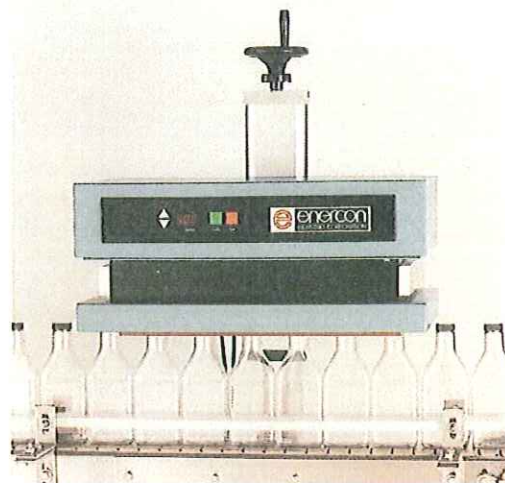


# Enercon Induction Sealing System

## Compak™ The Perfect Package: The Design That Earned A Patent\* Sets The New Industry Standard.



- **Perfect Package:** Designed as a compact "All-in-One" system, this third generation solid-state induction sealer combines control, power supply, and sealing coil into one easy to mount and operate package. No messy coil cables to connect. Installed over the conveyor on our rugged, precision adjustable mount, the Enercon system provides the ultimate in flexibility by easily adjusting to a variety of container heights and by presenting the operator easy to reach and read controls and indicators.
- **State-of-the-Art Electronics:** Our third generation solid-state design provides the latest in proven, high reliability components and circuits. Both power and control loops incorporate advanced operative, protective and diagnostic elements and circuits to provide a new level of operational reliability and efficiency. This combination of advancements makes it possible to offer an air-cooled power supply in a fully sealed, NEMA 4 enclosure.
- **Unique Coil Design:** Enercon's coil design capability is second-to-none in the industry. Our new standard coil design increase electromagnetic power coupling into the foil. As a result, uniform currents are induced across small and large mouth inner seals creating consistent seals with complete wax melt and separation of foil from pulpboard liner. Enercon offers custom coil design to meet the specific needs of unusual applications reliably and efficiently.
- **Top Total Performance:** Enercon's excellence in power conversion with 95% efficiency and coil design for superior electromagnetic coupling permits effective operation at high line speeds with optimal power usage. **Line speeds exceeding 300 fpm** can be achieved depending upon closure size, innerseal type and container material.

### Features

- Single Compact Package for Easy Conveyor Mounting.
- Adjustable Support for Easy Set-Up to a Variety of Container Heights: includes a Floor Extension for Stability.
- Loss of Sealing Indicator: Alarm Circuit Contact Closure if Sealing Energy is Lost.
- Air-Cooled, NEMA 4 Enclosed Power Supply.
- Dead-Front, Membrane Controls for Easy Operation.
- Latest Digital Control Circuits & Sealing Energy Meter.
- Latest IGBT Power Transistors for 95% Efficiency.
- Automatic Closed-Loop Circuits for Frequency & Flux Density Control.
- Automatic Self-Protection and Self-Diagnostic Circuits.
- Advanced Sealing Coil Design.
- Second-to-None Customer Support & Service.

### Options

- **Water Recirculator:** water-to-air heat exchanger reduces costly coil cooling water usage.
- **Motion/Foil Detector Group:** shuts off power if a container back-up approaches the coil and detects missing foil liners.
- **Remote Start:** permits stop/start control via external commands for automated operation.
- **Mobile Cart System:** available with or without conveyor.
- **Manual/Auto Control:** allows sealing energy control via customer supplied signal.
- **Adjustable Loss of Sealing Indicator:** allows setting of low level limit on alarm circuit contact closure.
- **UL Listing:** unit built to UL Listing requirements and carrying the UL compliance sticker.

