



CURRENT INFORMATION SUMMARY

Recommendations for Using KODAK EKTACHROME Underwater Film

Underwater photography provides many challenges for the critical photographer attempting to capture a broad scope of images with variable light quality. Technically proficient underwater exposure equipment is on the market, but color slide film was not specifically designed to address the types of lighting situations found under water. When light goes through water, the red component of the visual spectrum is severely diminished, and results appear blue-green (cyan). There is also a reduction in the effective color saturation or brightness of warm hues, objects which are yellow, red, or pink. Flesh tones of divers, warm tones of flora and fauna, and the general appearance of the scene suffers in ambient underwater photography with conventional daylight-balanced slide films. There are also problems seen in strobe photography, where objects beyond the flash range are severely mismatched in color from the main subject, which itself is usually rendered somewhat cyan.

KODAK EKTACHROME Underwater Film has been developed to eliminate the deficiencies encountered when using conventional daylight films under water. The results show dramatic improvements in color quality in both ambient and strobe lighting situations. This film has been designed to be much more sensitive to red light, balancing the filtration effect caused by the water. The recommendations have been developed based on theory and practical test conditions. The additional technical information enclosed should be helpful to the photographer in understanding the performance of this new product.

EXPOSURE GUIDELINES

Speed

This product is DX coded for an exposure index of 50. As you initially work with the product, we strongly suggest bracketing exposures, if possible.

Underwater Distance

The distance the light has traveled under water to expose the film is the most important factor in determining exposure recommendations. Underwater distance in ambient photography is defined as the sum of the depth of the subject plus the distance

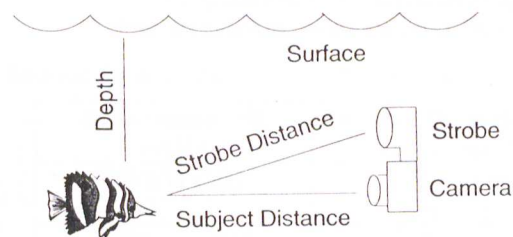
from the subject to the camera. In strobe photography, the underwater distance is the sum of the distance of the flash to the subject and the subject to the camera. Strobe photography is commonly used under water since many photographic opportunities reside at low light levels.

Each 10 feet (3 m) of underwater distance acts like a 30CC cyan filter. All distances in this document are measured, not apparent, distances. (See the figure below.)

Underwater Distance

$$\text{Ambient} = \text{Depth} + \text{Subject Distance}$$

$$\begin{aligned} \text{Flash} &= \text{Strobe Distance} + \text{Subject Distance} \\ &\approx 2 \times \text{Subject Distance} \end{aligned}$$



Ambient Light Photography

The exposure recommendations depend on the light level coming through the water, which could vary with the time of day or above-water weather conditions. Use the following trial exposures for a bright, sunny day between 10 a.m. and 2 p.m.

Underwater Distance	Camera Setting
10 feet (3 metres)	1/60 sec. at f/5.6
20 feet (6 metres)	1/60 sec. at f/4.6
30 feet (9 metres)	1/60 sec. at f/4.0
50 feet (15 metres)	1/60 sec. at f/2

Note: Do not expose the film at underwater distances less than 10 feet since the higher red sensitivity of this product will produce images with very red bias. We strongly recommend that photographers expose subjects at equal or greater depth than that of the photographer, unless the camera is 20 feet below the water surface.

Electronic Flash Photography

Underwater flash photographs with conventional daylight film often suffer from two defects: (1) a slight cyan cast to the main subject; and (2) strong color mismatch between the main subject and the severely cyan surrounding area. The first effect is due to the effect of underwater distance as described on page 2. The second effect is due to the mismatch in color between the flash, which illuminates the foreground only, and the ambient light, which illuminates the midground.

Use EKTACHROME Underwater Film with the appropriate flash filtration to eliminate or minimize both of these problems. Use a cyan filter over the flash to shift the flash illumination towards the same color as the ambient light. This reduces color mismatch between the flash-lit foreground and the mostly ambient-lit midground, bringing out the warm colors in the midground. The background water column color is unaffected at moderate depths.

