

NEW FUJI OFF-PRESS COLOR PROOFING SYSTEM
COLOR ART

F. SHINOZAKI, K. SUZUKI AND T. NAMIKI

Abstract: Higher quality and shorter delivery time have always been the most important considerations in the printing industry. To meet these requirements, efforts have been made to implement every possible electronic technology to the filmmaking and printing processes. To maintain the quality of enormous volume of prints at a high level, checks in respect to prints by means of a color proof in the filmmaking process is essential. As a means of this color proof, we have developed "Fuji Color Proofing System" and an outline of this system is follows.

Background of the Development

In the color printing, an original of a color picture goes through many different processes related to the image processing before becoming a commercial print. It is extremely important for producing a quality print that common quality standards be used among different processes which act in concert with one another. Especially, the quality of filmmaking greatly affects the quality of final prints. Under such circumstances, the color proof can be a medium to convey information in regard to quality standards throughout the entire processes of printing.

Conventional color proof has, however, the following problems.

1. Incapable of producing hard copies with final material to be used for printing.
2. Difficult to maintain the quality of repeated reproduction at a constant level.
3. Complicated mechanism requires a longer time to produce it.

On the other hand, while the color proof by means of a CRT display is highly valued from the viewpoint of its immediate response, it has a problem in conveying an alteration and content to the next process because of its inability to verify a delicate quality in regard to complexion of original color or to produce a hard copy. Under such circumstances, we have successfully developed a color proof system capable of meeting the quality standard in printing. In March 1985, we introduced this system referring to it as the "OFF-PRESS PROOF, FUJI COLOR ART SYSTEM" and subsequently started to put it on the market.

Technical Features and System Line-Up.

Fuji Color Art System has the following features to solve the previously described different problems, and to correspond with a wide variety of prints.

1. Capable of producing hard copies with final materials for use in printing.
2. The tone reproduction is in accord with the web offset publication.
3. An excellent repeated reproductivity.
4. Simple operation and fast production time of 10 minutes.
 - Simultaneous exposure by means of 4-color identical work sensitivity.
 - Development/transcription separation system.
5. White light system and clean work environment

With these excellent features, Fuji Color Art System may be extremely useful in consideration of quality standards in the color printing. In addition, for the benefit and convenience of correlation between the system and prints concerning finish color reproduction and tone reproduction, we have also started the marketing of the related different software and tools. These facilities will enable users to obtain not only the intended work quality standards but also a color proof that is even more approximated to the desirable finish of prints.

Fuji Color Art System Line-up

Colored Films

| | | |
|---------------------|-------|-------------------|
| Fuji Color Art Film | CN-Y1 | Negative, Yellow |
| Fuji Color Art Film | CN-M1 | Negative, Magenta |
| Fuji Color Art Film | CN-C1 | Negative, Cyan |
| Fuji Color Art Film | CN-K1 | Negative, Black |

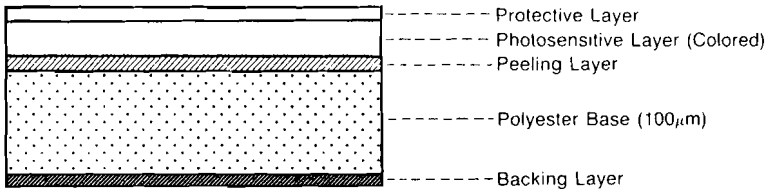


Fig.1 Film Structure

Receiver Film

Fuji Color Art Film CR-T Transparent Receiver Film

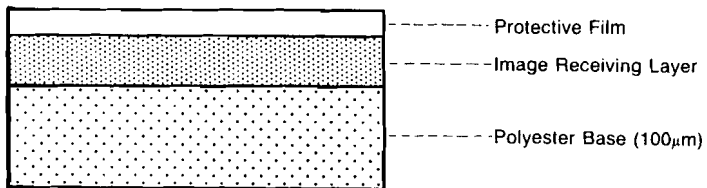


Fig.2 Film Structure

Chemicals

| | |
|--------------------------------------|-------|
| Fuji Color Art Developer | CA-1 |
| Fuji Color Art Developer Replenisher | CA-1R |

Processor

| | |
|--------------------------|---------|
| Fuji Color Art Processor | CA-600P |
|--------------------------|---------|



