

# An Eye-Opener on Static: It Can Be Controlled on Rewinders

By Mark Blitshteyn and Michael Anderson

*The problems caused by static are many, and they can be dangerous as well as costly. Read on for some ways in which you can neutralize static on your winding rolls.*

The problems that static electricity brings to operator safety as well as process control and product quality are very real. Operators are still being jolted from unwanted – yet painfully expected – static charges built up on rolls during the winding process. This paper recommends specific and effective ways of eliminating shock hazard and other static-related problems in winding films and paper through the application of the patented Virtual AC technology.

## Outlining the Hazards

Following are brief descriptions of static electricity hazards in winding and unwinding.

unwinding roll are high enough to cause spontaneous discharges in the form of sparks from the material to the roll shaft or other machine components. Although not very common, the damage creates a visual streaking on material surfaces, often described as “static trees.” Such damage especially affects products such as paper with silicone release liner or cosmetic materials such as holographic films.

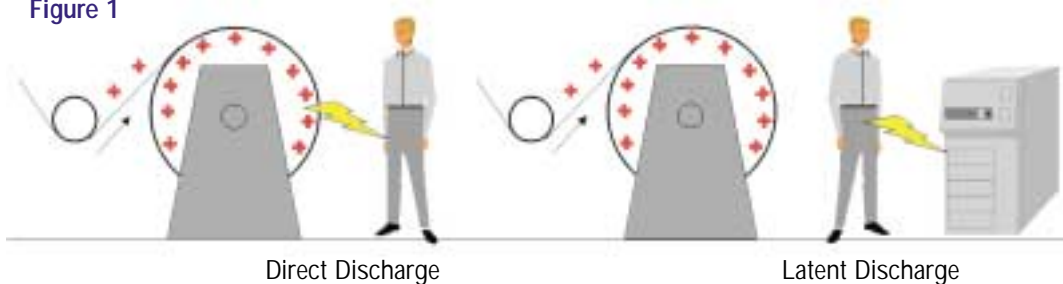
*Finished product contamination:* In simplest terms, electrostatic force contributes to attracting and retaining contaminants, like slitter dust, to film surfaces. Simplistic static control devices, like tinsel or strings, also collect these contaminants when allowed to touch or lay on the web, and occasionally release them onto the surface of the material.

*Controls lock-up:* Accidental lock-ups of electronic control circuitry in response to an electrostatic discharge is another

process problem. Electrostatic discharge can be virtually invisible and difficult to detect. Electromagnetic interference can crash a computer or a microprocessor, causing a more far-reaching damage.

*Wind-up problems:* Static charges on the roll and on the incoming web are usually of the same polarity. Physical science dictates that like charges repel. Thus, if tension on the web is not sufficient, the incoming web may float over the roll, trapping more air and creating wind-up problems. This situation is most likely to develop on gap winders.

Figure 1



*Operator shocks:* Operators commonly have to work in the strong electrostatic fields generated by static charges on rolls of film on rewinders and unwind stands (see **Figure 1**). The field from charged material induces charges on the operator's body that may suddenly discharge when the operator touches a metal frame of the machine, or in the most severe cases, a discharge may occur between the operator and the charged roll itself. Whether positive or negative, both charges can be equally dangerous.

*Material damage from electrostatic sparks:* There are conditions when the charges on a winding or

## Static Neutralizing Issues

A number of issues face a converter who desires to produce a neutral roll.