Tiffen (TM), Inc. manufactures two flash filters to optimize main-subject color balance. The first, UW 0-2, produces excellent main-subject color balance for close-up (macro) photography (less than 2 feet (0.6 m) measured distance from the camera to the main subject). The second filter, the UW 2-7, is optimized for typical wide-angle work from 2 to 7 feet (0.6 to 2 m). Beyond 7 feet (2 m), no flash filtration is required. The flash filtration recommendations are summarized in the table below.

Subject Distance From Flash	Recommended Filter
Less than 2 feet (0.6 m)	Tiffen UW 0-2*
2 feet to 7 feet (0.6 m to 2 m)	Tiffen UW 2-7

* The UW 0-2 filter provides satisfactory performance out to 3 feet (1 m), but from 2 to 3 feet (0.6 to 2 m), the UW 2-7 is preferred.

If the flash is off-camera, the photographer should base filter selection on the average of the strobe-to-subject and camera-to-subject distances (i.e., half the underwater distance). The Tiffen filter factors are less than 1 1/3 stop, and the filter factors have been incorporated into EKTACHROME Underwater Film, so no compensation is necessary. Filters may be taped over the flash lens or attached using rubber clamps.

Reciprocity

This film can be exposed between 1/10,000 and 1/10 seconds with no additional filtration or exposure compensations.

PROCESSING RECOMMENDATIONS

Process KODAK EKTACHROME Underwater Film in Process E-6 chemicals. The film can be underexposed up to 1 stop and pushed 1 stop in process with acceptable results. Process variations beyond this range should be made only in the event of an exposure error or equipment malfunction.

EKTACHROME Underwater Film contains water-soluble dyes that enhance the film's performance. These dyes are removed from the film during the latter stages of the process. Pink coloration may occur in one or more of the solutions near the end of the process, but this coloration will not affect the film or process quality. The dyes will not be reabsorbed into processed film and will not damage processing equipment. Magenta dye residue can be removed from processing equipment by using normal maintenance procedures.

RETOUCHING

Retouch this film on the emulsion side only. For more information, refer to KODAK Publication No. E-66, *Retouching Transparencies on KODAK EKTACHROME Film*.

PRINTING TRANSPARENCIES

Print slides from this film directly on KODAK EKTACHROME Paper and KODAK EKTACHROME Select Material.

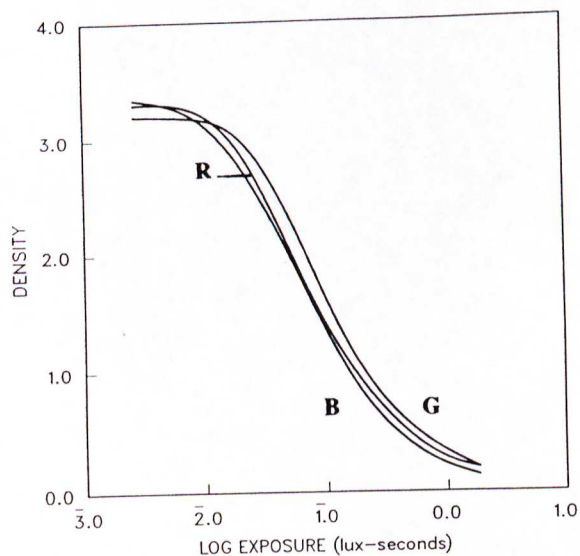
Make duplicate slides by direct printing or enlargement on KODAK EKTACHROME Duplicating Films or KODAK RADIANCE Overhead Material. Make internegatives on KODAK Commercial Internegative Film for printing on KODAK EKTACOLOR Papers, KODAK DURAFLEX® Print Material, or KODAK DURAFLEX RA Print Material. Internegatives can also be printed as a positive image on KODAK VERICOLOR Slide Film, KODAK VERICOLOR Print Film, KODAK DURATRANS® RA Display Material, KODAK DURACLEAR™ RA Display Material, and KODAK EKTATRANS RA Display Material.