Fig.3 Color Art Processor CA600P



Fig.4 Color Art Thermoprinter CA600T

Setting the Primary Colors of Color Art Film

It is desirable that the color reproduction of color proof be equal to prints. Because of this, the following equipment, materials and method are determined to be used for the system: A Hitachi color analyzer type 307 for colorimetry, color matching function read visual field 2 degree, a light source in compliance with color temperature 5,000 degree K determined by the Japan Printing Society, a spectrophotometric curve by means of a fluorescent lamp approximated to CIE daylight D50. Tristimulus value is computed and subsequently, CIE 1976 L^* , a^* , b^* metric chroma C^*_{ab} , metric hue angle H°_{ab} is determined.

Fig.5 Through 7 show the primary colors of prints of several tens of companies measured by means of the colorimetry mentioned above, and plotted with chroma C^*_{ab} on the axis of ordinates and hue-angle on the axis of abscissas for every color of cyan, magenta, and yellow.

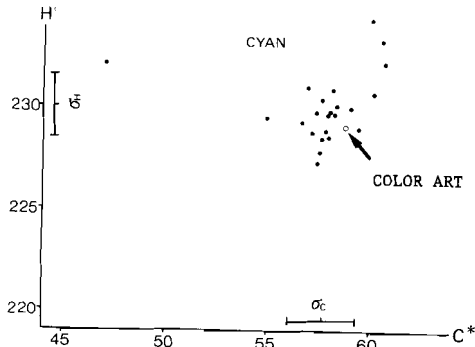


Fig.5 Distribution of Cyan

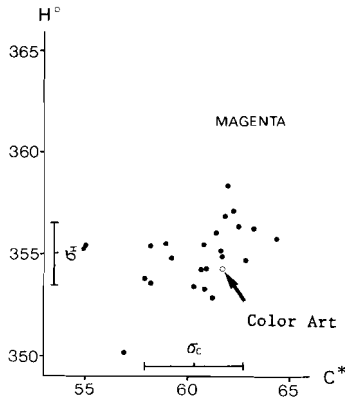


Fig.6 Distribution of Magenta

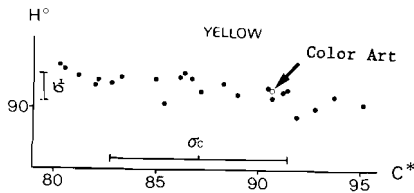


Fig.7 Distribution of Yellow

It is desirable that the primary colors of a color proof be positioned at a mean value of hue angle and chroma shown in Fig.5 through 7 or within a standard deviation. As can be seen from these diagram, the hues of primary colors of Fuji Color Art meet the requirement in regards to the primary colors in printing.

Tone Reproduction of Fuji Color Art

The tone reproduction on Fuji Color Art Film is basically a reproduction(1 to 1) with respect to a halftone negative film. Its reproduction area is 2 to 99 percent dots for 200 line screen. A tone reproduction for 150 line screen is shown in Fig.8.

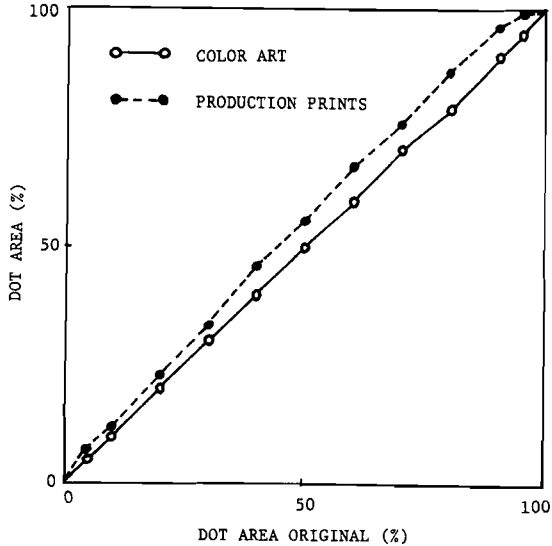


Fig.8 Tone Reproduction on Color Art Film

Because of this, basically no dot gain that can appear in the printing process will appear on Fuji Color Art Film. The dot gain can be classified into physical dot gain and optical dot gain. Physical dot gain refers to mechanical dot gain resulting from ink on printing plate being depressed and enlarged at the time of printing. Optical dot gain refers to light incident upon a print diffused on the surface of or inside a paper causing optical density to be sensed greater than the actual dot area.