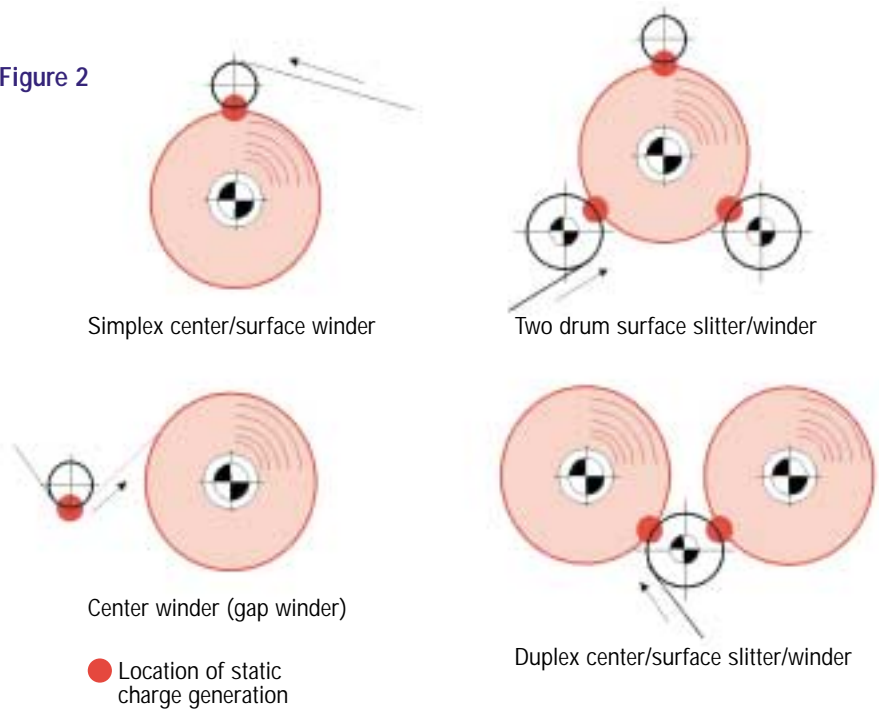
- Static electricity is generated during the winding process everywhere the incoming film or the outer surface of the roll contacts a roller. See **Figure 2** for examples. Static neutralizers have to be mounted at the roll itself, and not before the last known location where static charge is generated, such as an idler or lay-on roller.
- The variety of rewinder types and designs presents a challenge to find the optimal location for a static neutralizer every time.
- The changing diameter of the winding roll requires long range neutralization to be effective. Majority of static neutralizing bars don't have the range to neutralize the web or roll from start to finish. Ionizing air blowers, commonly used in the hope that fan-driven air will blow enough ions to the web or roll, simply don't have the power necessary for neutralization of a fast moving film.
- It is difficult to find a safe location for static neutralizers where they will not interfere with such routine activities as moving rolls and cores in and out of rewind and unwind stations.

## The application of Virtual AC™ Static Neutralizers in roll winding

Static charge accumulates as incoming material winds into a roll. In order to get a neutral roll at the end of the winding cycle, every layer of the material in the roll must be neutralized. Thus, static neutralizing bars often need long range capabilities in order for the bar to clear the diameter of the finished roll and still effectively neutralize the material as soon as it starts winding on the core.

Within the last couple years, a new technology with long range neutralizing capabilities has been introduced to the converting industry. This patented technology was named "Virtual AC" because of the special operating voltage waveforms used for ion generation. The unique construction of the static neutralizers based on the Virtual AC™ technology also allows more ions to reach greater distances. The following case studies describe successful installations of Virtual AC neutralizers in a variety of winding applications, many of which, require long range neutralizing to effectively eliminate static charge hazards.

Figure 2



## Follow the Rules

There are two approaches to controlling charges on winding rolls:

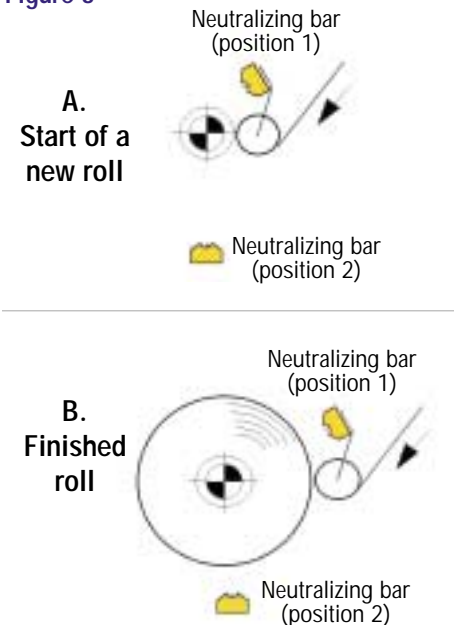
- neutralize incoming material, or
- neutralize the entire roll.

Neutralization of incoming material is possible only on gap winders with a long span of incoming material between the last roller and the winding roll. Even on gap winders, it is not always possible to neutralize the incoming material and roll neutralization becomes the only option. It is the only option on surface winders and on winders using pressure rollers. Roll neutralization is the primary focus of this paper.

The static neutralizer must be facing the roll and be positioned as close to the finished roll as possible. Machine frame or other metal components, such as rollers, knives, etc., must not obstruct the static bar's view of the roll. **Figure 3** shows two possible installations of a static neutralizer on a winder with a laydown roller. A static neutralizer in Position 1 remains at a constant distance to the surface of the roll, while a neutralizer in Position 2 would have the distance to the roll closing as the roll is building up.

