



## KODAK AEROCOLOR III Negative Film 2444

KODAK AEROCOLOR III Negative Film 2444 is a medium-speed, very fine-grain color negative aerial film. This film has a wide exposure latitude and is specifically designed for processing to a color negative only. Since this film does not have integral color masking, direct interpretation can be made from the negative. Objects are recorded in colors complementary to their natural colors.

The ESTAR Base provides flexibility, moisture resistance, high tear resistance, and excellent dimensional stability. KODAK AEROCOLOR III Negative Film 2444 has an abrasion-resistant emulsion, an antihalation undercoat, and a dyed-gel backing.

The hardened emulsion permits high-temperature, rapid processing in roller-transport processors, such as the KODAK Aerial Color Processor, Model 1611, and the KODAK EKTACHROME RT Processor, Model 1811, with Quick-Change, using Process AN-6. This process consists of selected KODAK EA-5 Chemicals and AN-6 Chemicals. Processing can be easily tailored to optimize contrast for specific applications.

This film is also compatible with Process C-41. It can be processed in existing C-41 processors using either KODAK FLEXICOLOR Developer or KODAK Developer Replenisher, Process AN-6.

This film can be processed in rewind processing equipment, such as the Morse M-10 developing outfit (Military Designator: B-5), although this is not a primary processing recommendation.

### APPLICATIONS

KODAK AEROCOLOR III Negative Film 2444 is for general use in medium- to high-altitude aerial-mapping and aerial-reconnaissance photography. It is suited for geological, pollution, archeological, crop and forestry studies; traffic control; city planning; railway, highway, and hydraulic engineering; oceanography; and remote sensing, as well as other areas where photogrammetry is used. It is also well suited and recommended for use in digital film recorders.

### BASE

**3.9-mil** (0.10 mm) ESTAR Base with a gel backing.

### TOTAL FILM THICKNESS

The nominal total thickness (unprocessed) of this film is **5.2 mils** (0.132 mm). This includes emulsion—0.8 mil (0.020 mm), base—3.9 mils (0.10 mm), and backing—0.5 mil (0.013 mm).

### WEIGHT

The weight of AEROCOLOR III Negative Film 2444 (unprocessed), conditioned in equilibrium with 50 percent relative humidity, is **0.04 lbs/sq ft** (0.018 kg/sq ft).

### SPECTRAL SENSITIVITY

This multilayer, color negative film is balanced for daylight exposure.

### SAFELIGHT

Total darkness is required.

### EXPOSURE

Aerial Film Speeds (EAFS or ISO A equivalent) should not be confused with conventional film speeds, which are designed for roll and sheet films used in pictorial photography. The characteristics of aerial scenes differ markedly from those of ordinary pictorial or ground scenes because of the smaller range in subject luminance, atmospheric haze conditions, and other factors. Therefore, different film-speed parameters are used to relate aerial-scene characteristics to practical exposure recommendations.

The KODAK Aerial Exposure Computer, KODAK Publication AS-10, has been published based on the aerial film speed criterion.

**Nominal speed**, daylight (no filter): EAFS or ISO A **125**

(based on development for maximum contrast)

**Note:** The Aerial Film Speed given in this publication is rounded to the nearest cube root of 2 step (equivalent to 1/3 stop).

### Filters

This film incorporates an integral ultraviolet-absorbing filter, so color correction filters are not normally used. If necessary, additional color-balance adjustment in the blue region can be achieved using KODAK Haze Cutting Filters HF-4 or HF-5.

## Typical Camera Exposure

A typical exposure for this film, in an aerial camera with a 2X antivignetting filter, is approximately 1/750 second at f/5.6. This exposure is based on a solar altitude of 40 degrees, a clear day, and an aircraft altitude of 5000 feet.

## Reciprocity Characteristics

No filter correction or exposure adjustment is required for exposure times from 1/10,000 second to 1/10 second.

## IMAGE STRUCTURE

Process	Resolving Power (line pairs/mm)		rms Granularity*
	TOC 1.6:1	TOC 1000:1	
AN-6, 3:00 dev time	80	100	16
C-41, 4:15 dev time	80	125	15
C-41, 3:15 dev time	80	125	10

\* Granularity values read at a net green diffuse density of 1.0 with a 48-micrometre aperture.

