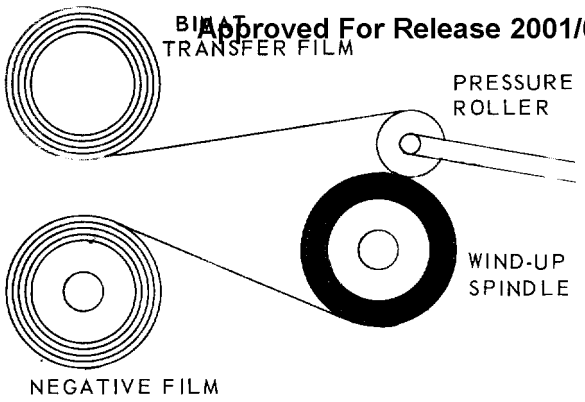


# An Introduction to the KODAK BIMAT Transfer Processing System

In recent years, the need for simplified photographic processing systems has become paramount. The conventional process—develop, rinse, fix, wash, and dry—has proven to be cumbersome in many applications. Secondly, it is often important to view results quickly, and if possible, without involved complicated processing techniques and bulky, expensive equipment. A new KODAK process goes a long way toward solving these problems; a high-quality negative is processed without free liquids, a positive film transparency is produced as the negative is processed, the technique is simple, and equipment requirements are within practicality.

## The Materials

The processing technique uses either of two special processing films, KODAK Dry BIMAT Transfer Film, Type 1 (ESTAR Base) or KODAK Dry BIMAT Transfer Film, Type 2 (ESTAR Base) Type SO-160. Both films consist of a 4-mil polyester film support carrying a hydrophilic gelatin layer containing physical development nuclei. The Type 1 material has a gelatin backing; the Type 2 material does not. Before these processing films can be used to process exposed film, they must be soaked with one of the appropriate processing solutions called KODAK BIMAT Transfer Imbibants.

Presoaked BIMAT Transfer Films, ready to use for processing, are available for many BIMAT transfer processing systems (See systems chart). Most users will prefer to purchase BIMAT Transfer Film in the ready-to-use form rather than perform the presoaking operation themselves.

| BIMAT Transfer Film | Marketed By* |
|---|---|
| KODAK BIMAT Transfer Films Types 21A and 22A (ESTAR Base) (For Aerial Photography) | Special Applications Sales |
| RECORDAK BIMAT Transfer Films, Types 21B and 22B (ESTAR Base) (For CRT Photography) | Special Applications Sales and Business Systems Markets Division |

*KODAK BIMAT Transfer Films are marketed directly to the user. For ordering instructions contact the appropriate sales department at: EASTMAN KODAK COMPANY
Rochester, New York 14650

For the user who needs to perform the presoaking operation, most of the KODAK BIMAT Transfer Imbibants listed in the table are available in packaged form. (Exceptions are noted.) KODAK Dry BIMAT Transfer Film, Types 1 and 2 (ESTAR Base) are available in the common widths from 16mm to 9½ in. Presoaking recommendations and technical assistance are also available to the user.

Wherever we use the term BIMAT Transfer Film in this pamphlet, we mean either the Type 1 or Type 2 material, presoaked by the user, or one of the Type 21A, 21B, 22A, or 22B materials, supplied presoaked.

The KODAK BIMAT Transfer Imbibants are solvent-containing developers. They develop and fix the negative simultaneously and completely by the diffusion transfer mechanism. No further processing steps are requred to use the images formed. (Conventional processing requires 3 steps and 3 solutions to accomplish this—develop, rinse in stop bath, then fix). Additional processing is required to produce archival records.

## The KODAK BIMAT Transfer Process in Brief

Four basic components are needed for BIMAT Transfer processing: a KODAK BIMAT Transfer Film, suitable processing chemicals, suitable handling equipment, and an exposed negative film.