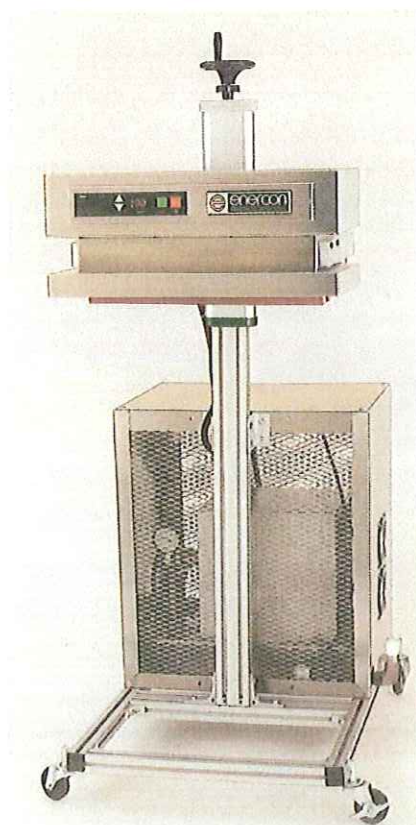
\*Design Patent: U.S. Des. 340,937; Nov. 2, 1993.



## Enercon Compak™ Induction Cap Sealing Capability

			Complete System				
Output Rating	Input 50/60 HZ		Approximate Dimensions Inches (mm)			Weight	Water Usage
	Volts $\pm$ 10%	Amps	H	W	D	Lbs. (Kg)	GPM (Liters/Min.)
1 KW	115, 1 $\phi$	15	11 (279)	24 (610)	12 (305)	55 (25)	0.35 (1.3)
2 KW	230, 1 $\phi$	15	11 (279)	24 (610)	12 (305)	55 (25)	0.50 (1.9)
3 KW	230, 3 $\phi$	12	11 (279)	24 (610)	12 (305)	55 (25)	1.00 (3.8)

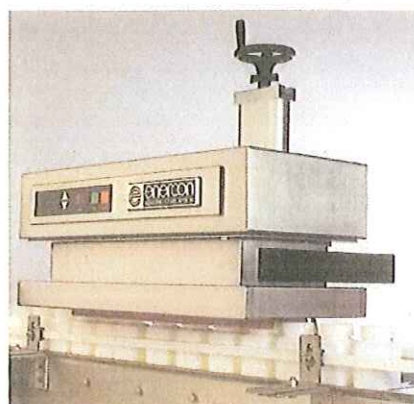
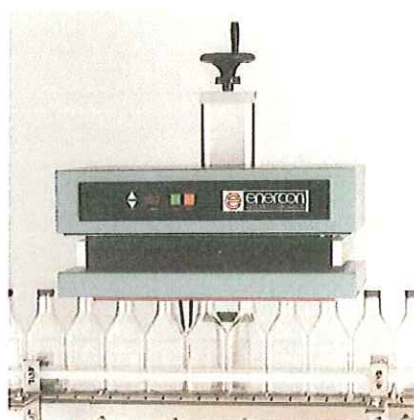
Air-Cooled Power Supply. NEMA 4 enclosure. Suitable for Washdown.



### COMPAK Cart

The COMPAK is available on two mobile cart models. The model pictured above features the power supply with built-in sealing coil and a water recirculator mounted on a mobile cart.

The second cart model features the power supply and water recirculator as well as a conveyor on one cart. This model is ideal for lab applications or small production lines.



The COMPAK is offered in both stainless steel and aluminum enclosures.



### Laboratory/Low Production Induction Sealer

Enercon's laboratory induction sealer provides all the advanced electronic features of our complete line along with a full 1kW of power. Timer control for automatic sealing cycle and a variety of hand-held coils allows wide range sealing application for lab testing or contract packager.