IMAGE STRUCTURE DATA

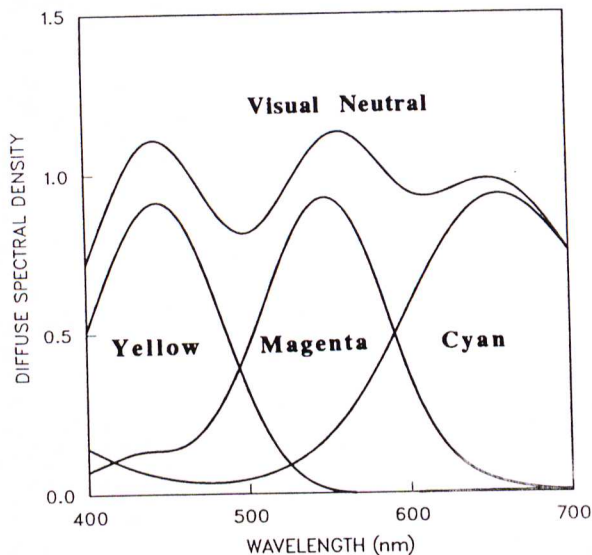
In all cases, the graphic information reflects results obtained as underwater exposures.

Sharpness: Very High
RMS Granularity: 12

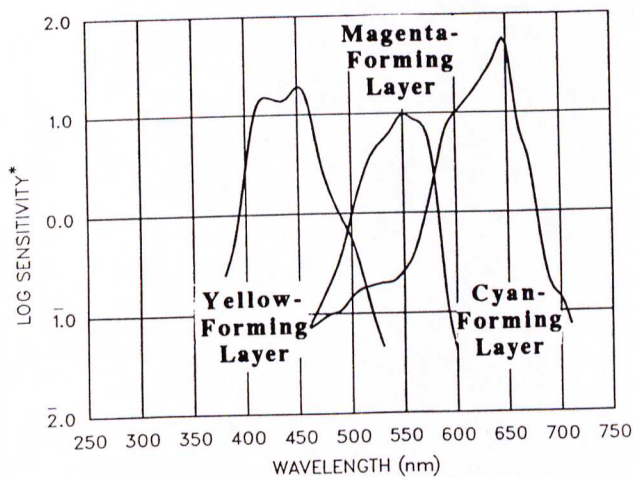
Characteristic Curves



Spectral-Dye-Density Curves

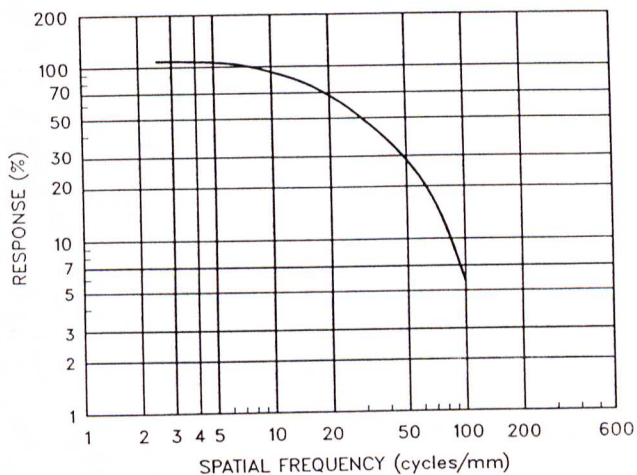


Spectral-Sensitivity Curves



*Sensitivity=reciprocal of exposure (ergs/cm²) required to produce specified density

Modulation-Transfer Function Curve



Notice: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings and therefore do not apply directly to a particular box or roll of photographic material. They do not represent standards or specifications that must be met by Eastman Kodak Company. The company reserves the right to change and improve characteristics at any time.

Current Information Summaries provide informal information of limited or specific application. Responsibility for judging the timeliness and applicability of the information to a specific photographic use rests with the end user.

Consumer Imaging
EASTMAN KODAK COMPANY • ROCHESTER, NY 14650



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Recommendations for Using
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