

Regular Corona Surface-Treater Maintenance Cuts Scrap, Reduces Downtime, Boosts Productivity

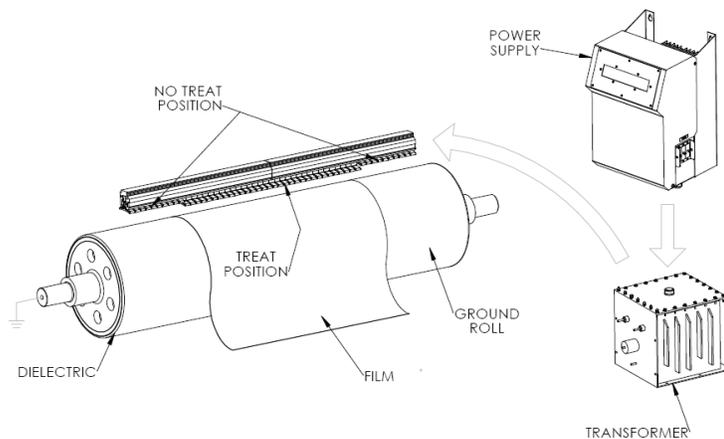
By Mark Spaulding with Tom Gilbertson and Matt Rajala

“Live Long and Prosper” isn’t just a saying from *Star Trek*. It could also refer to the sound advice for regular maintenance of your company’s corona surface-treating systems. By maintaining this vital component of your printing, coating or converting operation, your business can live longer and prosper through reduced downtime and increased productivity.

Starting a preventative maintenance program is the No. 1 way to increase the serviceable life of your corona treater. Knowing when to clean the system, what components to clean and how to clean them are the three pillars of any successful maintenance program.

First, though, a quick review of corona basics is in order. Although it has applications for paper, paperboard and other fibrous materials, a corona treater’s primary purpose is to increase the surface energy (or dyne level) of a non-porous substrate (plastic films or laminates). This higher surface energy allows for the lasting adhesion of inks, coatings and adhesives to the material.

A typical treater (Figure 1) is composed of a power supply, a high-voltage transformer, an electrode and a grounded support roll. Corona, which is simply ionized air between the surfaces of the electrode and the treater roll, is created at 10K volts at frequencies between 20-30 kHz in an airspace gap of usually 0.060 in. (1.5 mm).



(Figure 1)

Problems Resulting from a Neglected Corona-Treater Station

Now, that we’ve covered the basics, it’s important to realize that about 80 percent of issues related to corona treatment can ultimately be traced back to **poor system maintenance**. With a neglected corona station, a laundry list of problems results, and these fall into several areas.

Variations in treatment levels: Improper web handling, a dirty ground roll or both can let air beneath the web become ionized, thus allowing for backside treatment. Such reverse treatment steals energy from the process and lowers the treatment level on the front surface of the web.

Ground rolls: Dirt and debris on the ground roll, as well as contamination on the web or any upstream process rolls, can combine for poor corona treatment. Roll-covering failure can happen when dirt on a ground roll carbonizes (becomes a conductive material) and leads to localized heating on the roll surface.

Electrodes/electrode assembly: Contaminated electrode assemblies will cause electrodes to fail prematurely due to overheating, and they can also reduce the evacuation of ozone from the treater station. If the metal segments of the electrode become sticky, they are harder to adjust for treating different widths and types of webs.

High-voltage wiring and insulators: Any dirt or debris will provide a shorter path to ground for the high-voltage electricity, affect treatment and clearly present a serious safety issue.

Ozone, Heat and Proper Exhausting

Before we address the specifics of preventative corona-treater maintenance, it's essential to understand ozone, heat and the proper exhausting of a corona station. These three elements greatly impact the equipment's function, efficiency and productivity—all improved by good maintenance.

By-products of the corona process are ozone and heat. A corrosive gas generated as a result of creating a corona, ozone must be evacuated from an enclosed treater or from the ambient air surrounding an open treater station. Heat, generated from the previously mentioned system components (rolls, electrodes, power supplies and the exhaust equipment itself) must also be removed to keep things running well. The electrodes in particular need to be cooled, otherwise they change thermally and thus change the air gap to the ground roll.

Often considered a rather pedestrian topic, the exhaust system on a corona treater is more important than most converters think. Enercon recommends that you contract with a qualified HVAC professional to properly size and install the exhaust system to avoid future operational problems. Guidelines include using an aluminum-construction blower with ozone-resistant seals. The blower should be located at the exit side of the duct run so as to not pressurize the ductwork with ozone. Ducting should be made from PVC, aluminum or stainless steel only; never use galvanized steel. Any flexible duct sections should be constructed from ozone-tolerant materials and have a smooth interior. See the chart, "Minimum Pipe Diameter vs. Length of Exhaust Duct Run" below for more information.