# The Facts About Induction Sealing

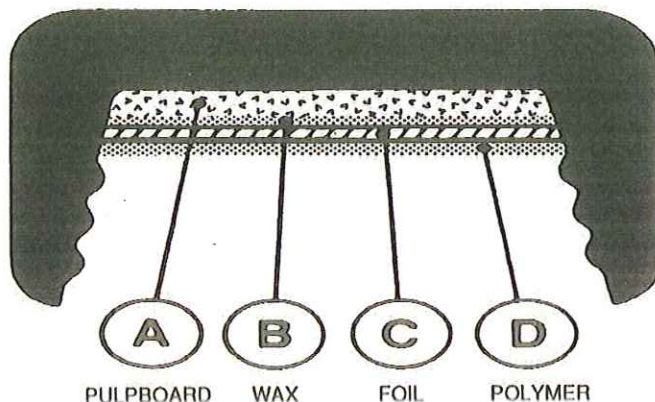
## What is induction capsealing and how does it work?

Induction capsealing is a unique non-contact heating process that hermetically seals a container by attaching a foil innerseal material to the lip of a container. Induction sealing requires little, if any, modification to an existing packaging line.

The hermetic seal requires an innerseal material that consists of a layer of pulpboard, a layer of wax, a layer of aluminum foil and a layer of polymer. The polymer must be compatible with the bottle material and capable of bonding to the lip of the container. The innerseal material is die cut and placed inside the cap by the cap manufacturer.

The sealing process takes place after the filling of the containers. Caps are placed onto the already filled containers, in the same manner as it was done previously. The containers then simply pass under the induction sealing head as they move on the conveyor. As they do so, they pass through the electromagnetic field created by the induction sealer. An electromagnetic current is induced into the foil layer of the innerseal, and heats it. The heated foil melts the wax layer, which is absorbed into the pulpboard, releasing the foil from the pulpboard. The foil also melts the polymer, bonding the foil over the container's mouth and creating a hermetic seal.

### **Closure with foil innerseal**



## What are the major components of an induction sealer?

- **Power Supply**  
The power supply is an electrical generator capable of operating at the medium to high frequencies required for the induction sealing process. It supplies the induction head with the current necessary to create an electromagnetic field. The power supply rating required for a specific application will depend upon the size of the closures and the speed of the production line.
- **Sealing Head**  
The head consists of a plastic housing with an conductor wound to form an inductive coil inside. The head produces an electromagnetic field when energized by the power supply. The most common shapes used in induction sealing are the flat head and the tunnel head. A tunnel head concentrates the current around the sides and above the cap, creating a more uniform electromagnetic field, and a more consistent seal. A flat head disperses the magnetic field more widely, allowing a larger area (and larger cap) to be sealed.

- **Water Recirculator**

The water recirculator is a water-to-air heat exchanger which cools the sealing head by pumping water through the sealing head coil via leads connecting the two. Although not required for the actual sealing process, the water recirculator is essential for continued use of the induction sealer to prevent overheating of the head.

### **How does an Induction Sealer fit on my production line?**

The induction sealing head is mounted directly over the conveyor. The power supply and water recirculator can be located either beneath the head or at a remote location, depending upon the availability of floor space. A portable cart can be included with the induction sealer that will allow easy mobility.

### **What Types of Products and Containers can be sealed?**

With the correct type of container and innerseal material, virtually all products can be sealed. Plastic containers are easiest to seal. Glass may need to be treated before the lip of the container will accept a seal. While it is possible to induction seal containers using metal caps, it is not recommended.

The metal cap is heated by the induction field and the innerseal is heated by conduction from the heat in the metal cap. The hot metal cap presents a safety problem to workers who may inadvertently touch it. In addition, the cap may become so hot it melts the plastic threads on the container.

### **How do I Select the Right Induction Sealer for my Application?**

There are two major factors that determine the rating of induction sealer appropriate for a particular application: the size of the cap and the speed of the production line (measured in feet or meters per minute). If it is a food application, a washdown enclosure may be necessary. Other factors to consider are the type and composition of the container, the type of innerseal material used, and the type of product (wet, dry, flammable).