The BIMAT Transfer Film is soaked in the imbibant which is absorbed by the special gelatin layer on the Transfer Film. The BIMAT Transfer Film, treated to contain a predetermined amount of imbibant, is then laminated in intimate face contact with the exposed negative film for a suitable length of time. At the end of the processing time, the two films are separated. The negative is developed and fixed, and the BIMAT Transfer Film contains a positive image. Both films are damp (they feel slightly tacky to the touch); with suitable equipment, they can be completely dried. If kept dry, the images will have satisfactory stability for a few months. If image permanence for archival keeeping is necessary, both films should be washed and dried, in the conventional manner, as soon as convenient.

The process follows the principles of diffusion transfer processing. When the exposed negative film is placed in intimate contact with the presoaked BIMAT Transfer Film, the solution begins to diffuse into the emulsion of the negative film. Exposed negative grains begin to develop, and both unexposed and exposed negative grains begin to dissolve in the silver halide solvent. Some of the dissolved silver halide diffuses into the BIMAT Transfer Film where it is reduced to silver on the nuclei there present and forms a positive image.

## What BIMAT Transfer Processing Offers

The advantages of BIMAT transfer processing over conventional processing techniques reflect the convenience, simplicity, quality, and, since saving time often means saving money, the economies offered by transfer processing. Specifically, the advantages are:

**No Free Liquids.** No free liquids are required at the time of processing negative films. Liquids cannot be squeezed or shaken from the BIMAT Transfer Film. Thus, the solution containment problem is completely eliminated from photographic processing. This is important in airborne processors and those operating in a space environment, as well as processors associated with electronic computer read-out systems. The absence of corrosive, free liquids permits the use of transfer processing in camera magazines without wetting and damaging adjacent components. Processing can be accomplished in locations where no water is available, such as in transit.

The materials handling problems are greatly reduced due to the simplicity and convenience of processing without free liquids. Processing is not affected by equipment position or orientation, or the presence or absence of gravity.

**A Positive is Produced Simultaneously.** A good-quality positive image is produced while the negative is being

It is most important that equipment be properly designed to accomplish the presoaking. The system must provide the required pickup of imbibant. The presoaked BIMAT Transfer Films must be wound tightly and accurately without trapping any air bubbles between convolutions. Anyone contemplating building equipment for presoaking is urged to contact Special Applications Sales for information.

**Packaging and Storage.** Customers purchasing ready-to-use presoaked BIMAT Transfer Film will not need to be concerned about packaging. The material will be supplied in a package designed to permit maximum shelf life of the unopened package. (Opened packages should be used soon after opening.) The customer performing the presoaking operation will, however, need to package the presoaked film suitably so that the material will keep until needed. Several types of packages have been investigated and descriptions can be obtained from Special Applications Sales.

Information on the keeping characteristics of the various packages and imbibants is still being collected and therefore all the answers are not yet in. The information thus far available indicates that the shelf life of presoaked BIMAT Transfer Film is dependent upon the following factors:

1. Storage temperature
2. Quality of package
3. The particular imbibant formula and pickup required
4. The type of negative film the BIMAT Transfer Film will process and processing method

Preliminary information indicates that properly packaged presoaked BIMAT Transfer Film can be successfully stored as follows:

| *Storage Temperature* | *Shelf Life* |
|---|---|
| 40 F ( 4 C) | 3 to 4 months |
| 70 F (21 C) | 2 to 3 weeks |
| 100 F (38 C) | 1 to 2 days |

Presoaked BIMAT Transfer Film must not be frozen.

As soon as more information is available, specific recommendations will be published for each combination of BIMAT Transfer Film and BIMAT Transfer Imbibant.

**Lamination for Processing.** The three basic methods of laminating and processing with BIMAT transfer techniques are discussed above. The equipment for lamination can be quite simple yet precise. It must assure good, even contact without entrapped bubbles or other foreign material. Proper processing cannot occur when there is poor lamination. Builder or pressure rollers are required. Good tracking is important and is dependent upon good alignment and sufficient back tension on supply rolls. Temperature control is not critical for most systems. Depending upon the environment in which the processing must be accomplished, temperature control may need to be provided. Commercial equipment for the lamination operation is beginning to appear.

