

# An Inexpensive Method for Preservation and Long-Term Storage of Color Film

By Roland Gooes and Hans-Evert Bloman

The Swedish Film Institute has begun an operation to save and store all Swedish color motion-picture films, starting with those made in the 1950's. This article describes the film conditioning apparatus (FICA) designed and built by the Film Institute that is used to accomplish this aim.

We are all aware of the difficulties with long-term storage of motion-picture color film. One of the problems is the difficulty and expense of maintaining controlled humidity in low temperatures. A method has been developed as a part of a program initiated by the Swedish Film Institute and a group of concerned film and TV professionals. The purpose of the group is to save all Swedish color feature films for the future. Black-and-white nitrate-based films have already been dealt with in a previous program.

The Swedish Film Institute is the central Swedish film institution. Its board is appointed by the government. Its major source of finance is a 10% tax on box office receipts. It is not a government body, but completely independent.

The method described here eliminates the difficulties in controlling the humidity in low temperatures, and thus the high costs involved in a dehumidifying plant combined with a refrigeration plant for the cold store. With our method, there is no need of a dehumidifying plant and the film can be stored in an ordinary "restaurant-type" room-sized freezer. This is possible by conditioning and sealing the films before storage.

To perform this conditioning, a special machine or cabinet, the film conditioning apparatus (FICA), was designed and built at the Swedish Film Institute in Stockholm by the authors. The FICA cabinet is shown in Fig. 1.

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Figure 2 is a schematic drawing showing the components in the cabinet. Here is a brief description of the cabinet and its machinery, together with the procedure beginning with the film roll being put into the cabinet, until the roll is conditioned and ready for deep-freeze storage.

The arrows in Fig. 2 illustrate the air stream circulating with an exchange rate of 90 times/hour. This air keeps a constant temperature of 68°F and a relative humidity of 25%. The air comes down through the perforated ceiling and the air curtain slot, and also

through a pipe directly into the hood over the film plates.

At (1) the air is filtered continuously; first, through a pre-filter that removes dust, and then, through a highly effective particle-absorbing filter that removes micro-particles. The chemical Purafil filter thereafter reduces air contaminants; e.g., sulfuric compounds that may affect image stability. This type of pelletized filter is much more effective than a simple activated charcoal filter.

The cooling unit (2) reduces the rise in temperature in the dehumidifier and gives a constant air temperature as set:  $\pm 1^\circ\text{F}$ .

The rotating dehumidifier (3) will keep the relative humidity as set within  $\pm 1\%$ .

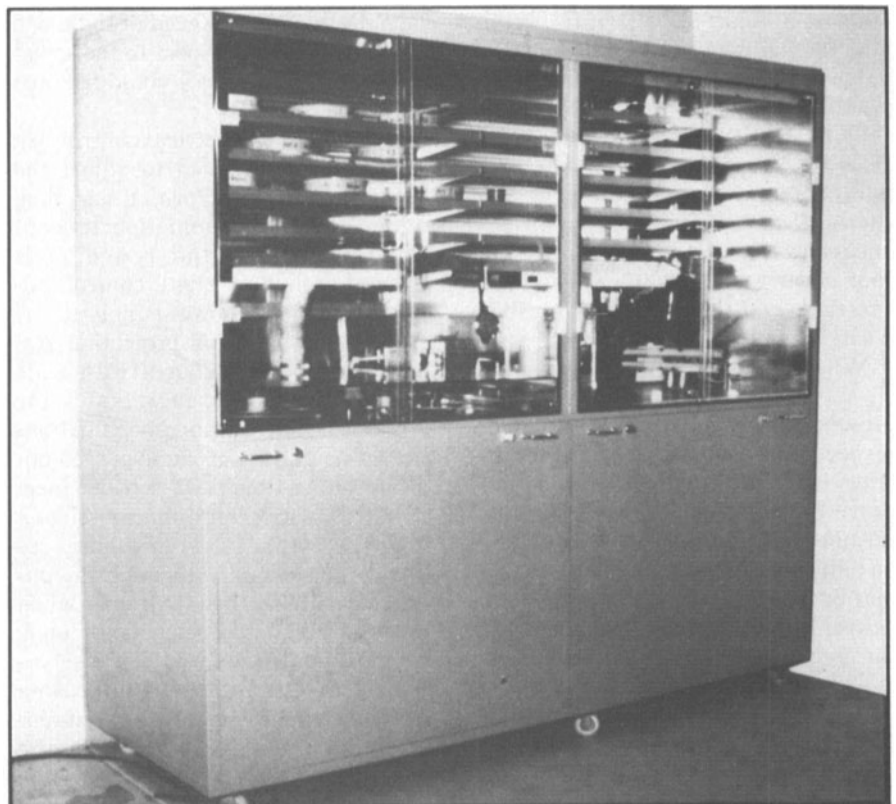


Figure 1. The film conditioning apparatus (FICA).