The optical dot gain of Fuji Color Art can be varied by controlling the thickness of receiver film.

Taking advantage of this capability, the tone reproduction of Fuji Color Art is designed so that it can correspond with the web offset publication by setting the volume of the optical dot gain greater than that of the respective prints. Fig.9 shows the dot gain of Color Art and prints, and plotted with dot percent of a halftone film on the axis of coordinates and dot gain percent on the axis of abscissas.

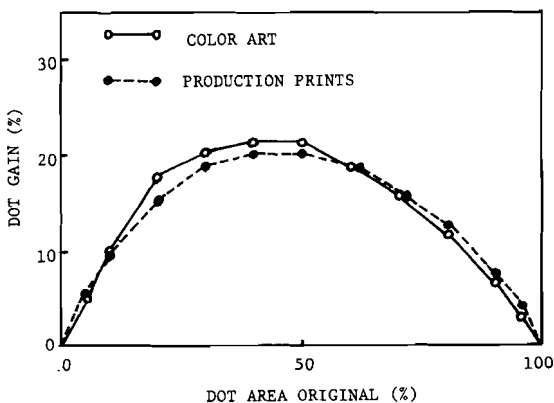


Fig.9 Dot Gain of Color Art

Color Reproduction of Fuji Color Art

Fig.10 shows a chromaticity diagram in respect to the data of gray color plotted when printings were performed at several tens of printing compaines using a same halftone film. The diagram clearly shows that the color reproductions of prints very widely. In comprison with this, the color reproduction of Fuji Color Art is extremely stable with respect to the identical transcription sequence. It is possible to correspond with the color reproduction of more prints by changing the transcripction sequence. Further, how Fuji Color Art is designed to attain even more approximation for the color reproduction of many different prints is follows.

Reviews have been made by attaching importance to the hue of complexions and gray color of prints based on the follwing facts.

"When looking at prints whose color reproduction slightly differs from original color picture, if the hue of complexion and gray color are approximated each other, both color reproductions will give nearly the same impression even when the rest of the colors differ slightly in both reproductions."

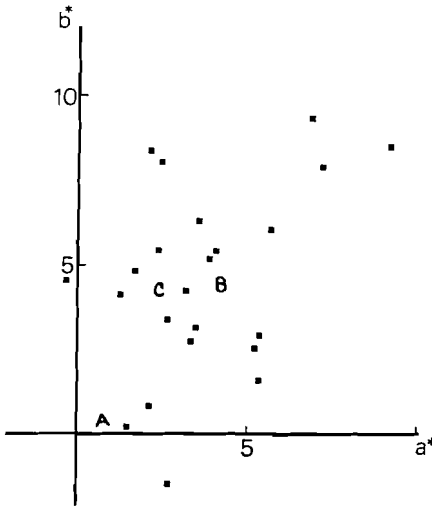


Fig.10 Distribution of Gray in Prints

Seq.
 A.Color Art B-C-M-Y
 B.Color Art B-M-C-Y
 C.Color Art B-M-Y-C
 Prints.

When exposing color art film through halftone negative film, the dot area can be changed by inserting a spacer between both films, vignetting image, and by changing the exposure. The changes in hues in this case are shown in Fig 11. In this way, the chromaticity corresponds with dot percent.

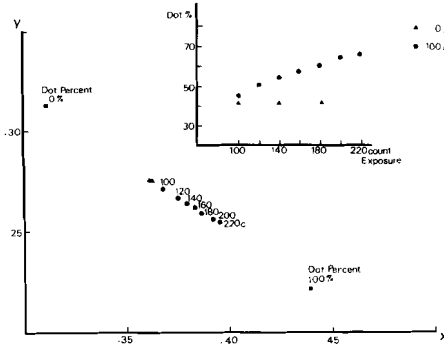


Fig.11 Relation between Dot Percent and Chromaticity

Thus, Fuji Color Art can optionally control the hues of the complexion and gray color so that they can be approximated to the finish of prints at each printing shop. Fig.12 shows how the color reproduction may change if the dot areas of yellow and magenta are changed when the 50% dot areas of yellow and magenta are exposed. The changes in the axis of abscissas show the changes in magenta, and the changes in the axis of coordinates show the changes in yellow.

