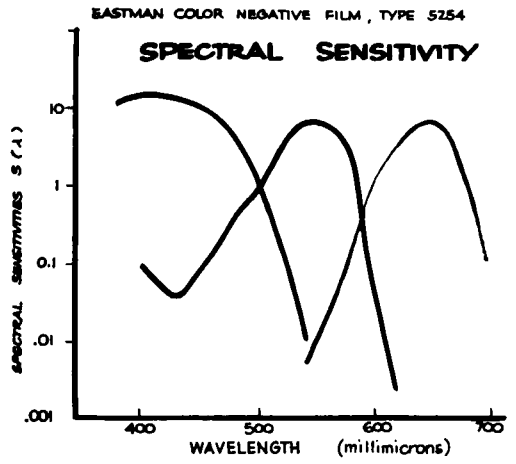

Fig. 1. Spectral sensitivity of the three emulsion layers of Type 5254 film.

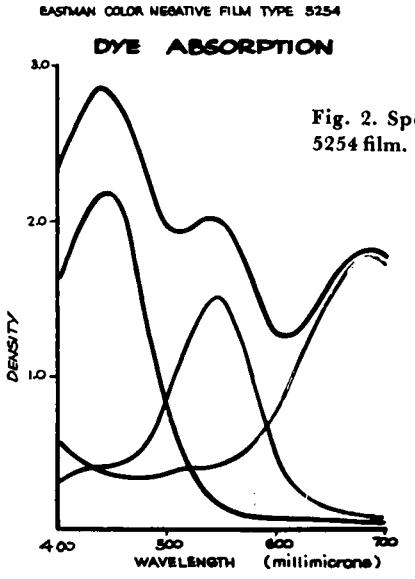

Fig. 2. Spectral density curves for Type 5254 film.

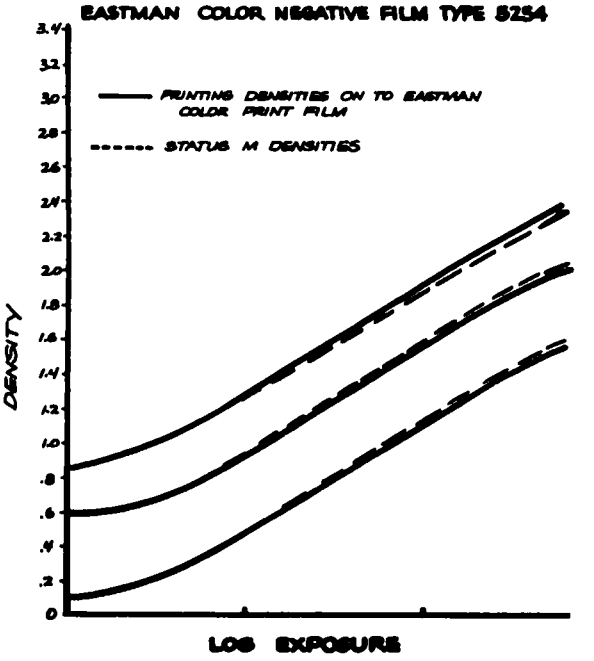

Fig. 3. Effective printing contrast onto Eastman Color Print Film, Type 5385 and red, green and blue light contrast measured on Eastman Type 31A densitometer.

tive printer, a Kodak Wratten 2B filter is recommended plus an efficient heat-absorbing filter such as Pittsburgh Heat Absorbing Glass No. 2043. The other filters required will, of course, vary with the printer and will be nearly identical to those needed for Type 5251. The new film can be timed for printing by using an Eastman 1635 Video Color Analyzer, just as for Type 5251. The stability of the processed image-forming dyes in the new film is equivalent to that of Type 5251. As with the older film, the S-9 stabilizing bath is recommended at the conclusion of other processing steps.

Other Characteristics

As mentioned earlier, the new film, although one stop faster, has the same graininess characteristics as Type 5251. In addition, all the other desirable characteristics of Type 5251 are preserved, including sharpness and color rendition.