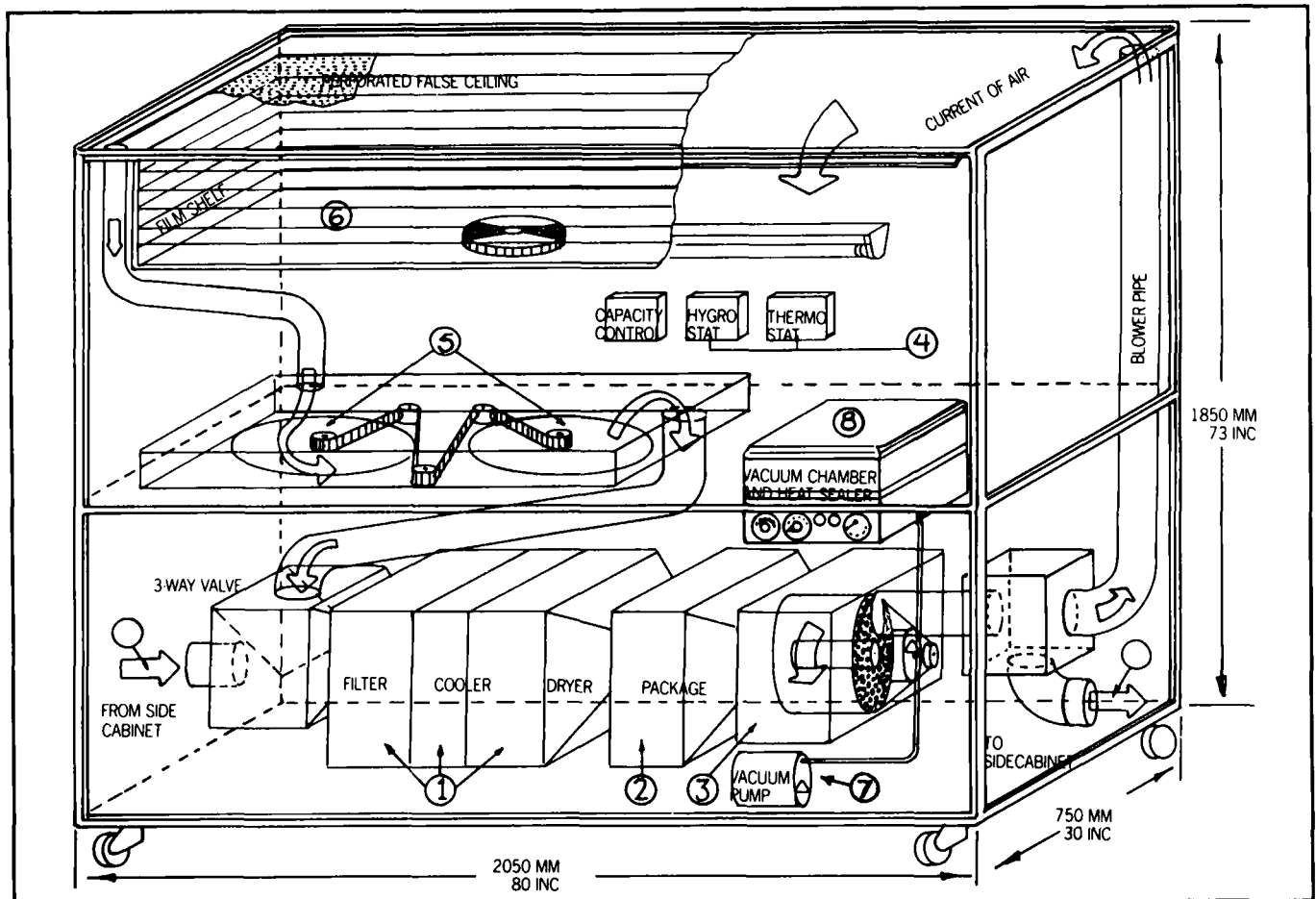


Figure 2. Schematic drawing of FICA.

Automatic controls for temperature and relative humidity are located at (4).

It is important for proper conditioning of the film that all rolls be uniformly wound and that compensation be made for any shrinkage that may occur during the procedure.

Two film plates (5) are included in the cabinet where the film is wound with a pre-determined tightness before conditioning time. This winding also takes place in the same clean air. Figure 3 shows the tension of the film during winding, 10 oz. This is measured on the governor level between the two film winding plates.

Figure 4 shows the winding speed, beginning with the soft start from the inside of the core and then showing how the winding speed is stabilized to around 5 ft/sec.

