

**MEGADYNE**

The Electrosurgical Authority™

# Principles of Electrosurgery





## Table of Contents

- Introduction
- Principles of Electricity
- Electrocautery is not Electrosurgery
- Electrosurgery: Techniques of Delivery
- Electrosurgical Waveforms
- Tissue Heating
- Tissue Responses
- Generators
- Active Electrodes
- Active Electrode Tips
- PTFE Coated Active Electrode Tips
- Specialty Active Electrode Tips
- Disposable Patient Return Electrodes
- Pressure Sores
- Reusable Patient Return Electrodes
- Considerations in Endoscopic Electrosurgery
- Surgical Smoke
- Summary

## INTRODUCTION

Having an understanding of the principles of electricity is a strong foundation for “best practices” in electrosurgical patient care. Electrosurgery units and accessories facilitate the passage of high frequency, oscillating electric currents through tissue between two electrodes to fulgurate, desiccate or cut tissue. Although the scientific application of electricity and the technologies have come a long way in regards to development and safety, hazards still exist for the surgical patient and OR team.

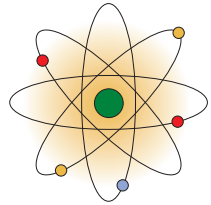
It is imperative that all surgical team members know the principles involved, the technology at hand and the safety practices necessary for optimal usage of electrosurgery.



# Principles of Electricity

# Principles of Electricity

## Principles of Electricity

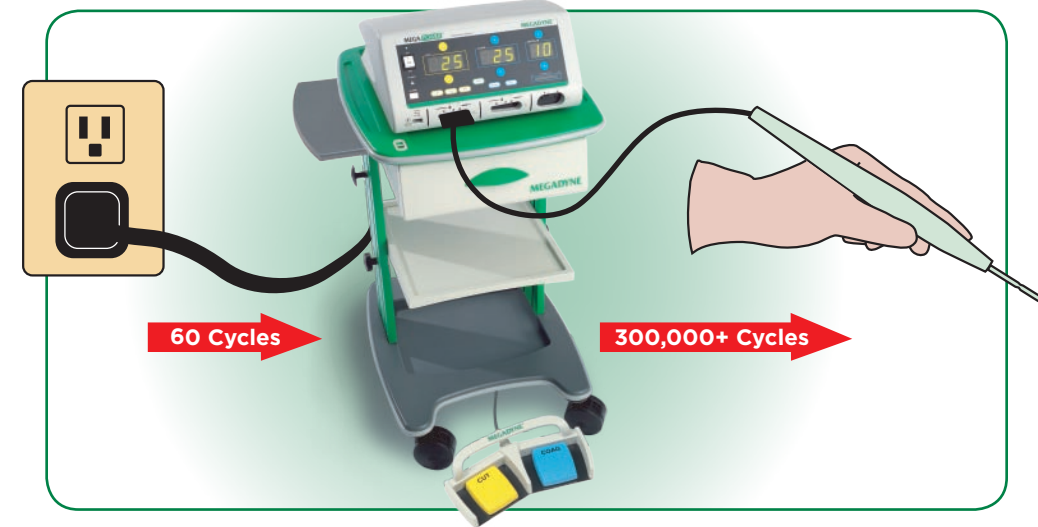


Electrons orbit atoms and with energy move out from one atom to another to produce an electrical current.

Understanding the science and principles of electricity is an important step to using the technology properly and eliminating potential hazards possibly encountered during patient application of electrosurgery.

<b>Current:</b>	The number of electrons moving past a given point per second, measured in amperes (A).
<b>Circuit:</b>	The path along which electricity flows.
<b>Voltage:</b>	The force that pushes electric current through resistance; electromotive force or potential difference expressed in volts.
<b>Power:</b>	The energy produced over a period of time.
<b>Resistance:</b>	The lack of conductivity or the opposition to the flow of electric current, measured in ohms.
<b>Capacitance:</b>	The ability of an electrical circuit to transfer an electrical charge from one conductor to another, even when separated by an insulator.

In surgery, the generator converts the electricity to high frequency waveforms and creates the voltage for flow of current. 60 cycle current is increased to over 300,000 cycles per second by the generator.