Minimum Pipe Diameter vs. Length of Exhaust Duct Run				
Exhaust Air Flow	<100' (30m)	<100' (30m)	<150' (45m)	<200' (60m)
CFM (CMM)	(< 6 Elbows)	(6-10 Elbows)	(< 10 Elbows)	(<10 Elbows)
1 - 199	4"	5"	6"	6"
(.1 - 5.6)	(100mm)	(125mm)	(150mm)	(150mm)
200 - 299	5"	6"	6"	8"
(5.7 - 8.5)	(125mm)	(150mm)	(150mm)	(200mm)
300 - 499	6"	8"	8"	8"
(8.5 - 14.1)	(150mm)	(200mm)	(200mm)	(200mm)
500 - 899	8"	10"	10"	10"
(14.2 - 25.5)	(200mm)	(250mm)	(250mm)	(250mm)
900 - 1599	10"	12"	12"	14"
(25.5 - 45.3)	(250mm)	(300mm)	(300mm)	(350mm)
1600 - 2499	12"	14"	14"	16"
(45.3 - 70.8)	(300mm)	(350mm)	(350mm)	(400mm)
2500 - 3000	14"	16"	16"	16"
(70.8 - 85.0)	(350mm)	(400mm)	(400mm)	(400mm)

NOTE: The above chart is a guideline only. Refer to qualified HVAC contractor for specific sizing and design recommendations. Customer is responsible for final duct design and installation to meet treater station exhaust requirements.

The What, When and How of Preventative Maintenance

With the corona-treater system sized correctly, the exhausting properly installed and the electrode air gap set for the materials to be run, you're ready to go. But long-term success, namely minimum downtime and scrap and maximum productivity, is still dependent on good maintenance. So, let's turn now to the what, when and how of preventative maintenance and cleaning for the four major corona-treater components.

Maintenance Schedule: In general, cleaning and maintenance of all four components should be done quarterly. However, depending on what materials are being corona-treated, as well as the plant-environment temperature and humidity, the aforementioned tasks may have to be done as often as once a week or even daily.

1. **Power Supply:** While probably the easiest part of the system to maintain, the two main areas of the power supply that need attention are the tightness of the electrical connections and the cooling-fan operation. Poorly made connections can lead to overheating and premature terminal-block failures. Check if the fan is working well and that it and the fan filters are not clogged with dust. This task should be done weekly.

Electrical-grounding inspections are also imperative. For the ground-roll brush, good contact must be made with the roll. Otherwise treatment level can immediately begin to degrade as well as cause premature ground-roll bearing failure. For the treater-station, high-voltage transformer and power-supply, improper grounding can result in a shock hazard or equipment damage—just as with any electrical product.

2. **Exhaust System:** Remove the cover on the exhaust side of the plenum to check for and remove any dust, dirt and debris. Inspect the exhaust blower to confirm that it's rotating in the proper direction. Over the years, the electrical service may have changed, the blower was replaced or the treater itself may have been relocated; thus the phasing of the input power may reverse the blower's rotation. Lastly, ductwork should be scrutinized for cracks, leaks or corrosion and thus repaired.

Vital to any exhaust-system maintenance: Regularly checking the exhaust flow and static pressure. Devices are available for this task. Exhaust static pressure is measured in in./water column or kilo-Pascals. An anemometer will measure the exhaust flow in CFM/CMM after inputting the exhaust-tube diameter. Several measurements should be made at the longest, straightest duct run, then averaged to determine a final figure. Every Enercon corona treater has a specification for these two measurements and you should contact Enercon if you are unsure of the specification.



Left:
Differential pressure gauge measures static pressure.



Right:
Anemometer measures air flow.

3. Roll Cleaning Regimens:

<u>Ground Roll Type</u>	<u>Cleaning Supplies</u>	<u>Rules of Thumb</u>
Ceramic-covered	Mild soap and water Household abrasive pad Mild household abrasive cleaner Soft, lint-free cloth Isopropyl alcohol	NEVER USE METALLIC TOOLS. Use only non-metallic tools. Wear protective gloves. Some discoloration may remain. Wipe down with isopropyl alcohol.
Non-Ceramic (Hypalon, silicone or Epoxy coverings)	Mild soap and water Soft, lint-free cloth Isopropyl alcohol	Wear protective gloves. Rinse with isopropyl alcohol.
Non-ceramic (silicone-covered)	Mild soap and water Soft, lint-free cloth Isopropyl alcohol	Wear protective gloves. Use alcohol sparingly because silicone can act as a sponge.
Aluminum	Mild soap and water Household abrasive pad Soft, lint-free cloth Isopropyl alcohol	Oxidation is more pronounced on parts of the roll outside the web path. Wear protective gloves. Rinse with isopropyl alcohol. If oxidation is severe enough, roll can be skin-cut, removing no more than .001-.002 in.