Mounting the neutralizer in the position 1, as shown in Figure 3, is a preferred installation because the distance to the charged surface of the roll seldom exceeds 12 inches regardless of the diameter of the

Figure 3



finished roll. In position 2, the distance between the neutralizer and the charged surface could be over 20 inches at the start of the roll and 2 inches at the end. At the start of a large roll, when the distance is long, neutralization may be incomplete. Yet, as the roll grows and the distance to the neutralizer closes, the ion current will increase until a complete neutralization occurs.

Following are some successful installations of the Virtual AC.

**Case study 1**

*Gap Center Winder or Rewinder:* An example of an incoming web neutralization application can be seen in **Figure 4**. The neutralizer-to-material distance is varying throughout the winding cycle, changing between 2 and 10 inches. The Virtual AC neutralizing bar is mounted downstream of the idler roller, the last point of static generation. The bar is installed with the necessary consideration for clearance from the paths of rolls and cores moving in and out of the winders, and for accessibility for cleaning ionizing pins of the bar.

**Case study 2**

*Contact Center Winder with Pressure Roll:* This is an example of a roll neutralization application. The neutralizer-to-material distance is constant throughout the winding cycle, being in the 6 to 12 inches range. The Virtual AC neutralizing bar is facing the roll. The machine frame or other metal components, such as rollers, knives, etc., do not obstruct the static bar's view of the roll. The bar is installed with the necessary consideration for clearance from the paths of rolls and cores moving in and out of the winders, and for accessibility for cleaning ionizing pins of the bar. (See **Figure 5**.)

**Case study 3**

*Duplex Center/Surface Slitter/Rewinder:* This is another example of a roll neutralization application. Unlike the previous case, the neutralizer-to-material distance is varying throughout the winding cycle, from the radius of the finished roll to 2-3 inches. The static bars are facing the respective rolls. The machine frame and the pressure roll do not obstruct the static bars' view of the rolls for most of the winding cycle. The same considerations for clearance and accessibility were applied. (See **Figure 6**.)

**Case study 4**

*Continuous Turret Center/Surface Rewinder:* This is an example of a roll neutralization application. The neutralizer-to-material distance is constant throughout the winding cycle at about 9 inches. The static bar is facing the roll. The machine frame or other metal components, such as rollers, knives, etc., do not obstruct the static bar's view of the roll. The static bar is outside of the path of rolls and cores moving in and out of the rewinder as shown in **Figure 7**.

When the roll is nearly finished, the turret rotates to bring the new core in to the winding position and to move the finished roll out. During this period of time, the incoming material, after being neutralized by the static bar, goes over an idler roller. Depending on the tension and speed, and the duration of the transfer, the incoming material may pick up some charge at the idler roller.

There is also an alternative arrangement that addresses the roll transfer issue. In that arrangement, two bars are installed inside the turret, one facing the first winding position, the other facing the second winding position, as shown in **Figure 8**.