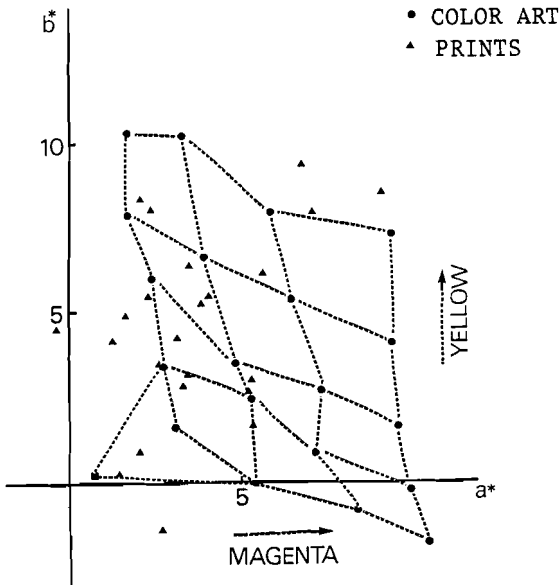


Fig.12 Distribution of gray in prints and the changeable range of Color Art.

Because the system is capable of selecting the color reproduction on the one and same halftone film in such a wide range, it can properly correspond with the color reproduction of variety of prints.

In addition, Fuji Color Art is capable of making transcription not only to printing paper but also to many kinds of different materials such as metal plate, plastic, and cloth. With these abilities, Fuji Color Art is expected to come to be widely used in the areas of design and display in the near future.

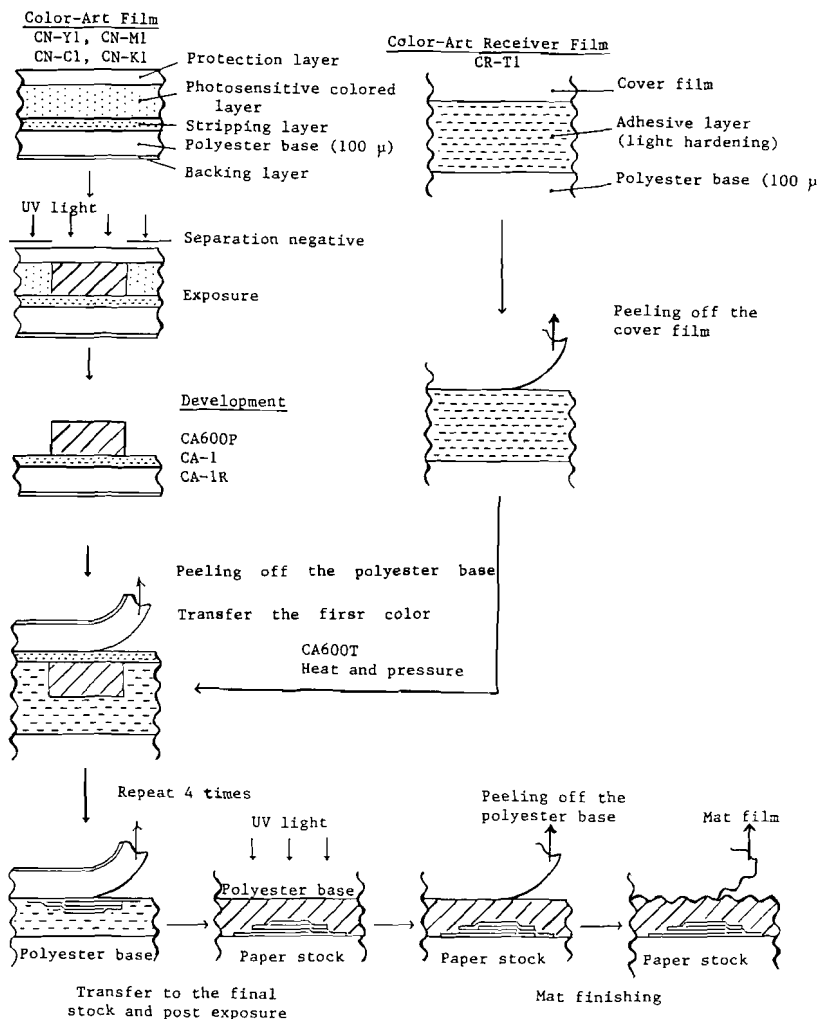


Fig.13 Film Structure and Processing Mechanism