### **What is IGBT technology and What Benefits Does it Provide?**

The state-of-the-art in power device technology, Insulated Gate Bipolar Transistors (IGBT) are found in the newest power supplies. IGBT transistors are more reliable than other types of transistors. They allow the power supply to be designed with fewer internal components and reduced heat generation, resulting in less overheat failure and fewer parts to fail. Kilowatt per kilowatt, IGBT transistors have a greater efficiency at higher line speeds.

### **Why Induction Seal?**

- Tamper Evident seal for consumer protection
- Freshness seal for longer shelf life
- Leakage protection seal to reduce returns
- Pilferage protection seal to eliminate theft

If you have any further questions about induction sealing or induction sealing equipment, feel free to call Enercon at (414) 255-6070 or the representative listed below.





## Unraveling the MYTHS AND MYSTERIES of Induction Sealing

By William F. Zito

**H**igh frequency. Low frequency. Ferrites. Air cooled. Water cooled. Solid state. Vacuum tubes. Microwave.

Anyone who has attempted to buy an induction sealing system has been inundated with these terms and many more. There has been a plethora of articles written discussing the technical aspects of induction cap sealing. Many of these have appeared in this Journal, and the uninitiated may want to refer to these to gain information not covered in this offering. The intent of this article is to separate fact from fiction concerning induction sealing in a way that anyone can understand and to offer suggestions to assist in selecting the proper equipment.

Since the inception of induction sealing in the mid-60s, frequently referred

to as induction cap sealing, there has been an almost mysterious aura surrounding this phenomenon. Most of the mysteries and misinformation have been generated by the manufacturers and sellers of this equipment.

Just what is induction sealing and what can it do for you? Induction sealing is a noncontact heating process that accomplishes the hermetic sealing of a container with a closure that includes a heat-sealable foil laminate. The typical induction innerseal begins as a multilaminate liner inside a closure. It consists of a layer of pulpboard, a layer of wax, aluminum foil and a layer of polymer that is compatible with the bottle material and capable of heat sealing to the lip of the container (Figure 1).

When the closure is placed onto the

container and is passed through an electromagnetic field produced by the induction heater, several things occur. An electromagnetic current, called an eddy current, is induced into the foil portion, resulting in a resistance-type heating effect. The heated foil melts the wax layer, which is absorbed into the pulpboard, releasing the foil from the pulpboard, and the polymer coating melts, hermetically sealing the foil to the lip of the container (Figure 2).

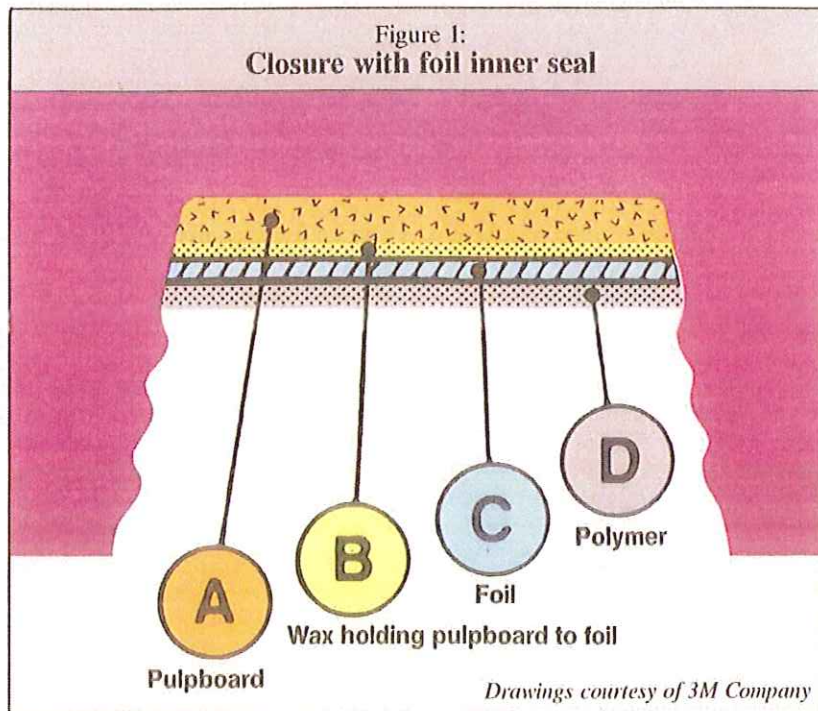
Notice I referred to the induction system as a heater and not a sealer. This clarifies the first misconception. Everyone who manufactures induction equipment for affixing a foil innerseal on a container refers to their generators as induction sealers. The truth of the matter is that we do not seal anything. The only function of the induction system is to heat the foil. You can heat the foil as much as you want, but if it is not in intimate contact with the lip of the container, you will not achieve a seal.