An Improved Color Internegative Film

By ROBERT C. BROWN, ROBERT A. MORRIS and REID J. O'CONNELL

Edit. Note: *This presentation is a somewhat abridged text prepared from the complete Conference presentation which was made with 16mm film in addition to the slides.*

A SYSTEM OF 16mm color motion-picture production, in general use, involves the use of a reversal camera original film, Eastman Ektachrome Commercial film, Type 7255; a color internegative made on Eastman Color Internegative Film, Type 7270 and a release print made on Eastman Color Print Film, Type 7385. The expected increased use of this system to produce 8mm or super 8 prints suggested an evaluation of these films and related operational procedures with special attention to sharpness and graininess. This evaluation resulted in the development of Eastman Color Print Film, Type 7380, with grain and sharpness improvements which show up well under the magnifications at which 8mm movies are viewed. This paper describes another result, an improved Eastman Color Internegative Film, Type 7271.

Presented on May 7, 1968, at the Society's Technical Conference in Los Angeles by Robert C. Brown, Robert A. Morris (who read the paper), Film Testing Div., Kodak Park, Eastman Kodak Co., Rochester, N.Y. 14650, and R. J. O'Connell, Film Emulsion Div., Kodak Park, Eastman Kodak Co., Rochester, N.Y. 14650.

Film Characteristics

The structure of the new film is conventional, consisting of red-, green- and blue-sensitive layers coated on a safety support with a removable jet antihalation backing. A yellow filter layer between the blue- and green-sensitive layers prevents blue light from reaching the bottom layers. As in Type 7270, colored coupler masks are used in the red- and green-sensitive layers to improve color rendition.

In addition, development edge effects are introduced in the new internegative film to improve sharpness. Interlayer effects are exploited to improve color reproduction.

The improvements in sharpness, color reproduction, and graininess have been achieved in the 75 F Eastman Color Print Process so that the two films may be processed interchangeably in the same machine, including the Color Print Stabilizing Bath.

The speed of Type 7271 is slightly higher than that of Type 7270. Together with improved curve shape, this should result in a printer speed increase of about six printer points. Some laboratories have forced Type 7270 this far or farther by extended development. In this case there will be little speed increase with the new film but there will be much

better curve shape and tone reproduction. Furthermore, forced processing should be less attractive to those laboratories processing Color Print and Internegative in the same machine because the process compatibility is then sacrificed. A comparison of old and new gray-scale characteristic curves is shown in Fig. 1. These exposures were made on an intensity-scale sensitometer at 1/25 s, using a properly-balanced tungsten source plus heat absorbing glass. The densitometry is integral, using Eastman Status M filters.

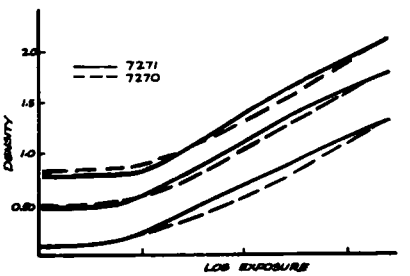

Fig. 1. Comparison of old and new gray-scale curves.

Image Characteristics

Modulation transfer characteristics for the films and printers show that the individual films are much sharper than the final picture, and the printer contribution to unsharpness is significant. While this situation could be improved by better printer optics or better film contact at the printer gate, it is also possible to increase the sharpness of the system by introducing over-correction in the internegative film. This over-correction can be achieved by means of edge or adjacency effects. When such effects are present at a relatively sharp boundary between heavily and lightly exposed areas, density is increased on the more-exposed side of the line and decreased on the less-exposed side. Under the usual conditions of light exposure or conditions of poor contact, image spreading occurs so that an edge trace has a definite slope. As shown in Fig. 2, edge effects will help to compensate for this sharpness loss.

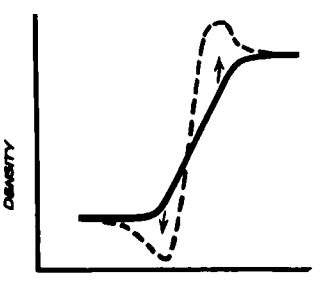

Fig. 2. Edge effects shown as compensating for sharpness loss.