## STORAGE

For consistent results, all aerial films should be stored under fairly constant conditions. Kodak aerial films are “usually” packaged in equilibrium with 40 to 50 percent relative humidity. High temperatures or high humidity may produce undesirable changes in the film. Color films are more seriously affected by adverse storage conditions than are black-and-white films. These adverse conditions affect the three emulsion layers to different degrees, thus causing changes in the color balance, as well as possible changes in overall film speed and contrast.

## Unexposed Film

While this film has exceptionally good rawstock keeping characteristics at room temperature, it is recommended that film that will not be exposed within two weeks be stored in a refrigerator at 55°F (13°C) or lower, or freezer at 0 to -10°F (-18 to -23°C), in the original sealed container. If the film is stored in a refrigerator, remove it about 2 hours before opening; if stored in a freezer, remove it about 8 hours before opening. A sufficient warm-up time is necessary to prevent moisture condensation on cold film—otherwise, moisture spotting, ferrotyping, or sticking may occur.

## Exposed Film

Although this film has excellent latent-keeping properties, it remains prudent to keep exposed film cool and dry whenever practical. Process the film as soon as possible after exposure to avoid undesirable changes in the latent image. If it is necessary to hold exposed but unprocessed film for more than a week, it should be resealed and refrigerated at 40°F (4°C) or lower. Before unsealing and processing exposed film that has been held in cold storage, follow the warm-up procedures described above for unexposed film.

## Processed Film

For best keeping, store processed film in a dark, dust-free area at 50 to 70°F (10 to 21°C) and 30 to 50 percent relative humidity. Preferably, store negatives on the spool or in individual KODAK Sleeves. High relative humidity promotes the growth of mold and causes ferrotyping. Very low relative humidity causes excessive curl and brittleness. Avoid storage temperatures over 80°F (27°C).

**Caution!** Do not freeze processed AEROCOLOR III Color Negative Film 2444. Freezing processed film can cause coupler alterations.

## PROCESSING

The primary recommendation for processing 2444 Film is in Process AN-6 using mechanized processors. Mechanized processing in roller-transport processors offers the advantages of uniform treatment of all portions of the roll, freedom from banding, and absence of significant density variations from ends of the roll to the center.

**Note:** Contrast may be easily tailored over a range of approximately 0.65 to 0.95 gamma to suit various acquisition and personal preferences. The following tables for Process AN-6 pertain to the highest contrast option; a table at the end of this section lists both AN-6 and C-41 developer time/temperature options to achieve a variety of desired contrasts.

### Process AN-6 Cycle Times

Processor	Transport Speed (feet per minute)	Dry-to-Dry Processing Time
KODAK Aerial Color Processor, Model 1611	4.2	11.8 minutes
KODAK EKTACHROME RT Processor, Model 1811 (with Quick-Change)	4.2	11.6 minutes

In each case, the film is fed emulsion side down into the processor.

This publication provides general information regarding the KODAK Aerial Color Processor, Model 1611, and the KODAK EKTACHROME RT Processor, Model 1811. Refer to the operating manuals for additional set-up information.

**Note:** For a list of firms equipped to offer machine processing of 2444 Film, send an e-mail to [aerial@kodak.com](mailto:aerial@kodak.com) or write to Eastman Kodak Company, Aerial Imaging, Rochester, New York 14653-7128.

## Chemicals

Process AN-6 uses the following KODAK EA-5 and AN-6 Chemicals:

- KODAK Developer Starter, Process AN-6
- KODAK Developer Replenisher, Process AN-6
- KODAK EA-5 First and Second Stop Bath and Replenisher
- KODAK EA-5 Bleach and Replenisher
- KODAK Aerial Color Fixer and Replenisher
- KODAK EA-5 Stabilizer and Replenisher

**Notice:** Observe precautionary information on product labels and Material Safety Data sheets.

## Processing Sequence (4.2 fpm):

### KODAK Aerial Color Processor, Model 1611

Solution/Step	Tank No.	Time (seconds)	Temperature	
			°F	°C
AN-6 Developer	1, 2, 3	179.3	106 ± 0.5	41.1 ± 0.3
Skip Tanks	4 - 9	28.4	—	—
Stop Bath	10	58.9	120 ± 5	49 ± 3
Wash	11	58.9	120 ± 5	49 ± 3
Bleach	12	58.9	120 ± 5	49 ± 3
Fixer	13	58.9	115 ± 5	46 ± 3
Final Wash*	14, 15, 16	176.0	120 ± 5	49 ± 3
Dryer	—	88.7	145 ± 5	63 ± 3

\* Inject EA-5 Stabilizer and Replenisher into tank 16 of the final wash at a rate of 50 mL/min for all film widths.