**Delamination.** In some applications, delamination (or separation) of the positive and negative film can be accomplished by running the laminating equipment backward provided the equipment has been designed to accomplish this. The same requirements of good, tight winding with a pressure roller and good alignment apply especially if the damp films are to be wound upon themselves without drying. A poorly wound roll of either film will dry at the edges and result in sticking and discoloration. Alternatively the films can be dried at the time of delamination. Films dried thus should be stored and used at 30% R.H. or less to prevent a return of tackiness (the gel layer of the BIMAT Transfer Film, Type 21A or 21B, is hygroscopic).

**Post-Processing Treatment.** The post-processing treatment required (if any) depends entirely on the subsequent use and required storage life. If either archival or commercial storage is required, then both films must be washed and dried in the conventional manner. A Morse B-5 rewind processor can be used for washing. If sophisticated processing equipment such as the KODAK VERSAMAT Film Processor is available at some nearby facility, then fixing as well as washing and drying is recommended. (Fixing improves the hardness of the emulsions of the two films.)

If conventional post-processing facilities are not available to either wash and dry or just dry the two films, the following procedure is suggested: The positive film can be laminated to a special transparent 2.5-mil polyester film material, such as KODAK Dry Cover Sheet for BIMAT Transfer Film (ESTAR Thin Base), Type SO-358. This will permit immediate handling of the damp film and protect the positive image against damage. This lamination step is just as important as it is in the processing step, and the same equipment design parameters apply. The image keeping of the positive image on the BIMAT Transfer Film is reasonable (about a week) and should be adequate for most applications when on-the-spot interpretation is necessary and the positive film can be discarded in a few days. With equipment of appropriate mechanical design, cover-sheeting offers a way of making large quantities of positive film available for use in a very short time.

If the negative is to be preserved, it should be wound tightly and sealed in an impervious package to prevent its drying out until it can be given a suitable washing-and-drying treatment.

## Suppliers of Equipment for Applications of the **KODAK BIMAT Transfer Processing System**

This list is not presented as being complete nor is it an endorsement by Eastman Kodak Company.

**Processing Equipment:**

Fairchild Hiller Corporation
1455 Research Boulevard, Rockville, Maryland 20850

Mark Systems, Incorporated
2999 San Ysidro Way, Santa Clara, California 95051

Photomechanisms, Incorporated
15 Stepar Place, Huntington Station, Long Island, New York 11746

Radio Corporation of America, Defense Electronic Products
Missile and Surface Radar Division, Moorestown, New Jersey 07960

**Presoaking Equipment:**

Fairchild Hiller Corporation
1455 Research Boulevard, Rockville, Maryland 20850

Mark Systems, Incorporated
2999 San Ysidro Way, Santa Clara, California 95051

EASTMAN KODAK COMPANY • ROCHESTER, N.Y. 14650

An Introduction to KODAK BIMAT Transfer Processing System
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# Current KODAK BIMAT Transfer Processing Systems

