# GTO-DI DIRECT TO PRESS SPARK DISCHARGE TECHNOLOGY

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Abstract: This paper describes a new direct-to-plate imaging system using Spark Discharge Imaging. A polyester support layer, which is oleophilic is vapor coated with a metal surface. This metal surface is then coated with a silicone which is eleophobic and capable of repelling the printing inks.

When addressed by the electronic signal, a high voltage pulse is sent to a metal stylus which causes an electrical spark to jump through the air from the stylus to the vapor coated metal layer. The heat generated by the spark causes the metal layer and ink repelling layer to erode. At the location of the spark, the polyester layer is exposed and allows dryographic offset printing to occur. Descriptions are given of the printing press, the plate, the electrodes and operation of the system.

## INTRODUCTION

Today's prepress systems are capable of producing complete, four-colour, fully composed pages electronically and outputting them as film separations. This virtually eliminates the need for manual stripping, making prepress activities faster and less expensive than ever before. Unfortunately, the advances made in electronic prepress didn't benefit the remaining steps in the process; the films still had to be developed, then exposed onto plates. Then the plates had to be developed, brought to the press, mounted and registered. The inks and water had to be be adjusted before printing could finally begin.

The obvious solution to this problem is direct image technology. This technology can process data from computer publishing systems and offers direct plate imaging on the press.

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The advantage of direct imaging is speed and the elimination of film exposure or processing. Spark discharge direct-to-direct imaging, lends itself to such a solution.

Spark-gap direct to plate imaging, lends itself to such a solution.

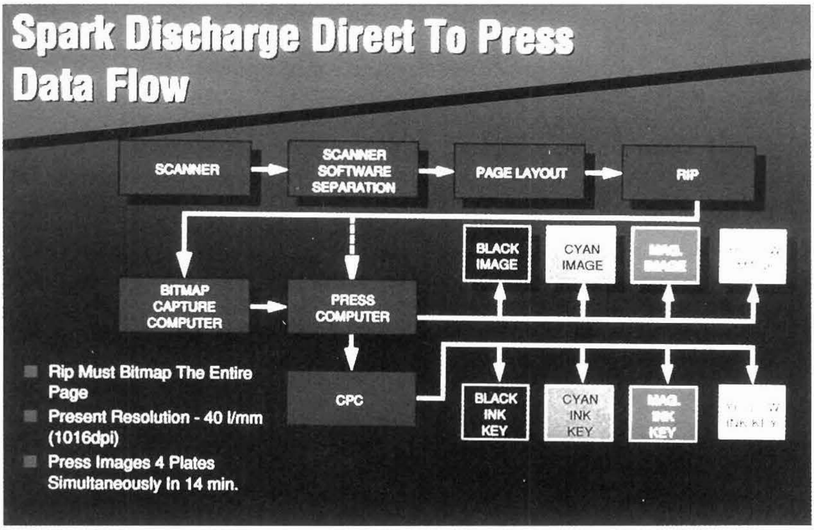



Figure 1. Details the chain of operations that allows spark-gap direct to plate flow.

The advantages of direct imaging include the imaging of 4 of 5 plates in the press, true-to-register. The computer calculates ink presetting with no processing. The fact that there is no plate processing also indicates there is no film exposure or photo chemical processing. In this implementation of direct-to-plate exposure, a plate surface that allows dryographic printing is employed. The concept of dryography was pioneered by 3M Company, eliminating the need for ink and water balance, contributing to short make-ready times and ecologically friendly systems.

## DESCRIPTION OF THE SYSTEM

Spark Discharge imaging is used in this direct-to-plate system. There has been some terminology confusion between spark discharge technology and electro-erosion.

Electro-erosion is a process by which materials are eroded or removed by theapplication of energy. The electrodes used to provide the energy to allow such modification can be in surface contact with the material to be modified, or at a distance from them. When the electrodes contact the ground layer, it is called electro-erosion. When the electrodes are placed at a distance from the material by means of an air gap and the energy to erode the material sparks across the air gap, the technique is called spark discharge. In spark discharge, imaging the electrode is non-contacting and the size of the dot is controlled by the series resistor which controls the energy in the spark. The spark discharge needs a much higher voltage to jump the spark and generate the dot. Because spark discharge technology is not light sensitive and requires no chemical development, it can be used for "Direct-to-Press" imaging where it is possible to simultaneously image a set of blank plates which are already mounted on the print stations of a press. The discharge pattern produced by the system creates gravure like cells for ink transfer.