Occasionally, I'll receive a call from a customer who tells me something is wrong with his induction sealer. He goes on to tell me he has run 100 containers under the induction sealing head and only 97 of them sealed. I explain that if 97 of them sealed, there is nothing wrong with the induction system and suggest he look elsewhere for the problem.

Further examination usually uncovers the fact that there was insufficient torque on the three containers that did not seal. Either the foil was not in intimate contact with the lips of the containers, the lips of the containers were deformed or the caps were cocked.

If a series of identical containers are put through an induction field and one of them seals, then all of them should seal. You must realize that when you are dealing with hundreds or thousands, if not millions, of containers and caps, you will experience an occasional bad lip, insufficient torque or cocked cap. When this occurs, poor seals cannot be blamed on the induction equipment.

What about frequencies? The high frequency/low-frequency confusion was initiated by the manufacturer of vacuum tube equipment. The very first induction systems for heating foil were vacuum tube units, state-of-the-art at that time, which operated at approximately 450 kHz. As more modern devices were developed, many suppliers introduced solid-state generators that operated in the 26 to 100 kHz range. The makers of equipment who resisted change and continued to build vacuum tube systems began referring to the two systems as high-frequency and low-frequency,





rather than vacuum tube and solid state, which would insulate their equipment may be old fashioned and not state-of-the-art.

There has been much written about the advantages of low-versus high-frequency induction equipment. It's almost a moot point at this time, since there are very few, if any, vacuum tube units manufactured now. As the older vacuum tube systems fail and become high-maintenance items, they are being replaced with solid-state systems.

In late 1988, a major manufacturer of induction sealing equipment announced the development of what they said was a radically new power supply. They said that because of load matching and variable frequency, their unit would outperform power supplies of higher KW ratings supplied by their competitors. In addition, this unit was advertised as air-cooled. Reports from the field indicate that because of reliability problems and failure to perform at advertised sealing rates, a number of these units have been returned to the manufacturer by dissatisfied customers. One other point: although the power supply and high voltage leads do not require water cooling, the sealing coil requires a water system costing over \$2,000,000. So much for air-cooled systems. There is, of course, the possibility that the manufacturer will work the bugs out of this system, and it may become a viable alternative in the future.

Most makers of induction systems mislead customers by advertising their equipment as being air-cooled. This leads people to believe they do not need any water for cooling. While there are air-cooled power supplies available from all of the major suppliers, all production systems require water to cool the sealing heads where undesirable heat is produced by the current going through the copper tubing that produced the electromagnetic field. The bottom line is that all induction systems require water for cooling, except for small lab-type systems that are used on an intermittent basis.