| Film | Conventional Processing | | | BIMAT Transfer Processing | | | | | | | | | | | | BIMAT Transfer Process Aims and Applications |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | KODAK Developer | Speed | Resolving Power (TOC=1000:1) in lines/mm | Dry BIMAT Transfer Film Type | BIMAT Transfer Imbibant (Note 5) | Imbibant Pickup grams/sq ft | Presoaked BIMAT Transfer Film Type (Note 4) | Process Method | Access Time Positive | Access Time Negative | Processing Temperature Range | Speed | Average Negative Gamma | Resolving Power (TOC=1000:1) in lines/mm Negative | Resolving Power (TOC=1000:1) in lines/mm Positive | |
| **KODAK PLUS-X AEROGRAPHIC, Type 2401 (ESTAR Base)** | D-19 | 80 | 100 | 1 | MX-615 | 7.3 | 21A | Wind-up | 20 min | 20 min | 60-80 F | 64 | 1.15 | 125 | 55 | Produces a low-contrast negative and positive. For aerial reconnaissance. |
| | D-19 | 80 | 100 | 2 | MX-615 | 6.8 | **22A** | Wind-up | 20 min | 20 min | 60-80 F | 64 | 1.15 | 125 | 55 | |
| | D-76 | Note 1 | | 1 | MX-572 | 7.3 | — | Wind-up | 20 min | 20 min | 60-80 F | 64 | 1.15 | 125 | 55 | |
| | | 80 | 112 | 2 | MX-572 | 6.8 | — | Wind-up | 20 min | 20 min | 60-80 F | 64 | 1.15 | 125 | 55 | |
| | | Note 1 | | | | | | | | | | Note 1 | | | | |
| **KODAK PANATOMIC-X Aerial, Type 3400 (ESTAR Thin Base)** | D-19 | 20 | 170 | 1 | MX-615 | 7.3 | **21A** | Wind-up | 10 min | 10 min | 60-80 F | 20 | 1.35 | 190 | 55 | Produces a moderate-contrast negative and positive. For aerial reconnaissance. |
| | | Note 1 | | 2 | MX-615 | 6.8 | 22A | Wind-up | 10 min | 10 min | 60-80 F | 20 | 1.35 | 190 | 55 | |
| | | | | | | | | | | | | Note 1 | | | | |
| **KODAK Special High Definition Aerial (Gray Base), Type SO-243** | D-19 | 1.6 | 465 | 1 | *PS485K | 6.0 | — | Wind-up | — | 5 min | 70-90 F | 2.0 | 1.55 | 450 | — | Produces a moderate contrast negative. The positive is poor and usually discarded. For closed environment processing. |
| | | Note 1 | | 2 | *PS485K | 5.5 | — | Wind-up | — | 5 min | 70-90 F | 2.0 | 1.55 | 450 | — | |
| | | | | | | | | | | | | Note 1 | | | | |
| | D-19 | 1.6 | 465 | 1 | MX-603 | 6.0 | — | Wind-up | 90 sec | 90 sec | 60-80 F | 1.6 | 1.55 | 450 | 55 | Produces a quick-access, moderate-contrast negative and positive. For aerial reconnaissance. |
| | | Note 1 | | 2 | MX-603 | 5.5 | — | Wind-up | 90 sec | 90 sec | 60-80 F | 1.6 | 1.55 | 450 | 55 | |
| | D-76 | 1.6 | 525 | | | | | | | | | | | | | |
| | | Note 1 | | | | | | | | | | | | | | |
| **KODAK Special, PLUS-X Aerial (ESTAR BASE), Type SO-390** | D-19 (8 min at 75 F) | 80 | 100 | 1 | MX-615 | 7.3 | **21A** | Wind-up | 20 min | 20 min | 60-100 F | 64 | 1.0 | 125 | 55 | Produces a low-contrast negative and positive. Designed for high ambient temperature conditions. For aerial reconnaissance. |
| | | Note 1 | | 2 | MX-615 | 6.8 | 22A | Wind-up | 20 min | 20 min | 60-100 F | 64 | 1.0 | 125 | 55 | |
| | | | | | | | | | | | | Note 1 | | | | |
| | D-19 (8 min at 75 F) | 80 | 100 | 1 | MX-572 | 7.3 | — | Wind-up | 20 min | 20 min | 60-100 F | 64 | 1.0 | 125 | 55 | Same as above. |
| | | Note 1 | | 2 | MX-572 | 6.8 | — | Wind-up | 20 min | 20 min | 60-100 F | 64 | 1.0 | 125 | 55 | |
| | | | | | | | | | | | | Note 1 | | | | |
| **RECORDAK DACOMATIC, Type 5461** | D-19 | 250 | 150 | 1 | MX-615 | 7.3 | 21A | Continuous | 10 sec | Not Completed | 110-130 F | Note 3 | — | — | 90 | Produces a rapid-access positive; the negative is normally discarded. For cathode-ray tube monitoring. |
| | | Note 2 | | 2 | MX-615 | 6.8 | **22A** | Continuous | 10 sec | Not Completed | 110-130 F | | — | — | 90 | |
| | D-19 | 250 | 150 | 1 | *MX-625-1 | 8.0 | 21B | Continuous | 1 min | 1 min | 110-130 F | 125 | .95 | 150 | 80 | Produces a quick-access positive and negative. For cathode-ray tube monitoring. |
| | | Note 2 | | 2 | *MX-625-1 | 7.5 | 22B | Continuous | 1 min | 1 min | 110-130 F | 125 | .95 | 150 | 80 | |
| | | | | | | | | | | | | Note 2 | | | | |

