DEVELOPING COLOUR NEGATIVE

by Harold Coxon
Head, Film House Laboratories

Harold Coxon is the technical director of Film House Laboratories. He was born and educated in Ottawa. In 1946, Coxon joined the National Film Board in Ottawa. He transferred to the National Film Board Picture Lab, and became head of developing services in Montreal. In 1957, Coxon joined Crawley Films Ltd. as a department head. He came to Film House in 1965. He has been involved in all aspects of laboratory operation, including partial design and installation of major equipment facilities. He is an active member of the SMPTE and an associate member of the Audio Engineering Society.

What really happens when your valuable colour negative enters the laboratory?

This article will give you some idea of what happens to your footage which may well represent many weeks or months of work, and which could be wasted if it were carelessly handled in dirty conditions and by people not skilled in their various functions as laboratory technicians, once it has been shot.

When your colour negative enters the laboratory along with your ¼" magnetic tape, it is entered along with all information pertaining to your requirements – information that is necessary are things such as:

Stock type	5254 Eastman colour negative
Emulsion #	574 - 12
ASA Rating	100 - Normal
Footage	400 ft.
Production Title	"Epic"
Camera & #	Arri #6
Mag No	#3
Roll # & Takes	Roll 6 T6 - 11
Required	Develop negative and supply 1 lite mide-scale edge # W/P

All this information is necessary to allow the laboratory to proceed with your job. At this point, your ¼" tape is routed to the sound department for transfer to 35mm magnetic for a double system screen of your "dailies".

If you do not give the laboratory the information, it will cause delays while you are contacted to fill in the gaps. Here are some of the precautions a crew can take that will enable a laboratory to serve you better.

It is safer to leave a few feet at start and end of rolls sent in for processing. This avoids the risk of our making developing machine splices in exposed areas of your negative. It also allows the developing machine technician to cut a short section off and examine it in white light for pre-processed scratches, which could come from a camera or magazine. If any are detected at this stage, the crew is notified immediately so that they may check their equipment.

If your film arrives at the laboratory without a plastic core, it must be inserted by us in complete darkness – this is a difficult operation and can cause unnecessary damage. Please send your film in on cores.

Loosely wound rolls are another source of possible damage, causing cinching or handling marks. The outer end should be secured with a small piece of tape, the exposed material placed in a black bag, put in a suitable can, and marked as exposed material.

The laboratory receives negative for "forced developing". Unless ASA rating is clearly shown on can, delays are caused until we have this information.

Bear in mind that in photography, some of the chemicals are in the film emulsion, the other chemicals are in the processing solutions. These react on each other to give the final result. The manufacturer of the film is responsible for the proper design and building of each individual emulsion. The laboratory is responsible for the correct processing of each emulsion according to the manufacturer's recommended specifications. The manufacturer and the laboratory are widely separated by time and by space before the film and the processing come together.

This then leaves the middle-man who is the user or the cameraman and he must be satisfied with the final results.

Ideally, any wide variation in the final outcome of an emulsion should be in complete control of the cameraman. Assuming that the film manufacturer and the laboratory carry out consistent and rigid control of their respective methods, the camera-man, by using the manufacturer's recommended specifications for any particular emulsion can then control the final tonal values of his film.

Sensitized material exposed in a camera or by any other means produces an invisible latent image which is made visible by development in established developing chemistry.

With the rate of projection at 24 frames per second and magnification of size on projection, it is quite easy to detect tonal values and physical defects such as scratches, streaks or directional development, dirt, or many of the other defects which render a film unusable.

Preparation for developing colour negative is carried out in a completely dark loading room. A physical check is made for possible fold-overs or creasing, broken or damaged perforations, or any other physical defect that might be detected by the fingers and concentration of a skilled developing technician. When the negative material has cleared this check, it is ready to be placed on a developing machine which has been pre-checked and tested for physical transport as well as chemical and sensitometric standards of operation.

Referring to figure #1, a schematic of a typical Eastman colour negative developing system, you can follow the colour negative film through its various stages.

Steps 1 & 2 of the process are extremely important in the colour negative system – the removal of "REM-JET" backing prior to developing.

The manufacturer has coated the underside of the colour negative transport with a "REM-JET" backing – this is a colloidal suspension of carbon particles applied to the base side of colour negative: –

Type 5254 - 35mm and Type 7254 - 16mm. It offers unusually good antistatic and antihalation properties. It appears

