

Advancements in **ESA** in **Rotogravure**

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Electrostatic Printing Assist (ESA) has contributed more to improve the quality of rotogravure printing than any other innovation. ESA systems optimize ink transfer from the gravure cylinder to the printing substrate. Over the past 30 years ESA power supplies and application mechanisms have undergone many changes. Such technical developments, particularly those from ENULEC, have since raised the bar for ESA.

ESA Eliminates Dot Skip

ESA systems facilitate ink transfer in the rotogravure process to ensure that each engraved cell filled with ink can make contact to the substrate for optimal ink transfer. In the absence of ESA, gravure print is prone to missing print; this is known as dot skip. Dot skip is a common problem seen in the half tones and below. When printing paper, cartons and films ESA is an effective solution to complete vignettes, improve ink density and eliminate dot skip. When the objective is to produce consistent quality high standard

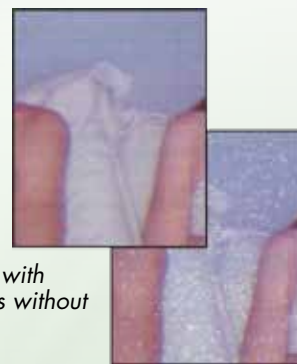
gravure print, ESA is an important tool that can help achieve quality standards.

Dot Skip occurs when ink in the image cells do not make contact to the substrate. The physical cut of the doctor blade used to clear ink from the surface of a gravure image cylinder can leave behind a concave meniscus of ink in the cell, thus ink is in position beneath the surface of the image cylinder. When a separation inhibits contact between ink and substrate, poor print quality with missing dots will occur. Ink contact to the substrate is the fundamental requirement essential for quality gravure printing. The transfer of ink in the gravure process is a phenomenon of inter-molecular attractive forces that occur between the ink and substrate called capillary action. (Concept: think of a water leak in a house where the water

path climbs up a wall.) Molecules of liquid media will move in any direction of molecules of a solid. In relative terms, the rotogravure process draws ink out of the image cell by means of contact-adhesion relationship resulting in a form of capillary action that enables evacuation of the gravure cell.

How ESA Systems Work

Simply put, ESA elevates ink to the surface to achieve contact with the substrate. How does that happen? ESA Systems work by means of 300-1500 Volt DC electrostatic force between a semi-



Top sample is with ESA; bottom is without ESA.



The latest presses coming from Italy are equipped with Enulec ESA



Left with Enulec ESA, Right without ESA

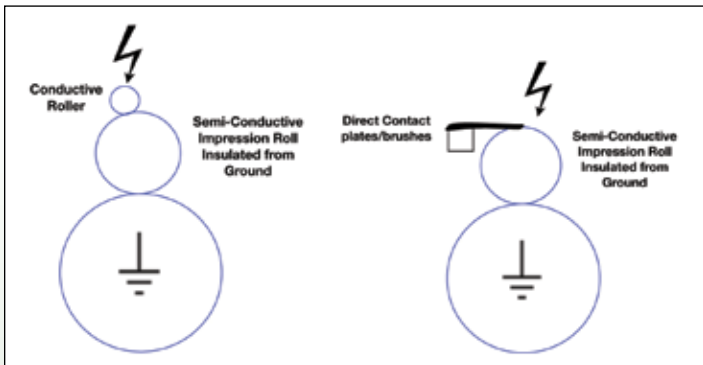


ESA 1000 installed onto latest cigarette packaging press.

conductive impression roll, the substrate and the grounded gravure cylinder. The electrostatic force produces a downward force into the grounded gravure cells which creates pressure that disturbs ink cell contents resulting in a wave that elevates the ink to the surface. When ink is available at the surface of the cell, it will make contact with the Substrate. This enables capillary action to transfer ink to complete the rotogravure printing process.

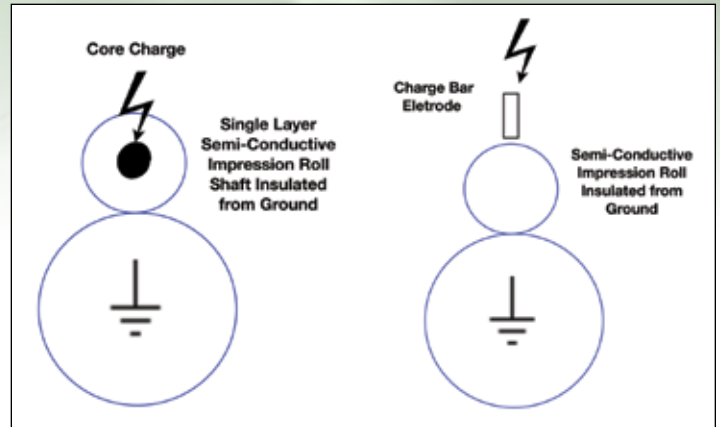
Advantages of ESA include:

- Optimum ink transfer to paper and film substrates
- Longer running time for impression rollers
- Reduced impression roll line pressure
- Optimal print results on low quality papers, board and plastic materials
- Faster production speed and best print results
- Consistent control of print quality
- Built in antistatic safety bars before and after each print station