1. **Aerial Exposure Index.** These indexes are for use with the *KODAK Aerial Exposure Computer* to determine the correct exposure for aerial (air-to-ground) photography. Aerial Exposure Indexes are not equivalent to, and should not be confused with, ASA speeds (which are designed for pictorial photography). Aerial Exposure Indexes are defined as the reciprocal of twice the exposure (in meter-candle seconds) at the point on the toe of the characteristic curve where the slope = 0.6 $\gamma$.
2. **Relative CRT Speed to a P11 Phosphor.** Measured at a density of 1.0 (net) and relative to the speed of 100 assigned to EASTMAN Television Recording Film, Type 5374, when exposed to a P11 phosphor and developed in KODAK Developer D-19 for 4 minutes at 68 F (20 C).
3. The speed is comparable to the speed attained by reversal processing the negative.
4. The preferred presoaked KODAK BIMAT Transfer Film is shown in boldface type.
5. Starred (*) Imbibants are not available in 1-qt. sizes.

**Note:** The information in this table is intended to assist the user in selecting films and as a starting point in using them.

**For information about sizes, prices, minimum orders, availability, and technical applications, write or call:**


**Special Applications Sales**
**Eastman Kodak Company**
**Rochester, New York 14650**

**or Business Systems Markets Division**
**Eastman Kodak Company**
**Rochester, New York 14650**

**Area Code 716, 325-2000, extension 3221 or extension 2505**

The continuously generated positive image can be used immediately. To complete the negative processing, a second BIMAT Transfer Film is laminated to the negative, held for a period, and then separated when convenient. Alternately, the negative can be fixed in the conventional manner.

The obvious advantage of this method is that it allows quick access to a usable positive image and still produces a high-quality negative.

**Continuous Process.** This method uses one presoaked BIMAT Transfer Film to produce, on a continuous basis, one positive film and the processed negative film. In use, the presoaked BIMAT Transfer Film is laminated to the exposed negative, and the two are allowed to remain in contact until processing is complete. Two methods of allowing the two films to remain in contact for a period of time are to pass the contacted films around a slowly revolving drum or through a straight-line tunnel. When processing is complete, the films can be separated.

The continuous process is also adaptable to providing a rapid-access positive. This is accomplished by conducting the process on a heated drum or in a heated tunnel. It is chemically easier to obtain a positive rapidly than it is to obtain a completely developed and fixed negative image rapidly. Hence some systems have been designed to discard the partially processed negative once the positive is available. The high-temperature continuous processing method requires more critical control of temperature and time of lamination than the other methods.

The continuous processing method is best suited to application where a monitoring function is required.

## Sensitometric and Image-Structure Characteristics

The sensitometric and image-structure characteristics of films processed by the BIMAT transfer technique compare favorably with those of films processed in the conventional manner. Imbibants (and ready-to-use presoaked BIMAT Transfer Films) are available to process many different types of films. In some cases there is a choice of either high- or low-contrast images.