Some manufacturers of induction sealing systems tout their use of ferrites in the sealing head, as if this is something new and radically different. Ferrites are nothing more than dense homogeneous ceramic structures made by mixing iron oxide with oxides or carbonates of one or more metals such as manganese, zinc, nickel or magnesium. They are pressed,

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Figure 2:  
Closure and inner seal after sealing operation

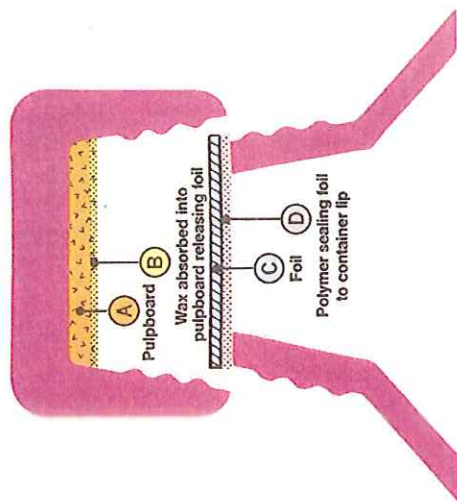
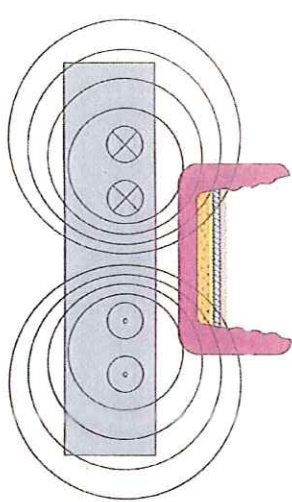


Figure 3:  
Coil flux without ferrites



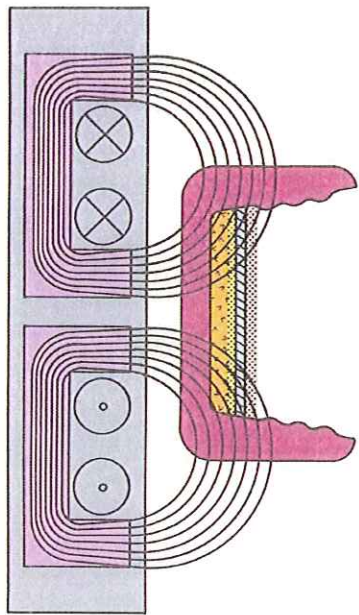
then fired in a kiln at 2000°F and machined as needed.

How and why are they used in induction cap sealing? If you examine the cross section of an induction sealing coil without ferrites (Figure 3) the electromagnetic field radiates equally in all directions.

By surrounding the coil with a ferrite material (Figure 4), the dense ferrites prevent the electromagnetic field from radiating and actually concentrates and directs the field, making it more efficient.

Ferrites have been in use as flux concentrators for over fifteen years and are

Figure 4:  
Coil flux with ferrites



certainly nothing new. Ferrites cannot be used with vacuum tube systems because the high frequency (450 KHz) causes excessive heat in the ferrites. This phenomena does not occur in the solid-state power systems which normally operate in the 26 to 100 KHz range.

Many people who are packaging liquid products are concerned that they will not achieve a good seal if there is product on the lip of the container when it is capped. Not to worry; this is not a problem. Normally the torque applied to the cap will squeeze out most of the liquid, and the heat generated by the induction process will eliminate whatever is left between the lip and the inner seal.

Many times I have taken WD-40 lubricant and sprayed the inner seal and lip of the container and then induction sealed them without any problems.

How can you tell which system is right for you? Most people will receive quotations from three or four different manufacturers, all saying their equipment is the best. To further confuse things, the prices are generally not more than a few hundred dollars apart. The truth is there is very little difference among the systems sold by the major sources of induction equipment.

Generally, if you send samples to all of the major suppliers seals and, after getting your samples back, mix them up. I doubt if you will see any difference in the seals.

This is not to say that there are not special applications where one manufacturer has an advantage over the others because of special coil design or other application knowledge. However, these special applications are such a small percentage of the overall industry as to be insignificant.

So what's a buyer to do? How does he know who to believe? Little is accomplished by asking a manufacturer for references.