### Why over 300,000 cycles per second?

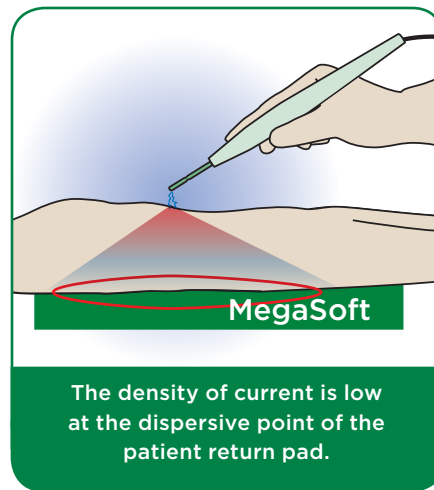
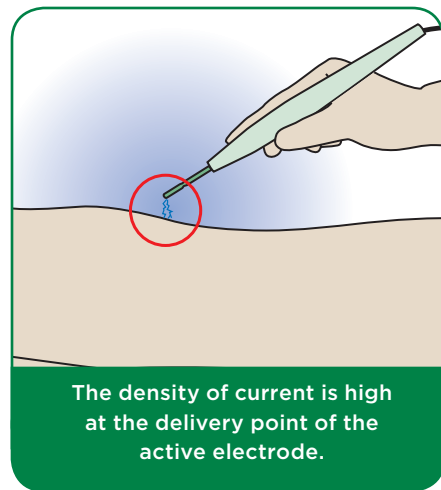
60 cycles per second creates nerve stimulation and electrocution.

High "radio" frequency eliminates nerve and muscle stimulation and electrocution.

# Principles of Electricity

## Current Density

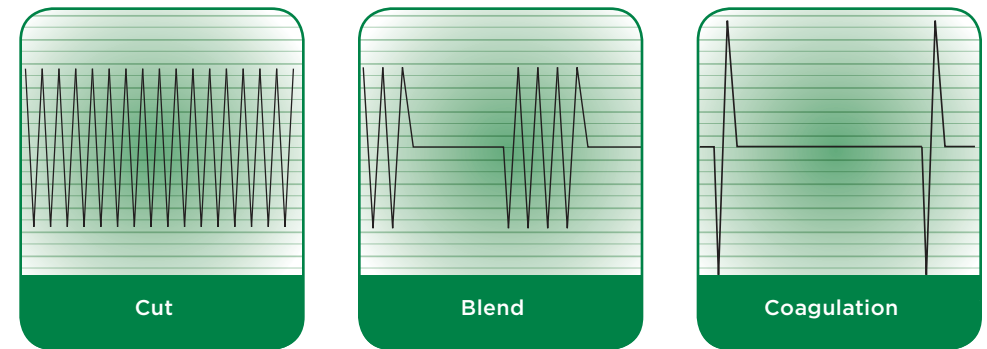
Current density refers to the intensity of the current as it passes through the tissue. When current is concentrated, heat is produced and the amount of heat produced determines the tissue response. The smaller the application area, the greater the current density at the application site.



# Electrosurgical Waveforms

## Electrosurgical Waveforms

Electrosurgical generators can produce a variety of waveforms and each waveform creates different tissue results.



The cutting current will cut the tissue but provides little hemostasis. The coagulation current provides coagulation but does not allow for smooth cutting. The blend current is an intermediate current between the cutting and coagulation currents but is not a combination of the two as the name might imply. It is a cutting current in which the duty cycle (time current is actually flowing) is reduced from 100 percent of the time to approximately 50 percent of the time (depends on manufacturer).

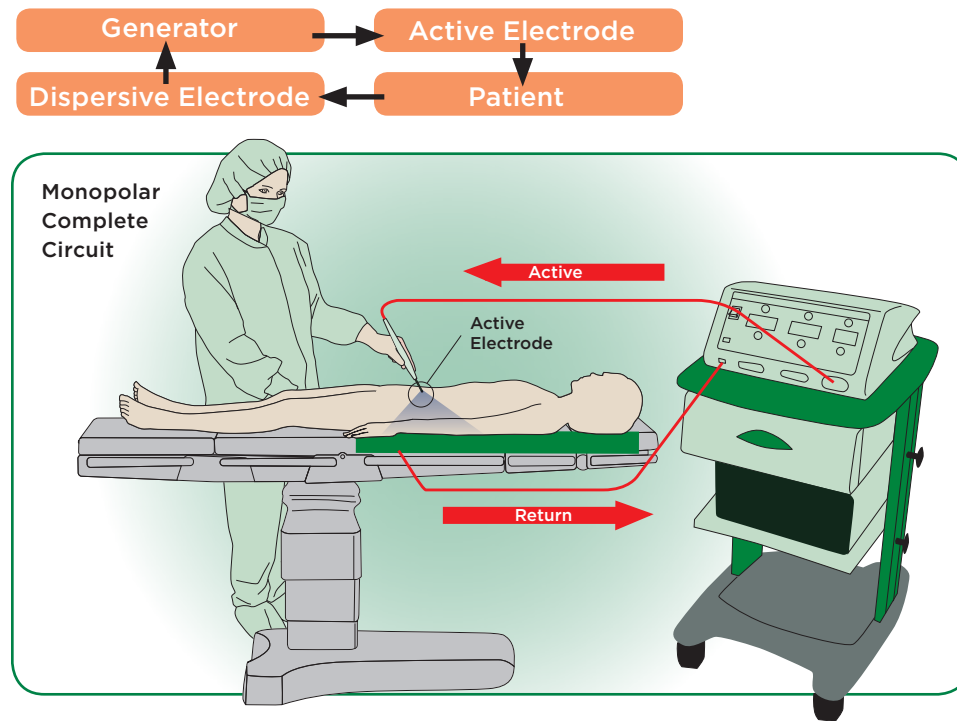
The "off" time allows the tissue to cool creating some hemostasis. It is important to know that the "Blend" currents in ESUs are delivered only when the cut button/footswitch is activated. Depressing the coag button/footswitch will deliver the coag or spray coag current.