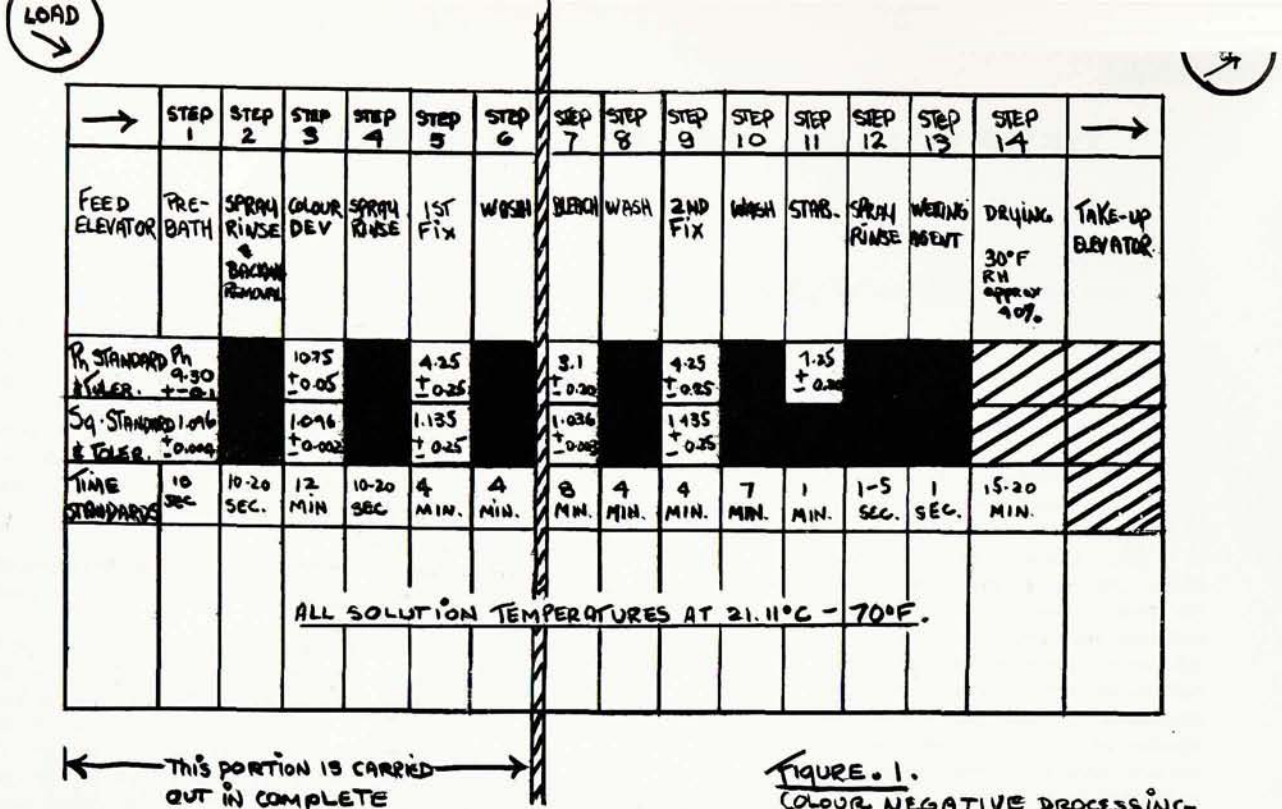

FIGURE. 1.
COLOUR NEGATIVE PROCESSING SYSTEM.

carbon black and is quite opaque. Its purpose is excellent, but its removal is something else again — it's the devil to get off properly.

The exposed colour negative must be transported through an alkaline pre-bath solution for the proper amount of time, at an exact temperature, and care must be taken to maintain the correct chemical composition and Ph values. After being treated to the pre-bath, the film then enters a backing removal tank with precisely positioned water rinse jets and a mechanical scrubber unit which firmly but gently removes residues from the base. If the backing is softened too quickly and becomes suspended in the pre-bath solution, there is the danger of small particles adhering to the emulsion. If this happens, the spots prevent development of the negative. The backing cannot be removed once it has clung to an emulsion surface.

After leaving the scrubber tank, your negative passes through a vacuum squegee or wiper device which removes excess moisture and possible carry over of contaminates to the developer.

Step #3 — the film now enters the colour developer and the development of the invisible latent image begins. The reaction now takes place acting on all three layers. The emulsion layers contain dye couplers dispersed within them so that after exposure metalic silver and appropriate dye images are produced in each layer.

Step #4 — the film is now given a spray rinse with tempered water after colour development to remove excess alkaline developing agents before going on to the next step. This minimizes the tendency of the formation of carbon dioxide gas and the possibility of blistering. Variations can affect speed and fog levels.

Step #5 — First fix — this step tends to arrest development and to provide hardening of the emulsion. It also converts the unexposed and undeveloped silver halides to complex thiosulfate salts which can be removed by washing. Removal of salts at this point is desirable since the bleaching of the silver image can be done more effectively.

Step #6 — The film now enters a wash water to remove the residual salts which are present in the emulsion due to the action of the 1st fix and also to have it free of any residuals which might impair effective bleaching in the next step.

Step #7 — The film enters ferri-cynanide bleach solution to convert the silver image and yellow filter to compounds which may later be removed by the second fix bath.

Step #8 — We now progress to a wash water to remove any unreacted bleach solution from the film — a spray rinse of tempered water is most efficient at this stage.

Step #9 — From the spray rinse, the film follows along to the second fix. This film must be fixed at this stage to convert the silver compounds formed by the bleaching solution to silver thiosulfate complex salts which may be removed from the film by washing. The second fix bath is the same formula as the first fix. It is not recommended that they be circulated as a common circulation could cause stains in the top layer of the emulsion.

Step #10 — Washing is the next step in progression of the film — this serves to remove the soluble thiosulfate complex salts and residual hypo from the film. A spray wash is most efficient at this point. Incomplete washing may cause later fading of the dye images due to excessive residual hypo.

Step #11 — The next step is a stabilizer bath. It serves to stabilize the dye images and reduce any tendency of fading. It also removes final traces of hypo.

Step #12 — A brief water spray rinse is given to remove stabilizer chemicals from the surface of the film, thus preventing possible crystaline deposits on the film after drying.

Step #13 — It now passes briefly through a wetting agent to assist in even drying before passing through a set of vacuum squeezes or air jets which remove all excess moisture.

Step #14 — The final step is to dry the now completely processed negative — this is accomplished by passing through a cabinet of clean forced air which is temperature and humidity controlled.

We have completed the colour negative developing cycle and the next discussion will deal with How to Arrive to a Colour Print Stage.