Good sources of information are your suppliers of closures, bottles or induction interseal materials. They have no need to pretend, for the most part, can be objective. They are constantly in the field and usually know if a company has a reputation for reliability and good service, which is really what you are looking for.

You should also take a very close look at the warranties offered by the various suppliers. Service can be extremely expensive if you have a problem with your equipment. Don't fall into the parts-and-service trap.

Several companies advertise free parts and service on equipment for a period of one year after your installation.

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However, the travel and living expenses of the service technician are paid by the customer. This can amount to more than a thousand dollars for a so-called free service call. Only one company includes the service technician travel and living expenses in its warranty on power supplies above 2KW. Another company offers two different warranties in its quotations; one covers the equipment for six months and the other for eighteen months. So, you see, it can be very confusing. It's to your benefit to ask questions about each company's warranty. It could save you a bundle of money. One excellent way of comparing equipment is to personally visit each supplier.

Finally, let's look at the bottom line. The vast majority of induction sealing systems sold today use solid-state devices that operate at low frequency, below 100KHz. All suppliers offer air-cooled power supplies but require some minimal water cooling for the sealing coil.

Major differences between suppliers do exist in terms of pre- and post-sale service and in some areas of warranty. The rules haven't changed. To be a smart buyer, read the proposals carefully, investigate the vendor's reputation for product quality and service and ask a lot of questions.

Reprinted from the Journal of Packaging Technology, January 1990



# Universal Compak™ Power Supply Series 2000: Power & Watt Density Control

### The New Industry Standard

**Strong Enough To Carry Any Load:** The Enercon 2000 power supply meets the seemingly insurmountable challenge...matching the load requirements of a great variety of electrode types...automatically. Some suppliers solve this problem with transformer taps and other operator initiated adjustments, Enercon achieves true automatic adjustment of output to match a wide range of load conditions. Enercon 2000 offers automatic 5 to 1 load matching range and easy membrane front-panel control.

Enercon's 2000 will handle any type of roll or electrode combination; bare-roll to covered-roll and electrodes from blade to shoe type, or tube to segmented.

**Small Enough To Fit:** Another advantage of these new advances in power supply technology is the ability to pack more effective power into less space. And, higher efficiency results in more useful power to the load.

**The New Industry Standard:** Putting it all together:

- Advanced Technology
- User-Friendly, Easy-to-Operate
- 1, 2, 3, 4, & 5 kW
- Great Prices...Compak Size



1 to 5 kW Power Available in a  
NEMA 12, Compact, Cost-Effective Package

### Series 2000: Operating System Advantages

Standard Features	Benefits
<ul style="list-style-type: none"><li>• Broad Load Matching</li></ul>	<ul style="list-style-type: none"><li>• Use with any station.</li><li>• Reduces operator error.</li><li>• Wide 5 to 1 load matching range versus 2 to 1 max. for typical power supply.</li></ul>
<ul style="list-style-type: none"><li>• Membrane Panel Control and Indication</li></ul>	<ul style="list-style-type: none"><li>• Digital readout of output kW.</li><li>• Easy setup and operation.</li><li>• Self-checks all Interlocks for safe start-up.</li><li>• Retains setpoint in non-volatile memory.</li></ul>
<ul style="list-style-type: none"><li>• System Diagnostics<ul style="list-style-type: none"><li>• LTI Plus</li></ul></li></ul>	<ul style="list-style-type: none"><li>• LED's display operating status and fault isolation.</li><li>• Loss-of-treatment indication.</li></ul>
<ul style="list-style-type: none"><li>• Easy Installation</li></ul>	<ul style="list-style-type: none"><li>• No Input Transformer required.</li></ul>
Optional Features	Benefits
<ul style="list-style-type: none"><li>• Remote Control</li></ul>	<ul style="list-style-type: none"><li>• Allows full function remote control.</li></ul>
<ul style="list-style-type: none"><li>• Auto/Manual Mode</li></ul>	<ul style="list-style-type: none"><li>• Operational flexibility with Watt Density Control or Computer Interface.</li></ul>
<ul style="list-style-type: none"><li>• Programmable Control<ul style="list-style-type: none"><li>a) Watt Density &amp; Proportional Speed</li><li>b) Treat Width (Covered Roll)</li></ul></li></ul>	<ul style="list-style-type: none"><li>• User-friendly setup and control.</li><li>• Maintains consistent treatment despite line speed or other variables.</li><li>• All setpoints are retained.</li></ul>
<ul style="list-style-type: none"><li>• Computer Interface</li></ul>	<ul style="list-style-type: none"><li>• Allows integrated central control of Watt Density or kW Output.</li></ul>