### KODAK EKTACHROME RT Processor, Model 1811, Quick-Change

Solution/Step	Tank No.	Time (seconds)	Temperature	
			°F	°C
Skip Tanks	1, 2, 3	18.1	—	—
AN-6 Developer	4, 5, 6	175.9	106 ± 0.5	41.1 ± 0.3
Skip Tanks	7 - 12	29.2	—	—
Second Stop	13	58.6	120 ± 5	49 ± 3
Wash	14	58.6	120 ± 5	49 ± 3
Bleach	15	58.6	120 ± 5	49 ± 3
Fixer	16	58.6	115 ± 5	46 ± 3
Final Wash*	17, 18	117.3	120 ± 5	49 ± 3
Dryer†	—	122.1	140 ± 5	60 ± 3

\* Inject EA-5 Stabilizer and Replenisher into tank 18 of the final wash at a rate of 50 mL/min for all film widths.

† Set air-damper control knobs at 8. The dryer temperature may require adjustment depending on the ambient temperature and humidity conditions in the processing area.

## Replenishment and Wash Rates (4.2 fpm):

**Note:** These rates have been rounded to the nearest usable increment.

### Models 1611 and 1811 with Quick Change

Solution/Step	Basic Rate (mL/ft <sup>2</sup> )	Film Width		
		70 mm (mL/min)	5-in. (mL/min)	9 1/2-in. (mL/min)
AN-6 Developer*	110	105	195	365
Stop Bath	200	195	350	665
Wash	— 2 gal/min —			
Bleach	90	90	160	300
Fixer	100	100	175	335
Final Wash†	— 2 gal/min —			

\* The required rates will vary with the average exposure level. Make an adjustment if the control strip density levels increase or decrease substantially.

† Inject EA-5 Stabilizer and Replenisher into tank 16 (Model 1611) or tank 18 (Model 1811) of the final wash at a rate of 50 mL/min for all film widths. In the Model 1611, this wash flows countercurrent to tanks 15 and 14. In the Model 1811, this wash flows countercurrent to tank 17.

## Bleach Regeneration

Regeneration of used EA-5 Bleach will reduce processing solution costs and substantially reduce the amount of bleach discarded to the sewer. Collection and treatment tanks for bleach overflow solution and chemical testing capability are required. A detailed laboratory procedure is available from Eastman Kodak Company.

## C-41 Processing

This film may be processed in KODAK FLEXICOLOR Chemicals for Process C-41. To achieve results like Process AN-6, extend the development time to 5' 15" at 100°F (38°C) with a basic replenishment rate of 94 mL/ft<sup>2</sup>. Shorter development times may be used to achieve lower contrast, if desired. Substitute AN-6 Developer using a developer time of 2' 56" at 106°F (41°C) for increased productivity.

**Note:** Do not use KODAK FLEXICOLOR Developer LORR, as the low tank turnover would be insufficient to maintain proper chemical equilibrium and sensitometric control.

### C-41 Processing Cycle

FLEXICOLOR Chemical	Time min:sec (sec)	Temp °C (°F)	Basic Repl Rate (mL/ft <sup>2</sup> )
Developer	3:15 to 5:15 (195 to 315)	38 ± 0.3 (100 ± 0.5)*	94
Bleach III	3:00 to 6:00 (180 to 360)	38 ± 3 (100 ± 5)*	95
Wash	1:05 (65)	24 to 41 (75 to 105)†	2900‡
Fixer§	4:20 (260)	38 ± 3 (100 ± 5)	95
Wash	3:15 (195)¶	24 to 41 (75 to 105)	2900‡
Stabilizer LF —or— Stabilizer III	1:05 (65)	24 to 41 (75 to 105)	95
Dry	As needed	Not over 60 (140)	

\* If you increase the bleach and fixer times to 6:30 or longer, you can extend the temperature range to 75 to 105°F (24 to 41°C).