Spark Discharge technology is designed for dry offset printing. Resolution is 1016 dots per inch. Dot size is 1.4 mils in diameter. The imaging process has a repetition rate of 40,000 dots per second per imaging wire. (We currently use 16 wires per imaging head). The technology is versatile and can obtain higher as well as lower resolution. The plates are good for about 20,000 impressions - depending on many variables. Twenty thousand is very conservative.

The direct to plate imaging system employed is described below.

The Printing Plate is a multi layer construction and consists of:

A. Silicone Layer - which rejects ink, and therefore provides waterless offset with these plates. No moisture is requires on the press. This, of course, simplifies press setup and operation.

B. Vapor Deposited Aluminum Layer - which provides a return path for the electronic current. It also serves as the initiator. The spark discharge on the aluminum layer begins the process of vaporizing that removes the silicons and aluminum layers to generate the dot.

C. Mylar Base - which is the substrate or carrier, and provides the oleophilic surface which accepts ink. With a dot generated by removing silicone and aluminum layers, the Mylar layer is exposed to carry ink for transfer to the paper, much like the concept of a gravure cell. The Mylar base also provides mechanical strength to the plate.

The total plate thickness is .007 mils. The plates are not light sensitive.

The Spark Discharge consists of:

A dielectric assembly containing 16 needles per head. Many different head configurations are possible. We are not necessarily limited to 16 needles per head. The head is a consumable item. Every head can be used to expose 10 plates.

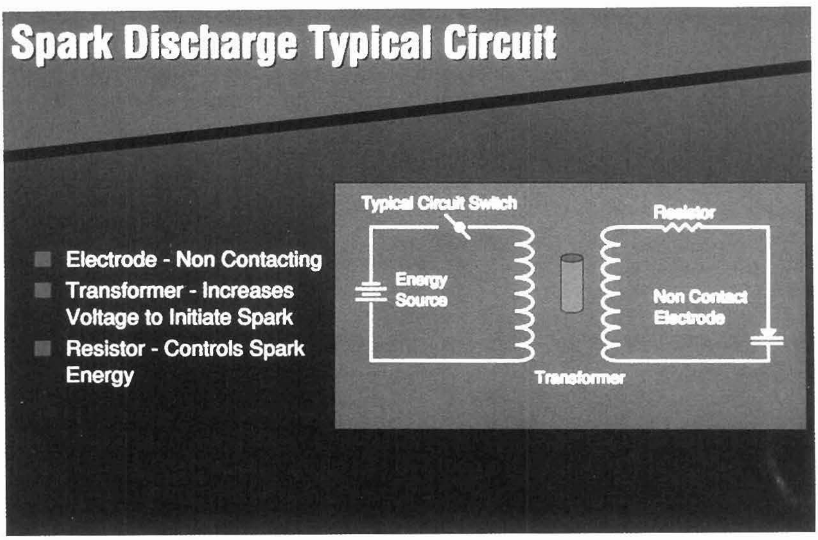



Figure 2 (EB#11) details a typical spark discharge head circuit.

The typical items in a spark discharge circuit are:

1. A circuit switch
2. An image controlled energy source (voltage), to initiate the exposure
3. A transformer to increase the voltage to the high voltage levels needed to initate a spark
4. A resitor to control the spark energy

5. A non-contacting electrode

Some additional information on the spark discharge/press mount:

1. A lead screw carries the head
2. The head is tracked by a servo system
3. Utilizes a lead screw carriage system which allows indexing at each revolution
4. The exposure area covers a swath width of 1/106 inches
5. The writing speed of a single dot is in the one to five microsecond range
6. Moist air is injected between the discharge head and the plate to insure system stability under all humidity conditions

The system as described also allows simultaneous register of 4 or 5 plates, and automatically pre-set ink values. It takes about 14 minutes to image a 13-3/8 x 19-3/4 inch plate.

Spark Discharge Debris Removal:

As the silicone and aluminum layers are vaporized some debris is left on the surface of the plate. This debris is removed by means of a rotating brush. After brushing, each plate is wiped down with a mild cleaner. The plates are then ready for printing.

