KODAK EKTACHROME Infrared AERO Film, Type 8443—20-Exposure Rolls

35mm

This is a modified-color ("false-color") reversal film originally designed for aerial camouflage detection. It must be exposed by illumination having daylight quality. In 35mm form it is useful for many biological, medical, and pictorial purposes. Unlike the usual color film, its three image layers are sensitized to green, red, and infrared instead of to blue, green, and red. A yellow filter is used on the camera to withhold blue light, to which these layers are also sensitive. Upon processing, a yellow, positive image records in the green-sensitive layer; magenta and cyan images appear in the red and infrared-sensitive layers, respectively. Table I lists the rendition of several subjects. The infrared sensitivity range is about 700 to 900 mμ, like that of regular black-and-white infrared films. Thus, the material cannot be used in thermography. Since the image on the film is made up from both visible-light and infrared records, and since a small lens opening is usually required for depth of field, there is seldom any need to make a lens adjustment for infrared focus.

Applications: This film can be used in forestry, plant pathology, and crop or ecological surveys. It also enables the photographer to make preliminary tests in such projects in order to work out techniques and to evaluate the usefulness of the modified-color record (Table I) before undertaking a full-scale program of aerial photography. In biology and medicine this film has particular value in recording physiological and botanical substances and lesions in characteristic colors. (See Table I.) In medicine it has been used to map venous patterns, to outline some subcutaneous tumors, to penetrate cloudy vitreous humor, to delineate arterial occlusion, and to emphasize melanotic lesions in retinal photography. In pictorial, illustrative, and fashion photography, unusual effects are obtainable with this film. (Table I.) It may have applications in industrial photography also.

Reprints: An introduction to the use of the film in plant pathology is contained in "Film Sees New World of Color," Norman L. Fritz; *Citrus World*, 2, 11-12, 26, 1965. A reprint can be obtained by writing Research Library, Eastman Kodak Company, Kodak Park, Rochester, New York, 14650. An extensive discussion of biological and medical applications, as well as camera and lighting techniques, is in "New Vistas in Infrared Photography," H. Lou Gibson, William R. Buckley, and Keith E. Whitmore; *Journal of the Biological Photographic Association*, 33, No. 1, 1-33, February 1965. This article, as well as instructions for using the film in aerial photography, can be procured from Publications Service; Professional, Commercial and Industrial Markets Division; Eastman Kodak Company, 343 State Street, Rochester, New York 14650.

TABLE I

Representative Modified-Color Renditions

SUBJECT	COLOR	SUBJECT	COLOR
Medical		**Biological**	
Retinal melanotic lesion	Dark blue	Healthy deciduous green foliage	Red
Arterial occlusion	Blue	Diseased or deficient foliage	Toward green or blue
Healthy retina	Yellow-red	Evergreens	Dark purple
Superficial melanotic areas	Red	Green caterpillar (*Protoparce spp*)	Brown-pink
Superficial veins	Dark blue	Black toad (*Bufo boreas exsul*)	Blue-black
Venous blood	Red-brown	Blue sky	Sky blue
Arterial blood	Green-brown	Red rose	Yellow
Vascular nevi	Green-brown	Buff seashell	Orange
Inflammatory skin areas	Yellow	**Miscellaneous**	
Fibrous (collagenous) tissue	Blue	Some green pigments	Purple
Cholesterol	Pale blue	Some green dyes	Magenta
Tooth cementum	Ivory-white	Black cloth	Dark red
Microscopic silver (autoradiographic)	Black	Brown hair	Red-brown
Hemosiderin in liver (unstained)	Green	Iridescent yellow feathers	Blue

Handling and Storage: Do not load or unload the camera, or leave the film magazine, in bright, direct light. Inasmuch as this film has an aerial-film base, there may be difficulty in winding it through some 35mm cameras having a sharp bend in the transport mechanism. This should be checked; you may have to use a different camera. An opaque leader is needed to close the lip of the cassette in order to prevent the entrance of infrared rays. In some cameras the splice may have to be advanced past the pressure plate before the camera is closed; this should be done in dim light. After making the last exposure and before opening the camera, rewind the film into the magazine.

Both the film, either unexposed or exposed, and the finished transparencies should be stored in a cool, dry place. Unexposed film should be kept in a refrigerator (at 55 F or lower) in the original, sealed package. Keeping effects can be arrested almost completely for long periods of time by actually freezing the sealed film in a freezing unit operated at 0 to −10 F. Exposed film should be processed as soon as possible after exposure to avoid changes in the latent image.