Generally speaking, BIMAT transfer processing results in a slightly lower gradient, equal or better granularity, approximately the same resolving power, and improved modulation transfer characteristics when compared to conventional processing. Fog tends to be slightly higher, but this should cause no problems. Transfer processing is less affected by temperature changes than conventional processing. The minimum time for processing can be decreased as the temperature is increased.

Because the negative emulsion, the BIMAT Transfer Film, and the BIMAT Transfer Imbibant act as a complete system, and since the processes are usually designed to go to completion, the sensitometric properties are not subject to the usual controls required in conventional processing. For example, gradient is usually determined by the imbibant–negative emulsion combination rather than processing time and temperature. Another important factor is that fresh processing chemicals are always used for processing all areas of the negative film. For these reasons, the BIMAT transfer processing technique is a highly reproducible one; it is not subject to the usual variables–operator, equipment, and processing conditions.

## Applications of the BIMAT Processing Technique

The current commercially available materials are designed for aerial reconnaissance and cathode-ray tube recording. In-flight processing is easily accomplished without free solutions being involved. The simple wind-up method of operation is directly adaptable to tactical aerial reconnaissance. By the time the aircraft returns to base, processing will have been completed, and a positive image can be made available for study immediately upon landing. Mark Systems, Incorporated, of Santa Clara, California, has built in-flight processing magazines with ejectable cassettes using the wind-up method of BIMAT transfer processing. The Fairchild Hiller Corporation of Rockville, Maryland, has designed a mobile flight line processing system using the wind-up method of BIMAT transfer processing.

Larger reconnaissance aircraft can accommodate the dual BIMAT Transfer Film method in which the positive image is available almost immediately for on-the-spot interpretation. Thus, films can be examined to determine whether the information originally sought has been successfully recorded. If not, more photographs can be made while the aircraft is over the target area, thus assuring a successful mission. Equipment for this process has been designed by Eastman Kodak Company under U.S. Air Force contract.

The continuous processing method with the rapid-access availability of a positive image is especially suited to cathode-ray tube monitoring. Two systems are currently offered. In the first, a positive is obtained very quickly and the partially processed negative is discarded. The second system produces both a positive and a completely processed negative but not as quickly as in the first system. The Missile and Surface Radar Division of RCA, Moorestown, New Jersey, has designed equipment for the continuous method of BIMAT transfer processing that produces rapid access to the positive image.

It is anticipated that future investigation will greatly expand the list of applications. Current laboratory work indicates that, with appropriate chemistry, a great many different types of films can be successfully processed by the BIMAT transfer technique. Thus many customers, in an endless variety of photographic situations, would benefit by the many advantages offered by the BIMAT transfer processing system.

## Recommended Techniques

Successful operation of any BIMAT transfer processing system requires the following operations: presoaking, packaging, and storing the presoaked material, lamination for processing, delamination, and post-processing treatment.

**Presoaking.** As mentioned earlier, it is expected that most users will want to purchase ready-to-use presoaked BIMAT Transfer Film. This film is supplied presoaked with one of several imbibants to accommodate numerous films and applications.

Eastman Kodak Company recognizes that some users will need to perform their own presoaking operations. Others may need to have a back-up facility for presoaking to supplement the purchase of ready-to-use material. Information about presoaking techniques will be furnished upon application to Special Applications Sales, Eastman Kodak Company, Rochester, New York 14650.

At present, several techniques have been designed for presoaking BIMAT Transfer Film. There are continuous systems and rewind systems. Both can be accomplished with one stage of presoaking. A greater capacity for presoaking films is realized when 2-stage presoaking is used. Equipment for single-stage rewind presoaking of BIMAT Transfer Film is being marketed by Mark Systems, Incorporated, of Santa Clara, California.