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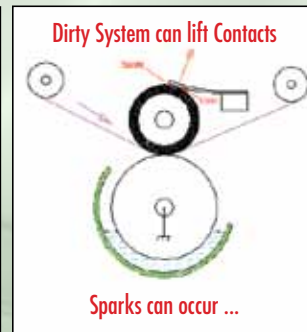
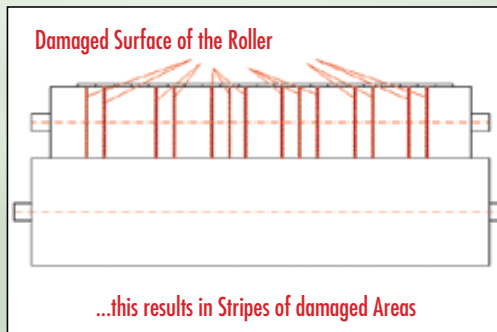
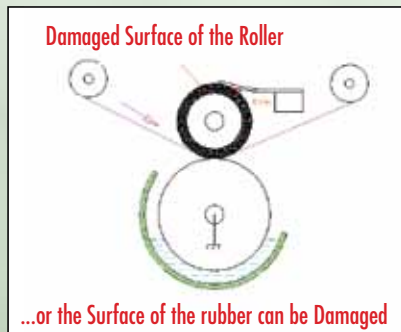
There are basically two types of electrostatic printing assist systems—contact and non-contact types. ESA can be applied directly to the surface of the roll or through the core via the impression roll shaft. Top load systems types have a charge bar electrode, conductive roller and direct contact plates/brushes



Single layer semi-conductive impression roll shaft insulated from Ground (left). Semi-conductive impression roll insulated from ground (right).

that require a 2 layer impression roller having layer one with insulation and layer two with semi-conductive material. Core charge systems require single layer impression covered in semi-conductive material. The bearing housings need to be insulated from ground. Insulation is normally done by milling out the press frame and inserting non-conductive phenolic bearing shells a task normally completed by the OEM for new presses. ESA systems have one thing in common; they all depend upon this 300-1500 volt field between the ESA impression roller, substrate and grounded gravure cylinder in order to create ESA. The methods of design used to transfer ESA energy varies greatly in terms of high voltage generators, ESA applicators, reliability, safety and performance. Conductive roller applicators charge through metal rollers through direct contact against the ESA impression roll.

Conductive rollers span the impression roller and are typically small diameter (e.g. small metal roller skate wheel.) Due to the small bearings in the metal rollers, they are quick to wear out mainly due to heat related to the speed difference of the impression roller. In addition, they can bounce, bend and arc. Hence, in the 70s and 80s the industry began using direct contact brushes or metal plates which mount in a static position





Typical Direct Contact Charge Contacts riding directly on the face of the impression roller.

directly upon the ESA impression roller. The metal paddles/brushes also make direct physical contact to the rotation of rubber impression roll. This condition brought forth another set of challenges that effected impression rolls, including rapid increase in shore hardness as the constant rubbing of metal to the pressure roller will polish the roller surface. Moreover, dust particles can accumulate under the plate/brushes, which can lift the contacts paddles (a spark hazard) and eventually the dust particles will fall into the ink tray directly further affecting the quality of the print.

Today non-contact top load systems are the practical ESA solution due to technological advancements in charge bar design, safety and ease of installation onto existing presses. This type of ESA system operates with no contact to the impression roll which eliminates the physical abrasion problem and the life of

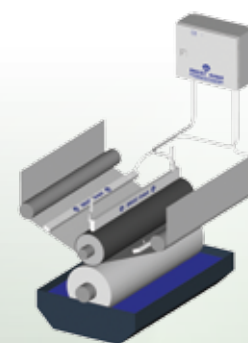
ESA power consistently to the impression roll. This advancement also allows the charge bar to be positioned 1-6 mm air gap which is a 50% improvement in proximity of the bar to impression roll, eliminating air gap (air is resistance to the transfer of ESA current.) The combination of having twice as many pins and half the air gap compared to older technology allows for safer voltage levels that more efficiently deliver ESA power. The safety of the non-contact electrode systems are further enhanced with integrated static eliminators leading into and out of each print station which eliminates static from accumulating on the substrate and also provides for static elimination when ESA is not in use.

Cleanliness Counts

ESA performance can be hindered by the cleanliness of systems when they become contaminated with ink and dust particles. In order to overcome this problem, ENULEC designed a virtually

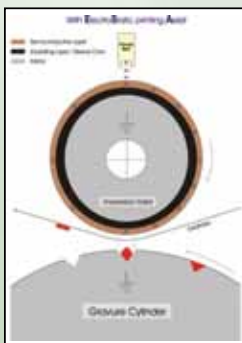


Open Body ESA Electrode Bar



Top Load Non-Contact ESA Example

maintenance free air-assisted impression roller charge bar. In contrast with conventional charge bars with exposed charging pins, the advantage of the ENULEC air-assisted ESA charge bar is that it does not require regular cleaning. By virtue of its special electrode construction, the charging pins in this bar are completely embedded into a small tube and this, together with a small air pressure in the area of the ionization points enable the air-assisted electrode cells to prevent contact with ink par-



Non-Contact ESA Example



Enulec ESA 1000 Dot Skip Eliminator with integrated static eliminators on entry and exit of print station.

the impression roller is significantly longer. Top load electrode bars in standard form have exposed pins and that provide optimal ESA performance in the majority of pressroom environments.