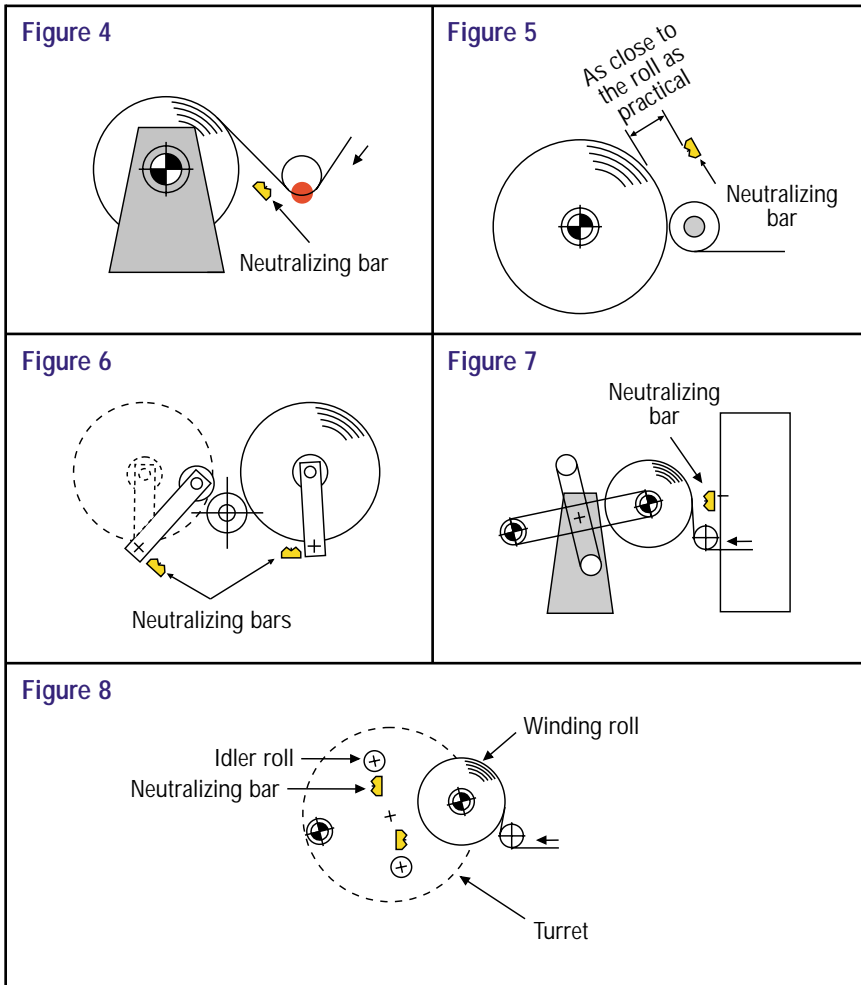
**Summary**

For effective neutralization of winding rolls static neutralizing bars with long neutralizing range, such as Virtual AC™ neutralizers, must be used. They must also be positioned in specific locations relative to the roll and incoming web.

*See the back page for information on neutralization at unwind stands.*

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# Static Neutralization at Unwind Stands

Requirements for neutralization at unwind stands are very different than those for winders. When film separates from the roll, it generates static charge on the outgoing film and the surface of the roll (Figure 9). No accumulation of charges on the roll takes place; the charges are always confined to the exposed surface of the roll and the outgoing material. It is important to note that the polarities of charges on the roll surface and on the outgoing material are opposite most of the time.

Static neutralizing bars for the unwind applications must be capable of neutralizing

the roll from the start of unwinding when the distance is short until the roll shrinks down to the core, and the distance is long. Also, in the unwind applications, the positioning of neutralizing bars is very specific, and depends on the objective (i.e. operator safety, product quality, etc.). For operator safety, the static bar must be positioned downstream of the point of web separation and ahead of the operator access location, as shown in Figure 10 where the bar is installed at the 11 o'clock position.

For all practical reasons, the bar could be installed between the 10 o'clock and 12 o'clock positions. Beyond that range, counterclockwise, the electro-static field from the charge on the outgoing material will start to dominate and pull ions from the bar, thus, diminishing the bar's ability to neutralize the roll. Clockwise, the roll surface must be neutralized before it endangers the operator.

Prevention of material damage caused by electrostatic discharge in unwind applications

is more complicated. The damage to the surface of the web takes place immediately after the material separates from the surface of the roll. The close proximity of surfaces carrying charges of opposite polarities creates conditions where damage from electrostatic discharges is possible. The close proximity of surfaces charged to opposite polarities requires the use of two neutralizers, one for

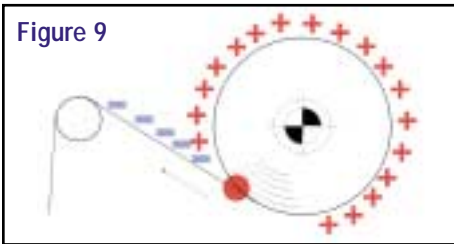


Figure 9

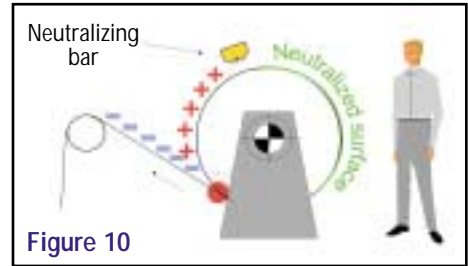


Figure 10

each surface. In fact, it may be necessary to continually move the neutralizing bars to follow the separation point as its location moves during the unwinding process.



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Ion Systems Industrial, Windsor Locks, Conn., was established in 1998 to bring advanced ionization technology to the web handling and converting industries. New product development efforts resulted in an advanced, patented design and the launch of the industry's first intelligent static control system, the Virtual AC™ Intelligent Static Neutralizer. The new static control system has the ability to monitor and display vital operating information and to provide stronger ionization at greater distances from the web than other static control bars on the market today.

Although a newcomer to static control within the web converting industry, Ion Systems Industrial's parent company, Ion Systems, Inc., has been heavily involved with state-of-the-art static control technology in the semiconductor, disk-drive and electronics industries for the last twenty years. This Berkeley, Calif.-based company is the world's leading producer of ionizers used in clean room environments where sophisticated semiconductor manufacturing takes place.