† In some processors, a lower wash-water temperature may affect solution temperatures in adjacent tanks. Longer warm-up times may be needed. If it affects developer temperature during processing, you may need to use a higher wash-water temperature.

‡ Rates are for first wash and a two-stage countercurrent final wash. Double these rates for a single-stage final wash.

§ Use a two-stage (two-tank) countercurrent fixer, preferably with the same time in each tank. Agitation and filtration in each tank are required. If your processor has a single fixer tank, using in-line electrolytic desilvering will decrease the safety factor for adequate fixing.

¶ If your squeegees are efficient enough to maintain a low fixer carryover, you can reduce the wash time to 2:10.

For additional information using Process C-41, see KODAK Publication Z-131, *Process C-41 using KODAK FLEXICOLOR Chemicals*.

### Development Options to Achieve Various Contrasts

Adjust developer time/temperature per the table below to achieve a variety of contrasts. When changing processor transport speeds, be sure to adjust replenishment flow rates accordingly, to maintain desired basic replenishment rates.

Developer	Time min:sec (sec)*	Temp °C (°F)	Approx. Contrast	ISO A Equivalent
AN-6	2:56 (176)	41 (106)	0.90	125
AN-6	2:17 (137)	41 (106)	0.80	100
AN-6	2:17 (137)	38.9 (102)	0.65	80
Flexicolor	5:15 (315)	38 (100)	0.90	125
Flexicolor	4:15 (270)	38 (100)	0.80	100
Flexicolor	3:15 (195)	38 (100)	0.65	80

\* Film must be completely immersed in developer. Includes immersion time and transfer time to the next tank. Keep transfer time to 20 seconds or less.

**Note:** Based on a 3-tank developer system in a Model 1611 or 1811 Processor, 2:56 = 4.2 fpm and 2:17 = 5.4 fpm.

## REWIND PROCESSING

**Note:** This is not a primary recommendation.

KODAK AEROCOLOR III Negative Film 2444 yields optimum results with modern, high-temperature, continuous-processing machines. It can be processed in rewind equipment, although this method is not a primary processing recommendation. Eastman Kodak Company no longer offers packaged chemicals for such processing. Customers wishing to use rewind equipment such as the Gordon/Morse M-10 Developing Outfit (Military Designator: B-5) may contact Aerial Imaging for information on exposure, processing chemicals, process cycles, and general recommendations.

## PROCESS CONTROL

KODAK Control Strips, Process AN-6, are available and are recommended for monitoring the processing of AEROCOLOR III Film in roller-transport processors. For detailed information on process control and troubleshooting, refer to KODAK Publication Z-200, *Using Processes AR-5 and AN-5 for KODAK Color Aerial Films*.

## PRINTING NEGATIVES

You can reproduce images made on AEROCOLOR III Negative Film by using a variety of Kodak materials.

### Color Transparencies

You can make transparencies directly (or by first scanning) on KODAK PROFESSIONAL ENDURA Clear Display Material.

### Color Prints

You can make prints directly (or by first scanning) on—  
KODAK PROFESSIONAL PORTRA, SUPRA, and ULTRA ENDURA Papers  
KODAK PROFESSIONAL ENDURA Transparency Display Material  
KODAK PROFESSIONAL ENDURA Metallic Paper

## DIMENSIONAL STABILITY

The dimensional stability of aerial films is of particular interest and importance in accurate mapping and in the reproduction of maps.

Dimensional stability is an all-inclusive term. In photography, it applies to size changes caused by changes in humidity and in temperature, and by processing and aging. The absence of solvent in ESTAR Base is one of the reasons why ESTAR Base films show excellent dimensional stability. The dimensional properties of ESTAR Base may vary slightly in different directions within a sheet; the differences that may exist, however, are not always between the length and width directions.