ENULEC has further improved the electrical safety characteristics of its ESA1000 charge bar electrode by providing safety resistors on every pin within their bar and by increasing the number of pins on the charge bars having pin pitch of 5mm providing 2-4 times more energy points for the ESA to transfer



Air-Assisted ESA 1000EX Charge Bar.

ticles and dust particles thus eliminating contamination. The advantage of being able to run ESA on press without contamination, performance loss or cleaning interruptions has earned



ESA 1000 Air-Assisted Charge Bar



Gravure Pilot Plant with Enulec ESA 1000

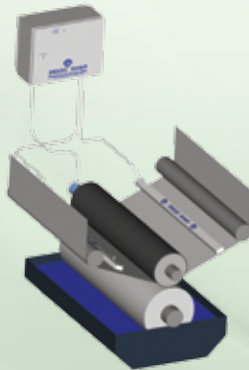
this ENULEC air-assisted ESA bar a respected position in the rotogravure technological advancements of this millennium. Direct Charging (Core Charging) systems deliver a charge to the impression roll shaft; the charge flows from inside out through a single layer semi-conductive impression roll. Typical methods used to apply the charge have been through carbon brush contact assemblies that contact the shaft. The physical

Enulec fluid coupling and Top Load ESA systems are integrated into new presses available from your leading Italian gravure press OEMS

contact of brushes to the rotating shaft is known to wear and create downtime issues. In order to overcome these maintenance issues ENULEC designed a special charge applicator having no moving parts to transfer the current to the core of the impression roller (sleeve mandrel.) Using a specially developed fluid transmission coupling which does not have any brushes or bearings has made it possible for gravure printers to run for years without maintenance issues related to ESA.



ENULEC Fluid Coupling Core Charge



Core charge systems require the shaft/bearing housing to be isolated from the press. Fitting for an insulation shell is done by milling out of the machine frames in order to expand the bearing sockets to open the area to hold isolation shell. This work can be a daunting task on existing presses and is most efficiently accomplished at the time of press manufacture. Today



ESA 1000 Capacitance Free Power Supply integrated into a new rotogravure press



ESA 1000 Touch Screen Interface with Quality Management Software



ENULEC EST Antistatic Bar.

the ENULEC fluid coupling ESA is now an integrated feature built into the new presses available from leading Italian gravure press OEMs.

Factors Affecting Performance

Successful ESA performance relies upon an effective method of application, a properly specified ESA impression roll in range for the system used, and a reliable power supply to bring forward the energy necessary to create ESA. Conventional ESA power supplies employ cascade-based generators for high voltage generation. Although they provide ESA power, safety can be an issue in circumstances such as when the impression roll is raised. When this occurs, the safety release contacts shut off the generator. However, the older power supplies have capacitors that release the residual internal charge remaining in process of generation to the ESA applicator. A concern is that the ESA impression roll may still be receiving a charge for several seconds after the power supply is shut off. This can become a problem when the impression is raised. When a charge continues to be applied onto the impression roll while it is raised, it will discharge to the gravure cylinder resulting in an arc. (Concept: If you ever worked on an unplugged microwave oven, opened the back reached in and got shocked you made contact with a capacitor)

ENULEC designs and builds only capacitance-free high voltage generators having high internal resistance that enable optimum power transfer to the ESA impression roller and increases the performance of the ESA system considerably. With capacitance free technology, the ESA charge bars can be guaranteed safe and current-free immediately after the system is switched off as there is no residual charge in the system. Alternatively,

when the ESA is switched on, high voltage is available immediately and the system can be used straight away without delay. This specially developed capacitance-free high voltage generator enables the system to be used in conjunction with ESA impression rollers having high surface resistances, including resistances outside the range normally specified. This results in a substantial increase in impression roller life related to electrical specification.

ENULEC®, a Germany manufacturer located near Hamburg, has introduced developments in the field of Electrostatic Assist and static elimination in terms of safety, performance and reliability. The company specializes in optimum charge and discharge systems for the printing, converting and packaging industries. ENULEC is best known for their ENULEC ESA1000 Dot Skip Eliminator system utilized by the leading OEM rotogravure press manufacturers and high quality gravure printers worldwide. Founded in 1981 by Hubertus and Christa Dettke, the company has been owned and managed by the Dettke family for more than 30 years. Since the 1980s, ENULEC has concentrated on the design and supply of electrostatic printing assist systems and discharging systems, developing expertise in this area. All parts of the system are manufactured in-house. The company supplies parts for the (unlimited) life of any ENULEC product sold. Where component parts cease to be commercially available, the company maintains that any newly sourced or designed parts or assemblies will be compatible with existing systems and capable of being retrofitted.