The typical job normally consists of three components namely: text, graphics and pictures. By combining these three components, for example: a colour separated image off a TIFF file, computer generated graphics from a TIFF or EPS file, and ASCII generated text, by post script into the Raster Image Processor previously required prepress steps.

SPARK DISCHARGE DIRECT TO PRESS DATA FLOW

This technology lends itself to imaging plates "on press". In this case, the output of the RIP can go directly to the press computer where a complete set of plates is imaged simultaneously. This takes about 14 minutes. The plates are already mounted on the print stations and the plates are imaged in register. In addition, the digital data is used by an online feed back system to automatically compute and make the ink settings. As an alternative, the output of the RIP can be sent to a bitmap capture computer which simply stores the data until it is needed. In this way,

multiple prepress systems can be used to support the productivity of the press. And, jobs can be archived in this way, also.

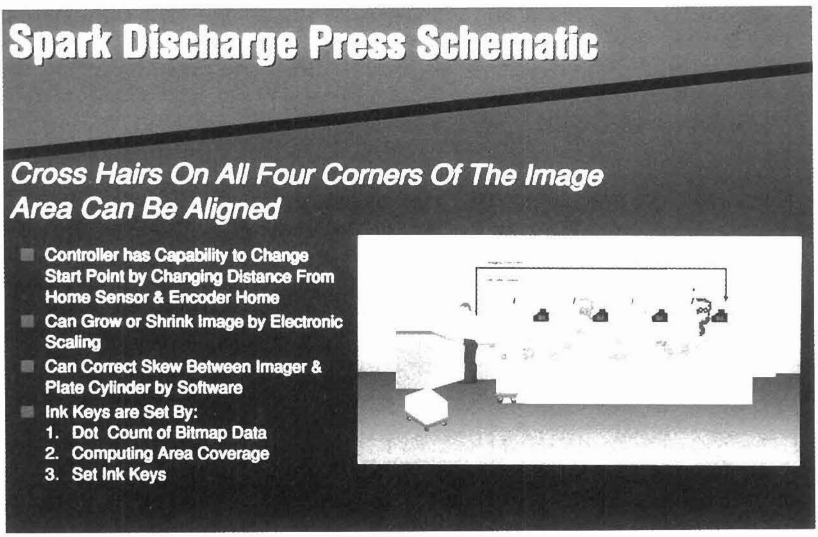



Figure 3 (EB#11) indicates the use of the cross hairs on all four courners of the image and the manner in which they can be addressed to control the image.

Registration of the press as well as accountability for roller or blanket changes can be accomplished using this means.

The controller can change the imaging start point on a plate by adjusting the distance from the home sensor and encoder home. In addition, electronic scaling can be used to grow or shrink the image. Software can also correct the skew between the imager and the plate cylinder. The ink keys are set based on a computation of the area coverage from the bitmap data.

The recommended screening for use with this technology is:

Macro-Dot Screening-Using Postcript Spot Function Modifier

| | | | |
|---|---|---|---|
| Resolution-Dots/In. | 1000 | 1000 | 1000 |
| Screen-Lines/In. | 100 | 200 | 200 |
| Spiral Type | Center | Center | Quadrant |
| Shades of Grey | 100 | 25 | 100 |