4. Electrodes:

As with ground rolls, cleaning regimens vary depending on the type of electrodes.

Ceramic Electrode Assembly: Neglected maintenance here results in overheating of the electrodes, leading to failure. First, check your exhaust system for proper operation because it removes heat as well as ozone, dirt and debris from the electrode-assembly area.

Enercon equipment allows for clean-in-place maintenance with electrode assemblies that conveniently pivot (for thread-up of the web) and hinge open, providing easier access. For light dust and dirt, use a clean cloth or sponge and mild soap. Finish with a wipe-down of isopropyl alcohol. Don't just clean what you can easily see; be sure to clean the back side of the assembly and insulators. For grease and oil contamination, use a clean cloth or sponge along with a grease-cutting agent (Simple Green all-purpose cleaner), before finishing with isopropyl alcohol. For tough stains, clean using an abrasive cleanser, abrasive pad, then alcohol.

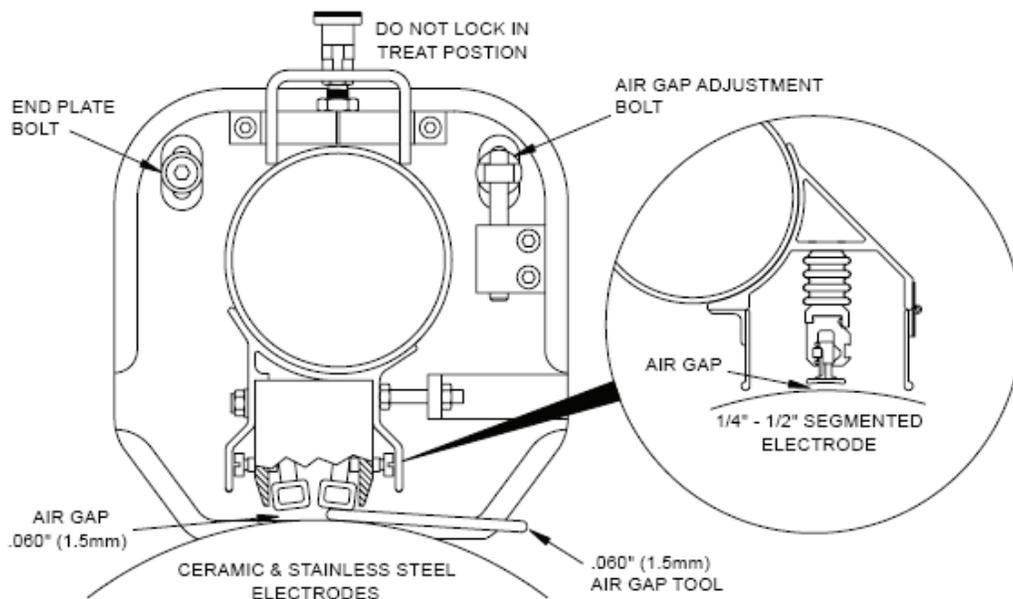
Metal Electrode Assembly: Two rounds of cleaning are often required. First, scrape the backside of the assembly with a metal brush, then vacuum off the dirt and debris. Second, for tough build-up of melted poly or other debris from the web, employ the aforementioned abrasive cleanser/pad method and alcohol rinse.

One More Thing: Electrode Alignment

Your corona-treating system is now completely clean and shining like new. But before it goes back into production, it's important to confirm that the electrodes are lined up properly. A misaligned electrode assembly causes uneven treatment, provides for inadequate treatment and may even lead to electrode failure.

What are the three characteristics of an aligned assembly? 1) The air gap between each electrode and the ground roll is equal. 2) The recommended air gap is 0.060 in. or whatever consistent distance is needed for the material to be treated. 3) The material is receiving equal discharge from each electrode.

Procedures: First, with the treater's power locked out for safety, use a non-metallic or plastic air-gap tool (0.060-in. thick) to check the distance between the electrodes and the ground roll (See Figure 2). Check only one side of the electrode assembly at a time. Second, loosen the end-plate bolt on the assembly; then turn the air-gap adjustment bolt clockwise to increase the gap, or counter-clockwise to decrease the gap. Third, adjust the assembly's stop bolt to modify the tilt of the electrodes so that they match the curvature of the ground roll. Fourth, confirm that the interlock switch is in contact with the interlock ring when in the treat position and the interlock opens when the electrode assembly pivots out of the treat position.



(Figure 2)

With this final task complete, your corona-treater station has been properly maintained. All its critical components are clean, the exhaust airflow is positively confirmed and the electrodes are aligned. You're set to begin efficient, profitable production.

**If you have any questions, please contact
Enercon's Technical Service Department
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