

## BLACK AND WHITE FILM PROCESSING

1. Ideally, chemical solutions including wash water should be consistent in temperature, preferably at 68°F. Temperature variations of +/- 5°F are tolerated though grain size may be affected.
2. Film developing time is determined by the type of film, type of exposure (personal exposure index and over- or under-exposure), type of developer, dilution of developer and temperature of developer.
  - A. With Kodak D-76 film developer, a 1°F change in developer temperature is the equivalent to a 30 seconds change in developing time. For example, if the normal developing time for 68°F is 11 minutes, then at 70°F the time will be 10 minutes. If 67°F the time will be 12 minutes. The warmer the temperature the shorter the time; the cooler the temperature the longer the time. The temperature range of film development is 65°F to 75°F with 68°F the "ideal."
3. Processing the Film:
  - A. In total darkness, load the film onto the developing reels and into the developing tank. Make sure the cover is securely closed as extraneous light entering the tank will totally destroy the film's image.
    1. For a stainless steel tank and cover, applying masking tape around the cover and the tank will prevent the cover from slipping off and developer from leaking.
  - B. For a Stainless Steel Tank System, measure the developer (Kodak D-76 1:1, one part developer to one part water) in a graduate. At least 4oz. of developer and 4oz. of water are used per reel, for a total of 8oz. of developer working solution. Two reels (rolls) will require a total of 16oz., 4 reels (rolls) will require 32oz., and 8 reels (rolls) will require 64oz. One roll of 35mm film requires at least 4oz. of stock developer regardless of the dilution with water.
    1. For a Jobo 1520 Tank System, use a minimum of 5oz. of developer and 5oz. of water per reel of film. The total solution for two loaded film developing reels is 20oz.
  - C. Measure the temperature of the developer working solution (adjustments to the temperature with iced or hot water jacket may be needed to bring the solution into a workable range).
    1. An easier method is to use either an iced water bottle or hot water bottle inserted directly into the graduate of mixed developer solution, carefully monitoring the temperature. Take into account temperature drift for all temperature readings.
    2. Listed below are developing times (from Calibration and System Testing done by students in the advanced photography class) which should give you an optimum density negative.

KODAK TRI-X	KODAK D-76 1:1	PRESOAK	68°F
Condenser Light Source		Diffusion Light Source	
Normal (E.I. 200)	= 11:00"	Normal (E.I. 200)	= 14:00"
N + 1 (E.I. 400)	= 14:00"	N + 1 (E.I. 400)	= 18:00"
N - 1 (E.I. 100)	= 8:00"	N - 1 (E.I. 100)	= 11:00"
N - 2 (E.I. 50)	= 5:00"	N - 2 (E.I. 50)	= 8:00"

3. For Kodak T-Max or Ilford Delta films, use 9 minutes developing times as normal.
- D. Set the timer and pour the developer solution into the tank as quickly as possible and rap the tank firmly to release air bubbles which may have formed on the film.
  1. An optional but highly recommended step: PRESOAK. Before placing the film with the developer solution, presoak the film with plain water. This wets the emulsion uniformly, which helps prevent uneven film development. Agitate vigorously and rap and let stand at least for at least two minutes, then drain and fill the tank with the developer solution. The developing time must be extended from 5%- 10% because the developer penetration into the emulsion will occur more slowly as the developer displaces the water in the emulsion. (The developing times listed above includes the presoak adjustment).
- E.\* Agitate the film in the developer continuously for the first minute and for 10 seconds for every minute thereafter until the total developing time is completed.
  1. Do not hold the developing tank in your hand between agitation cycles as this transfers your body temperature to the developing tank.
- F. Pour out and discard the developer solution 10 seconds before the developing time is completed. At the completion of the total developing time, fill the tank with short stop (1 1/2% solution of acetic acid) and agitate continuously for 30 seconds then discard.
  1. I suggest using a tap water rinse instead of the acid short stop solution. Fill and dump the tank two times with tap water. This should rinse away almost all developer solution in the tank and on the film. The omission of the acid short stop is to eliminate the possibility of tiny acid induced pinholes in the film's emulsion caused by the interaction with the residual trace elements within the film's emulsion.