Now the film rolls are ready for conditioning and are put on the shelves (6) in the cabinet, and the machinery for the conditioning plant is started. The conditioning time varies from 4 to 7 days depending on previous storage of the film. The FICA needs no attention during this time. Figure 5 illustrates the number of grams of water

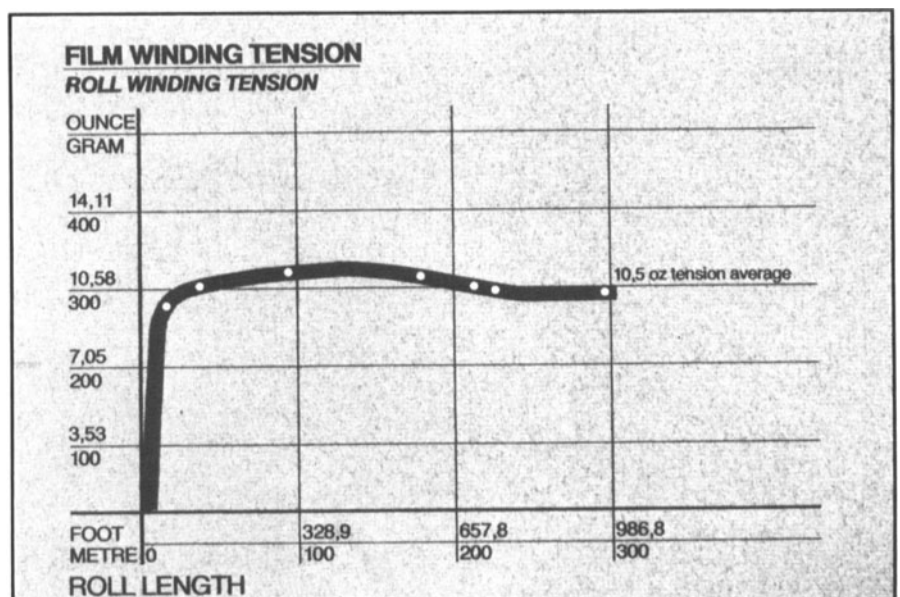


Figure 3. Tension of film during winding.

that evaporate per 24 hours from a 300-m 35-mm, Kodak intermediate 5243 film roll. The measurement of water evaporating from the film roll during conditioning has been made on an electronic scale with a tolerance of 0.05 grams. Figure 6 shows how a

similar roll with a known equilibrium of 52% relative humidity (RH) becomes conditioned down to 20% RH and the time required.

When the film has been on the shelf and has reached its proper condition, it is put into a special bag. This bag is

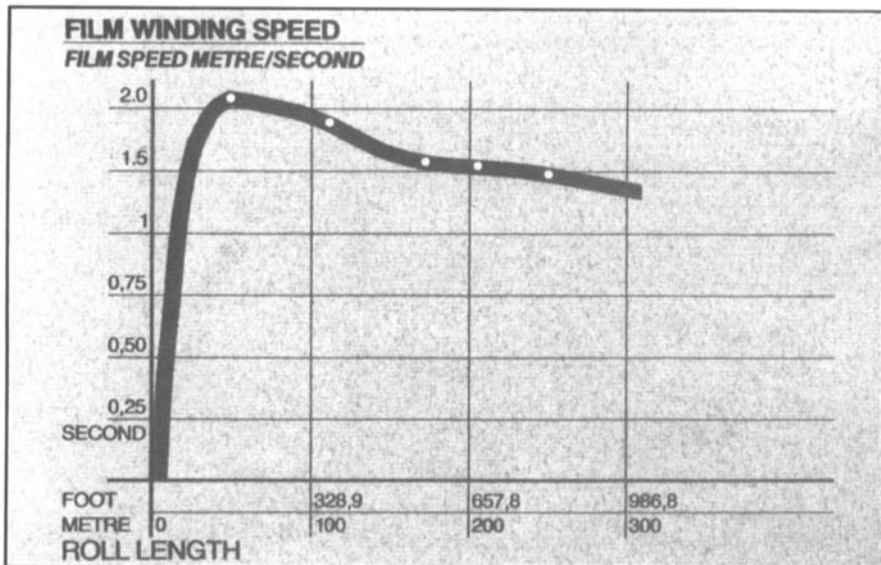


Figure 4. Winding speed of film.