# Techniques of Delivery

## Electrosurgery: Techniques of Delivery

There are two basic types of electrical circuits: monopolar and bipolar.

**MONOPOLAR** (monoterminal) is an electrosurgical technique in which the tissue effect takes place at a single active electrode and is dispersed (circuit completed) by a patient return electrode.

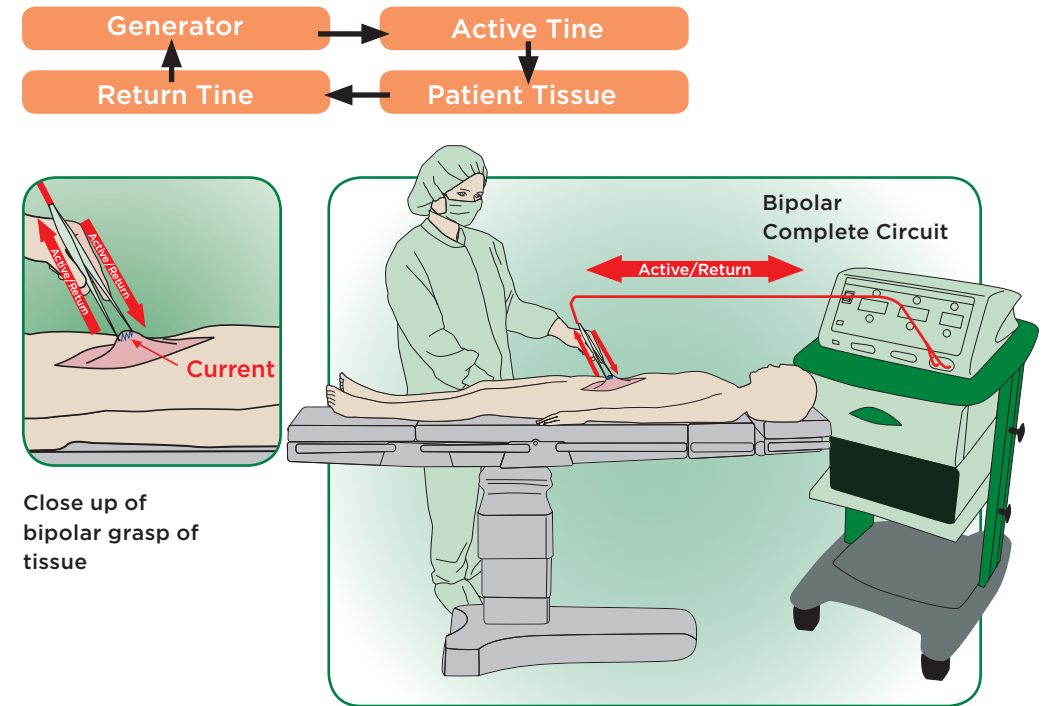


It is important to remember that the dispersive electrode is just as capable of producing injury as the active electrode unless the patient return pad has large contact over conductive tissue to provide a low current density; or incorporates technology to maintain patient safety. Pad safety technologies will be discussed in later sections.

# Techniques of Delivery

**BIPOLAR** (biterminal) is an electrosurgical technique in which the electrosurgical effect takes place between paired electrodes placed across the tissue to be treated. No patient return electrode is needed. Typically bipolar forceps are utilized for this technique.

The distance between the active and return electrodes in a bipolar circuit is very small since both electrodes are adjacent to each other. The distance the current flows is limited and is contained in the vicinity of the two electrodes. As current passes through the tissue from one electrode to the other, the tissue is desiccated and the resistance increases. As resistance increases current flow decreases. The LEDs on the Mega Power electrosurgical generator indicate current flow when bipolar instruments are used.