- G. Fill the tank with RAPID FILM FIXER and AGITATE CONTINUOUSLY.
1. To determine total fix time: Immerse an undeveloped film tongue into a graduate with fixer and agitate continuously until the film tongue is completely clear and transparent. Your fixing time is double the time it took to clear the film tongue. T-Grain films will require approximately twice of fixing time compared to conventional silver halide films. If the clearing time is 2 1/2 minutes, contact the lab assistant to change the chemistry, as the fixer is exhausted.
  2. **SAVE THE FIXER!!!!**
- H. The film is now insensitive to light and may viewed after rinsing with clean water.
- I. Fill the tank with HYPO CLEARING AGENT and agitate continuously for two minutes for conventional, four minutes with T-Grain films.
1. **SAVE THE HYPO CLEARING AGENT!!!!**
- J. Wash in the tank or a Hurricane Film Washer with gentle running water for 10 minutes.
- K. Fill the tank with clean water and place two to five drops of Kodak Photo-Flo and agitate with the film for 30 seconds. Discard the solution.
- L.\*\*Squeegee the film and place in the film dryer (or forced air dryer on cool setting for 10-20 minutes) or hang in the heat dryer for 10-20 minutes.
- M. When dry, cut the film into six (6) frame exposure strips for 36 exposure rolls and store in **Printfile 35-6-HB Negative Storage Pages**.
1. Do not apply weight or pressure or against hard edges to the stored negative. The negatives in this stage are extremely fragile!

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\* Suggested Agitation Method: Turn tank upside down and right side up as if on a pivot rod (Pivot-Inversion Method). This total inversion should be done in one second, thusly 10 seconds of agitation should be ten (10) cycles.

\*\* A good quality Chamois, Photo Wipe or squeegee soaked in the Photo-Flo solution can be used before the dryer. Make sure the chamois or Photo Wipe is absolutely clean and grit free as their presence will surely scratch and damage your negatives.

## NEGATIVE DEFECTS

1. If the negative is thin, lacks detail, especially in the lighter parts of the negative, the probable cause is underexposure. Intensification may help, or a higher paper contrast grade. In the future, give more film exposure under similar light conditions.
2. If the negative is generally dense and requires extremely long print exposures, the probable cause is overexposure. Reduction may help, or a higher paper contrast grade. In the future give less film exposure under similar light conditions.
3. If the negative shows sufficient detail but is generally thin and gives a flat or low contrast to the prints, the probable cause is underdevelopment. The film development was too short, too low in temperature, or too diluted, or the developer was exhausted. Intensification may help. Use a higher paper contrast grade. In the future, use fresh developer solution at the time, dilution and temperature.
4. Negative is clear in the thinner parts but dense and "blocked" in the highlight areas. The probable cause is over-development. Development is too long, or not diluted correctly for use, or developed at too high a temperature. Reduction of the negative may help, or use a lower paper contrast grade. In the future, decrease time of development, or use recommended dilutions and temperatures.
5. Negatives gives "flat" prints, is generally dense and has margins that are gray, not clear. The probable cause is light fog, or improper developer, or developer is too warm. To remedy, use a higher paper contrast grade. Also load and develop the film in total darkness using proper developer solutions and temperatures.
6. Negatives are obscured by milky, opalescent color, more noticeable on shiny side, possibly appearing in patches. The probable cause is incomplete fixing, using exhausted fixer, or too short a fixing time. To remedy, re-fix the negatives in fresh fixer solution. Complete removal may be impossible if the film has been exposed to bright light. Always test the fixer before using.
7. Extended wet time (beyond the normal film developing procedure) or extended developing times (developing times beyond normal) will invariably cause the silver halide particles in the film to clump and enlarge. To minimize this effect, follow developing procedures as defined above and minimize over-developing except when absolutely unavoidable.