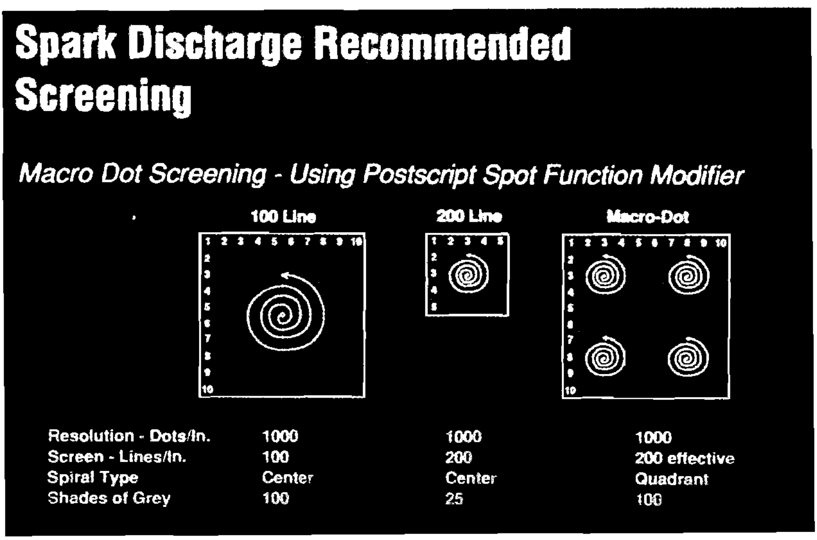
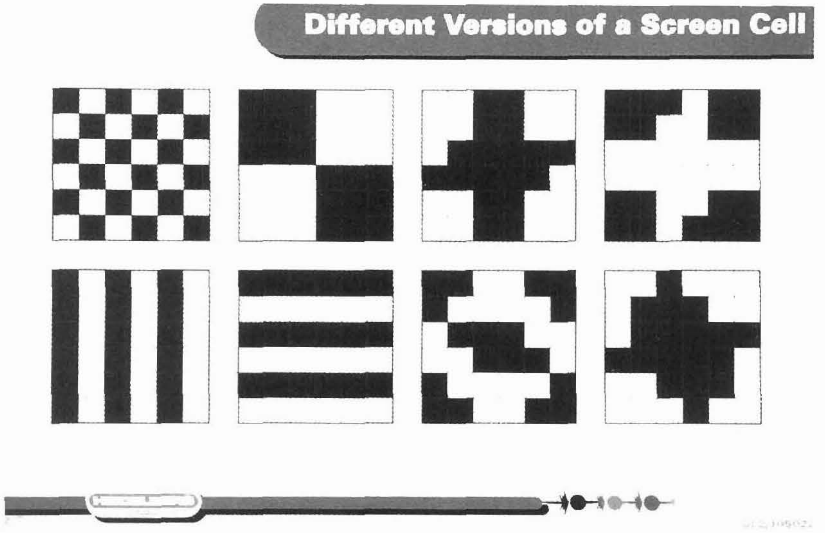
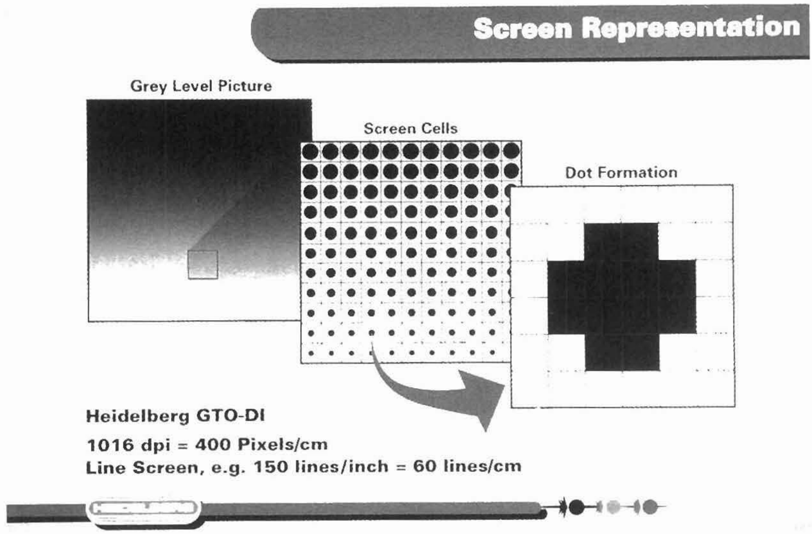


Figure 4 (EB#10) compares three different screening techniques. On the left is a screen with 1000 dots per inch resolution, 100 lines per inch screen, and center type spiral which yields 100 shades of grey.

In the middle is a screen with 1000 dots per inch resolution, 200 lines per inch screen, and a centre type spiral which yields 25 shades of grey.

On the right is a screen with 1000 dots per inch resolution, 200 effective lines per inch screen, and a quadrant type spiral which yields 100 shades of grey.






Figures 5 and 6 (EB#8a, 9) are of a 50% dot and show the various versions that a screen cell can take. Because of the ability of the RIP to build or structure the dots to the best configuration, the quality of image reproduction is greatly enhanced as patterns from incorrect screen angles and moires are eliminated.

## CONCLUSION

A direct to plate imaging system based on spark discharge imaging has been described. It has the advantages of being light sensitive, environmentally friendsly, direct link from prepress to plate, direct link from prepress to press. It allows lower cost colour printing and is ideally suited for fast turn-around colour printing.