Printing

Printing from Ektachrome Commercial Originals onto Type 7271 can be done with a step-contact, optical, or continuous-contact printer. However, the use of a continuous-contact printer at this stage may result in a noticeable loss of definition. Therefore, step-contact or optical printing must be used if the full potential of the film is to be realized.

The spectral sensitivities of the internegative film, shown in Fig. 3, have been slightly altered from those of 7270 to make them very similar to those of Eastman Reversal Color Print Film, Type 7387. Timing corrections used in printing 7387 from an Ektachrome Commercial Original will normally apply in making the internegative.

Correct exposure for best tone reproduction requires that the picture information of the camera original be placed on the straight-line portion of the Type 7271 curve. The better toe shape of the new film makes this easier to achieve and improves the rendition of shadows in the originals (Fig. 1).

Type 7271 has been designed for printing onto Eastman Color Print Film, Type 7380 or Type 7385, using any conventional printer having a high-intensity tungsten source. The interimage characteristics of 7271 produce much brighter, more saturated colors in the print, particularly reds and greens. Flesh tones are also improved. Spectral density curves for 7271 are shown in Fig. 4.

Processing

The new film was designed for complete processing compatibility with the 75 F degree Eastman Color Print Process. This means that no change in thread-up, temperature or solutions is required. This includes the use of the Color Print stabilization bath, which affords Type 7271 the same degree of dye stability as Type 7270 has had with its own stabilizer. The processing steps required for the new film are shown in Table I.

Table I. Processing Steps for Eastman Color Internegative Film, Type 7271.

	Kodak Formula	Time at 75 F
Prebath	PB-2	10 s
Spray Rinse		15 s
Develop	SD-31	8 min
Spray Rinse		15 s
Fix-stop	F-5	2 min
Water Wash		1 min
Bleach	SR-4A	6 min
Water Wash		2 min
Fix	F-5	2 min
Water Wash		6 min
Stabilize	S-1A	10 s
Dry		

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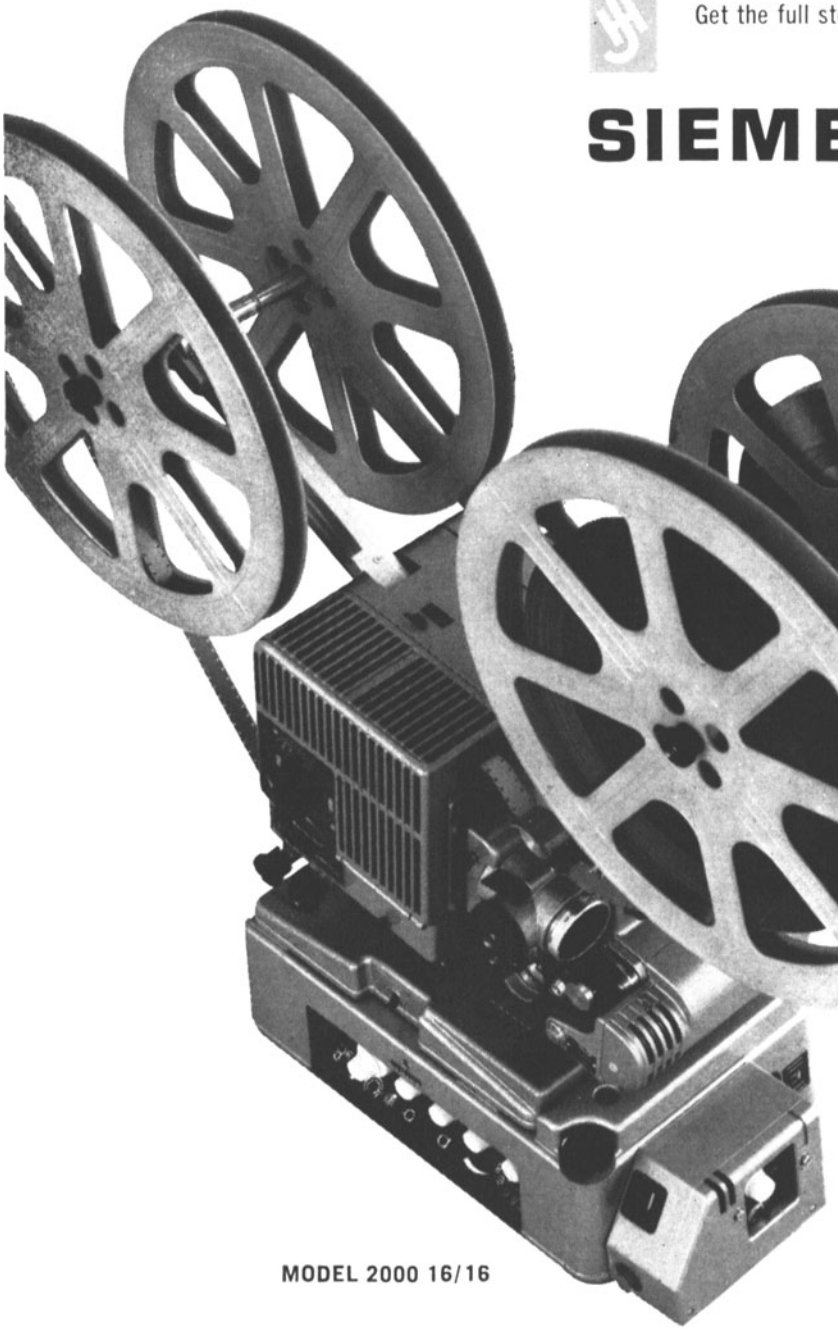