Notice: This film will be replaced if defective in manufacture, labeling, or packaging, or if damaged or lost by us or any subsidiary company, even though by negligence or other fault. Except for such replacement, the sale, processing, or other handling of this film for any purpose is without other warranty or liability. Since color dyes may change in time, this film will not be replaced for, or otherwise warranted against, any change of color

Filters and Illumination: A yellow filter must always be placed over the camera lens. For outdoor use, a KODAK WRATTEN Filter No. 8, 12, or 15 can be utilized. However, for scientific photography, where a "biological" color balance is necessary for consistent results, the No. 12 filter must be used. The No. 12 filter must also be adopted for indoor biological work and medical photography. Here, every effort should be made to employ electronic-flash lighting. Flashbulbs are not suitable. When illumination of photoflood (3400 K) quality has to be used, a KODAK Color Compensating Filter CC20C and a Corning Glass Filter C.S. No. 1-59 (3966) (specify diameter) provide an excellent balance; a filter factor of 2 should be tried. (In some applications a CC50C-2 filter alone may suffice.)

Slight color variations due to individual emulsion, aging, lighting, and processing are unavoidable. For exacting work, a given batch of film should be calibrated in the setup to be used. In photography of biological subjects, the best "test-object" is an area of white, non-suntanned skin of a colleague or assistant. The skin should be recorded as a slightly "cold" white for a good rendition of all biological and medical subjects. If it records too cold, so that veins do not appear in sufficient contrast or reddish areas are greenish rather than yellow, a CC10B filter will usually make a suitable correction. Table II shows how to use additional filters for trimming the color balance. Use a minimum number of filters in order to avoid degrading the image.

TABLE II

Filter	Color Shift
KODAK CC, Cyan or Green–Series 1	from green —to—more magenta
KODAK CC, Cyan–Series 2	from yellow—to—more blue
KODAK CC, Blue	from cyan —to—more red
KODAK CC, Magenta or Red	from blue —to—more yellow
Corning C.S. 1-59	from red —to—more cyan

Neutral density filters can be used in the light paths of optical instruments. Silver and carbon filters absorb infrared selectively and must be calibrated before use; to make the total density required, one of each should be used. A density ratio of 2:1, respectively, usually provides a suitable balance.

Lighting: Lamps must be arranged for flat, even illumination. "Tent" lighting is often best. (See second reprint in "Reprints" section.) Single lamps, or banks of lamps for large subjects, should be arranged at 45-degree angles on both sides of the subject. The shadows found on close-up science subjects lighted by sunlight outdoors should be filled in with a reflector or supplementary electronic flash.

EXPOSURE

It is not possible to apply an ordinary speed rating to this film because of its infrared sensitivity. Also, varying amounts of infrared reflection will not be read appropriately by an exposure meter. A meter setting of ASA 100 is suggested for trial (see "Latitude"), or a sunlight exposure of 1/125 second at *f*/16. This takes into account the No. 12 filter. Exposure tests can be made to determine the effects of other yellow or color-trimming filters.

Exposure Data:

Illumination	Filter	Meter Setting
Daylight	KODAK WRATTEN No. 12	ASA 100
Photoflood (3400 K)	KODAK CC20C plus Corning C.S. 1-59 and KODAK WRATTEN No. 12	ASA 50

Electronic Flash Guide Numbers:

Output of Unit (BCPS or ECPS)	350	1000	2000	4000	8000
Guide Number for Trial*	45	80	110	160	220

*With KODAK WRATTEN Filter No. 12

Reciprocity Data:

Exposure Time (seconds)	1/1000	1/100	1/10
Exposure Increase (stops)	none	none	1 stop†
Filter	none	none	CC20B

†Includes filter factor

Latitude: Due to its primary use, this film is a contrasty material. This quality makes it valuable for biological applications. However, it has only about ±½-stop latitude; exposure for best results is critical. Tests, ranging from 3 stops less to 2 stops more than the calculated exposure will usually serve to calibrate a given setup. After making the first tests, you can adopt ½-stop adjustments, or bracketing, for the actual project.

PROCESSING

Processing in the KODAK EKTACHROME Film Processing Chemicals, Process E-3, is recommended. (Capacity figures are given with the chemicals; it is advisable not to process other films in the same batch of solutions.) This provides optimum infrared differentiation in medical and other biological applications. Process E-4 may be adopted if the photographer is not particular about obtaining specific modified-color renditions.

No safelighting or infrared-inspection equipment is tolerable in the darkroom during processing. The photographer will usually have to do the work himself. Any custom-processing laboratory accepting rolls must be advised of the above restrictions.

Laboratory Processing: The Eastman Kodak Company does not offer a processing service for this film.

Film price does not include processing by Kodak, nor does Kodak sell, or authorize others to sell, this film with any prepaid mailer attached.

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