the lens‘ aperture ring from full aperture to two stops down to increase edge sharpness and give more even illumination. Count the number of clicks involved, so you can do it without looking at the lens. The actual aperture used can vary, but should give an exposure time of at least 10 seconds. Shorter times are hard to time accurately.

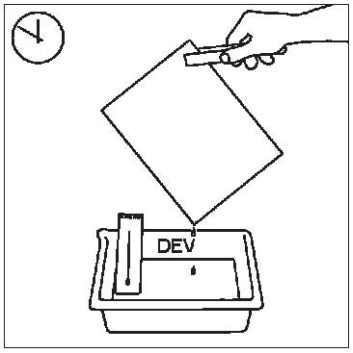
7. Exposing a Test Print



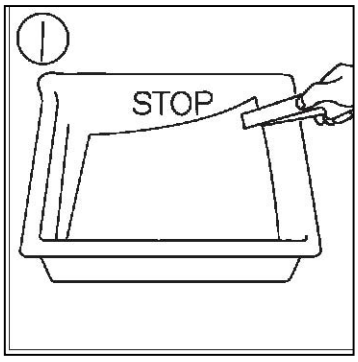
With the safelight on, and the room lights off, put a piece of paper into the easel, shiny side up. (Reseal the packet carefully.) You are now ready to make a test print. Switch on the enlarger lamp and expose the whole sheet for 2 seconds. Cover one-quarter of the sheet with opaque card, and expose the rest for another 2 seconds. Cover half of it, and expose the rest for another 4 seconds. Cover three-quarters, and expose the last part for another 8 seconds.

8. Developing a print

Set the timer to zero (or one minute if a countdown timer). Slide the paper quickly and smoothly into the developer, making sure there are no air bubbles on the shiny surface. Start the timer. Rock the developer dish continuously backward and forward to send the solution gently over the print. After 50 seconds, use tongs to lift the paper out, and drain off the developer.



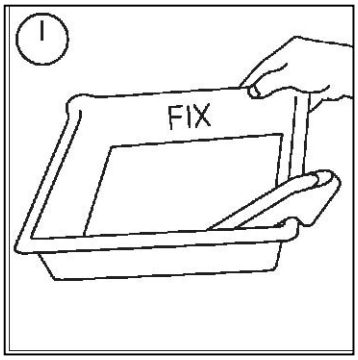
9. Stop bath



Quickly and smoothly slide the developed paper into the stop bath. take care not to contaminate the developer tongs with the stop bath. Rock the dish for about 30 seconds. Use the second pair of tongs to lift the print while solution drains from it, and transfer it to the dish of fixer solution. (The timing of this step is not critical.)

10. Fixing a print

Slide the paper into the dish of fixer, and rock the dish to get a good flow of chemicals over the surface of the print. Fixing takes only 30 seconds in fresh solution. It does not matter if this time is exceeded slightly, but prints should not be left in the fixer for minutes on end. If not washing a print straight away, store it in a dish of clean water.



11. Examining the test print

Rinse and blot the test print and examine it under a bright light (daylight or room lighting). It shows four strips, each one stop darker than the one next to it. The lightest had only 2 seconds exposure; the next, 4 seconds. The third strip received 8 seconds (2+2+4), and the darkest strip received 16 seconds (2+2+4+8). Note these times and the aperture used on the test for reference, so that you can learn from your results. From the test, estimate the correct exposure for the final print.

One strip should look about right, but if one strip is too dark and the next too light, the right exposure will be somewhere in between. If all the strips are too light, open up the aperture and repeat the test. If they are all too dark, close it and repeat the test.

12. Expose a full piece of paper at the chosen time.

13. Repeat the processing steps 8-10

14. Wash

Wash the print for 10 minutes in a good flow of water ideally at about 20°C/68ºF but cold water above 5ºC/41ºF will give adequate washing. Empty the wash tray a few times to ensure a complete change of wash water, or use rubber tubing to siphon water from the bottom of the tray. NOTE: This is for RC paper only. Washing fiber paper is much more involved.

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http://imaging.kodakalaris.com/sites/prod/files/files/products/edbwf.pdf

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