### Temporary Dimensional Changes

Thermal Coefficient of Linear Expansion:	
0.001%	per degree F of change
0.0018%	per degree C of change

Humidity Coefficient of Linear Expansion (Unprocessed):	
0.0025%	per 1% change in relative humidity

### Permanent Dimensional Changes

Processing Dimensional Change:	
-0.02% to +0.01%	shrinkage to swell

Aging Shrinkage of Processed Film:	
0.06%	1 week at 120°F (49°C), 20% RH
0.03%	1 year at 78°F (25.5°C), 60% RH

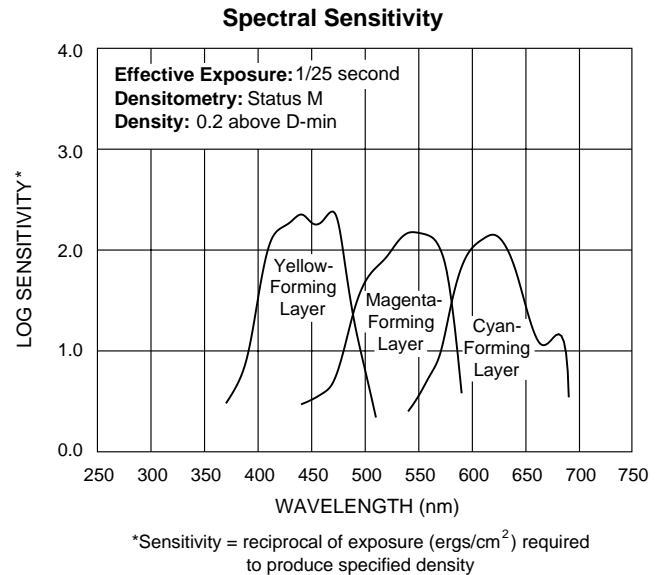
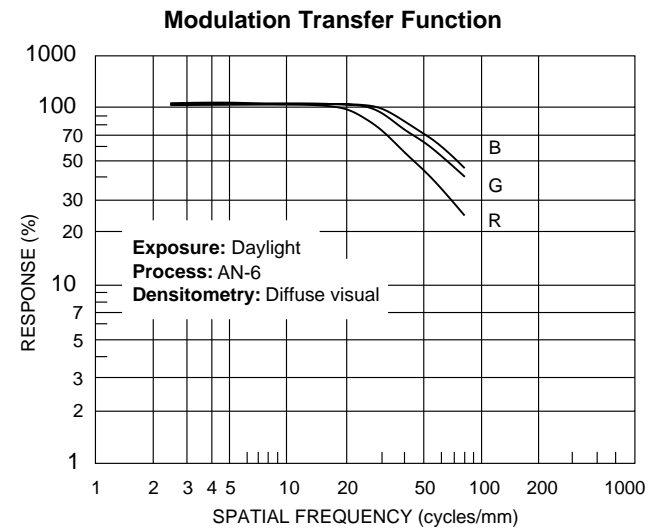
## SIZE DATA AND ORDERING INFORMATION

Information on available sizes and minimum order quantities of this film is available on the web at [www.kodak.com/go/aerial](http://www.kodak.com/go/aerial). You can also write or call:

Aerial Imaging  
 Eastman Kodak Company  
 343 State Street  
 Rochester, New York 14650-0505  
 (585) 724-4688  
 Toll-free in the US: (877) 909-4280

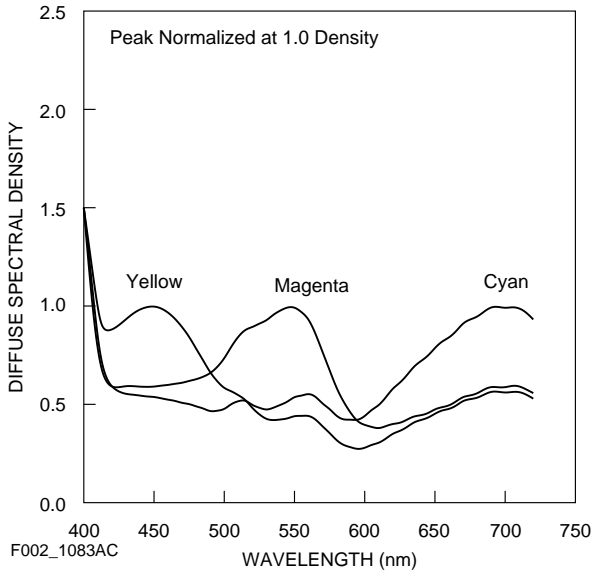
**Note:** The Kodak materials described in this publication used with AEROCOLOR III Film are available from those dealers normally supplying Kodak products. Other materials may be used, but equivalent results may not be obtained.