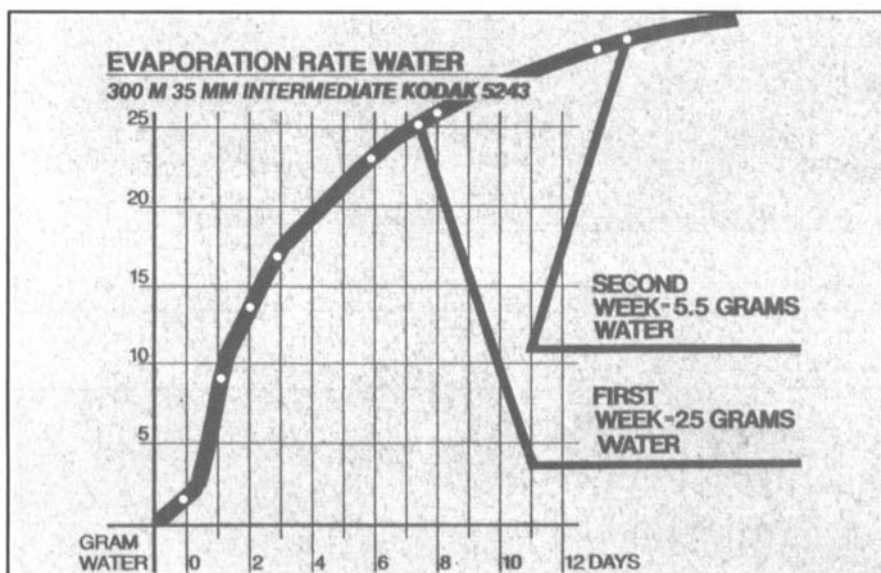


Figure 5. Measurement of water evaporating from film roll during conditioning.

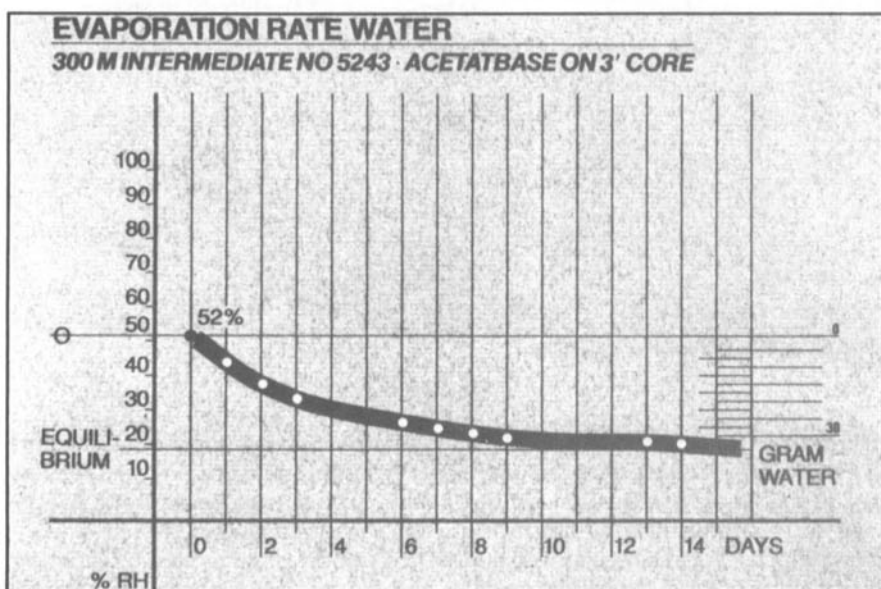


Figure 6. Film roll with 52% RH being conditioned down to 20%.

made of three laminated layers, the first of polyester or paper, the second of aluminum foil, and the third, inner layer, of polyethylene. The bag material must not contain any damaging softener or unknown additives that may react with the bag's contents.

The packing is done as follows: The film roll is taken from the shelf and put into the bag. With the vacuum pump (7), most of the air is taken from the bag. Then the bag is put into the vacuum chamber and heat sealer (8) and will be properly sealed. (The technique of this procedure is quite simple.) For double safety, the bag is put into a similar bag, which is also vacuum pumped and heat sealed. Lastly, the bag is placed, properly labeled, in a film can which, afterwards, is sealed with tape. The film is now ready for cold storage, whenever convenient, and no longer needs to be in a humidity-controlled environment. This is due to the extremely small amount of airborne moisture in the bag, which effectively cancels traditional temperature/humidity curves.

### Conclusion

#### *An Inexpensive Method for Long-Term Storage of Color Film*

A constant temperature must be carefully kept, which usually does not present any great difficulty. Even a household refrigerator or freezer can be used. This method also can be applied to old film material that has already begun to color-fade. The speed of the fading is then drastically reduced, thus saving time and money. In other words, "Stop fading cold."

The film is conditioned for re-use by leaving the bag at room temperature for 24 hours without breaking the seal. After 24 hours, thawing time, the roll is removed from its package and placed in normal room conditions for a day or two. If necessary, rehumidifying can be accelerated with the FICA machine.

It is well known that it is very difficult to maintain a constant relative humidity in cold storage. It is also extremely expensive to reach and keep a relative humidity of 20 or 30% within tight tolerances at low, especially freezing, temperatures. The film conditioning apparatus solves this problem by making it possible to store film in a protected climate inside a bag, unaffected by air contamination or changes in the outside air's relative humidity. At any temperature, sealed conditioned film has longer life.