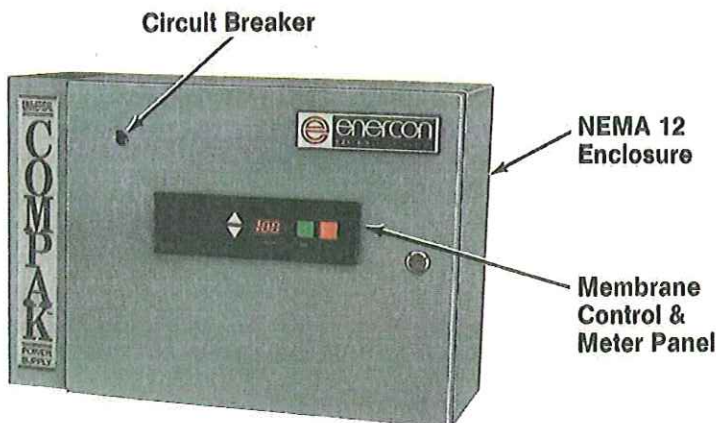
### More Power, Still Compak™ is Available:

If your application requires more power, you can still take advantage of Compak technology. Compak Power Supplies with even greater control capability are also available from 3 thru 100 kW in 13 ratings and application options.



## Enercon Corona Treating Systems

# Universal Compak™ Power Supply



- **Output Frequency:**  
Automatically adjusts over wide 5 to 1 load range.
- **Ambient Environment:**  
Temperature 50°C  
Humidity 90% Noncondensing
- **Controls**  
Membrane:  
POWER - Pushbuttons  
(Up/Down)  
START Pushbutton  
STOP Pushbutton  
Circuit Breaker:  
Input Power

- **Indicators**  
Digital Meter:  
Digital readout displays  
Output kW.  
LED'S:  
POWER — Green  
TEMP — RED  
RUN — Green  
REMOTE — Green  
FAULT — Red

- **Advanced Protective Circuits**  
**Guard Against:**  
Over-Temperature, Over-Current, and High-Voltage.

## Specifications

Rating	Input Power		Dimensions (Metric)		
	Volts	Phase	W	H	D
1 kW	115	1	24"	16"	8"
2 kW	230	1	(610 mm)	(407 mm)	(203 mm)
3 kW	230	3			
4 kW	230	3	25"	20"	13"
5 kW	230	3	(635 mm)	(508 mm)	(330 mm)

All input 50/60 Hertz. (380 V input available as option)



Full Function Remote Control in a 5" x 5" x 12" enclosure.



This small 10" x 10" x 6" unit provides either Watt Density Control or Computer Interface to the Series 2000 Power Supply.

## Applications

1. Bare-Roll and Covered-Roll Stations/Systems
2. Wire/Blade/Shoe/Fin/Segmented Metal Electrodes
3. Rectangular, Round or Segmented Ceramic Electrodes
4. Cast, Blown or Tentered Film Extrusion
5. Solvent or Water-Based, UV or EB Converting
6. Extrusion Coating/Laminating or Coating/Laminating Lines



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