## CURVES

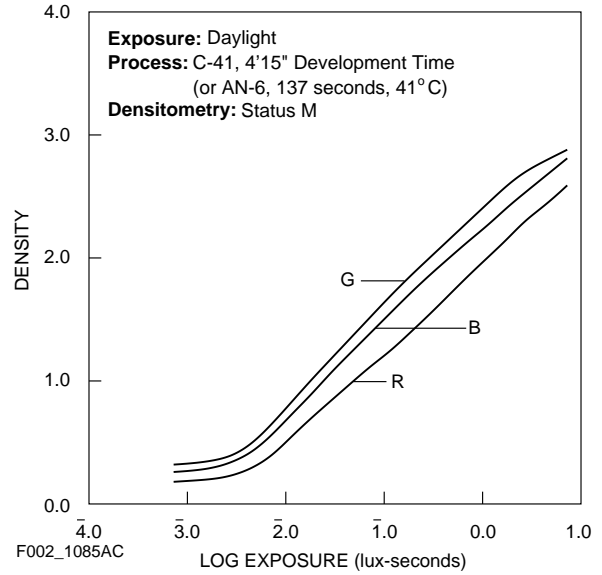


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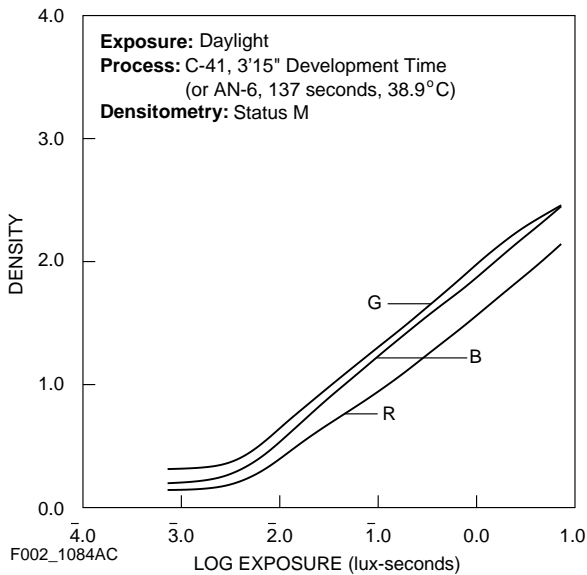
**Spectral Dye Density**



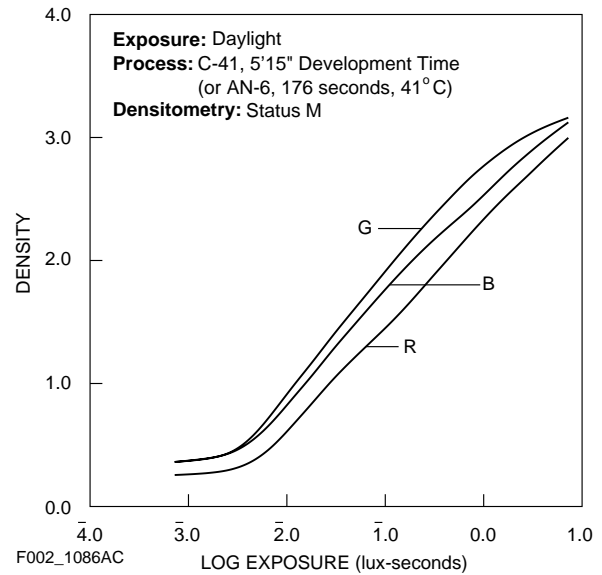
**Characteristic Curve, Developed for Medium Contrast**



**Characteristic Curve, Developed for Low Contrast**



**Characteristic Curve, Developed for Maximum Contrast**



NOTICE: While the sensitometric data in this publication are typical of production coatings, they do not represent standards which must be met by Kodak. Varying storage, exposure, and processing conditions will affect results. The company reserves the right to change and improve product characteristics at any time.

Aerial Imaging  
EASTMAN KODAK COMPANY • ROCHESTER, NY 14650-0505



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