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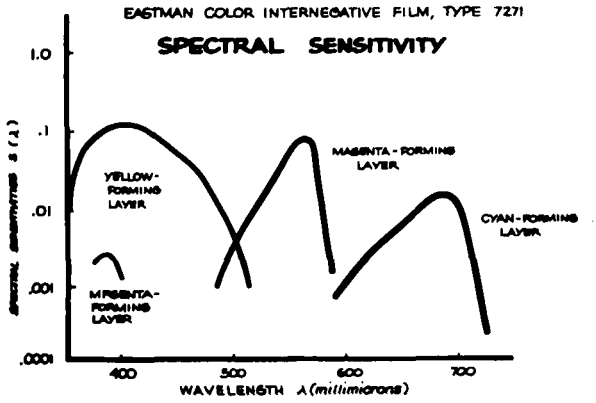

Fig. 3. Spectral sensitivities of 7271.

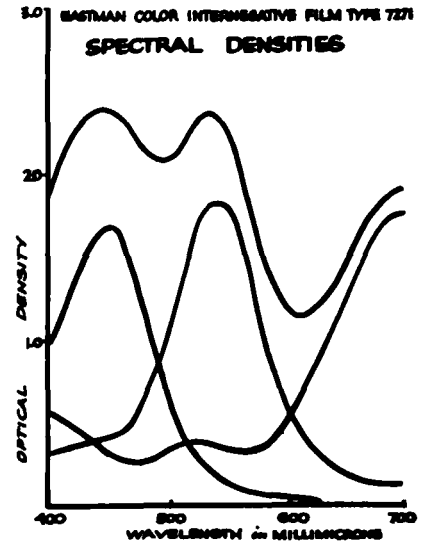

Fig. 4. Spectral density curves for 7271.

Although Eastman Color Print Film is processed at 70 F, 75 F or 80 F, only 75 F is recommended for Type 7271. When developed for 14 min at 70 F, a moderate contrast mismatch (high red, low green and blue) is introduced, although the effect in practical picture tests is admittedly small. When developed for 5 min 20 s at 80 F, a slight increase in grain and overall contrast occurs, as well as some contrast mismatch. However, at 80 F the film is quite sensitive to process variables; therefore, this processing condition is not recommended.

Summary

Type 7271 utilizes adjacency and interimage effects to produce sharper, finer-grain pictures with superior color reproduction. These features benefit both 16mm and 8mm prints. The film is also wholly compatible with the 75 F Eastman Color Print Process, thereby increasing the efficiency of operations in those laboratories desiring to process both films in the same processor.

Acknowledgment: The authors are indebted to H. J. Bello of the Kodak Research Laboratories for his contributions to this paper.