Close up of bipolar grasp of tissue

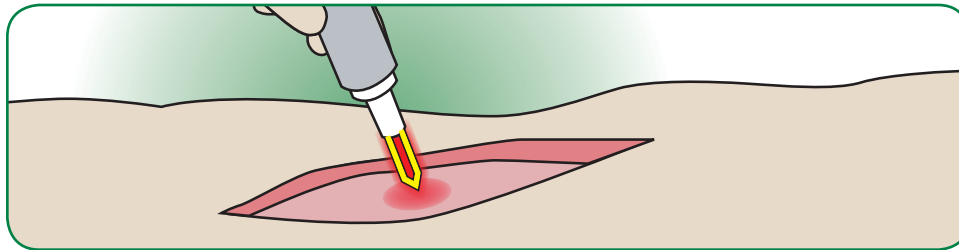
# Electrocautery is Not Electrosurgery

# Tissue Heating

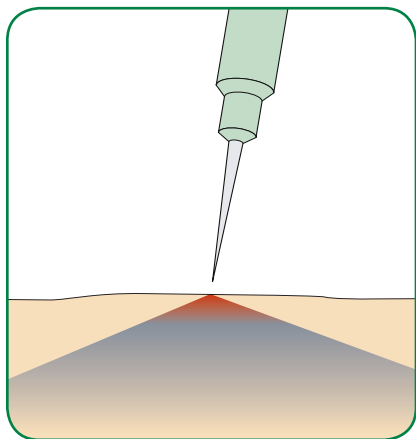
## Electrocautery is NOT Electrosurgery

The terms electrocautery and electrosurgery are frequently used interchangeably; however, these terms define two distinctly different modalities.

Electrocautery: use of electricity to heat an object that is then used to burn a specific site. Branding irons are a good example of this technology. In surgery, a hot wire is the most frequent example of electrocautery.



Direct “hot” wire burn to tissue. Current does not transfer through the patient.



Electrosurgery: the electrical current heats the tissue. The current must pass through the tissue to produce the desired effect.

Alternating current flows through the patient. Current enters the body at a high density and leaves the body at a low density.

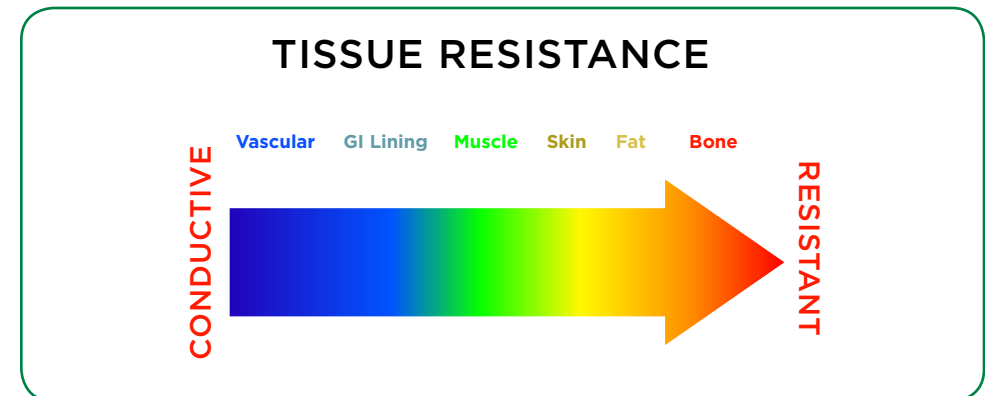
## Tissue Heating

As electrical current enters tissue, the ions within the cells become excited and begin to go into motion releasing kinetic energy. As this action increases or is prolonged, the cells begin to heat.

The temperature rise in tissue is directly proportional to:

- the resistance of the tissue
- the current density
- the power output
- the time of current application.

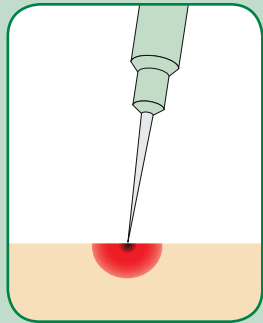
If a substance is an excellent conductor it will allow easy passage of current and offer very little resistance; therefore, the heat generated will be very little. The resistance to current flow in living tissues is inversely proportional to the water content. The more water present the greater current flow through that tissue because of the lower resistance. Therefore, current flow is greatest in tissues of high water content, such as blood, and least in those of low water content, such as bone. Electrical current flows preferentially through blood, then nerve, then muscle, then adipose tissue and finally bone.



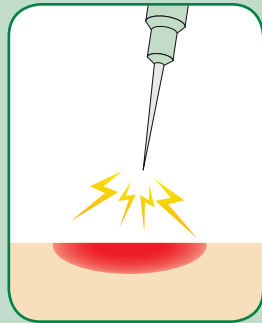
# Tissue Responses

## Tissue Responses

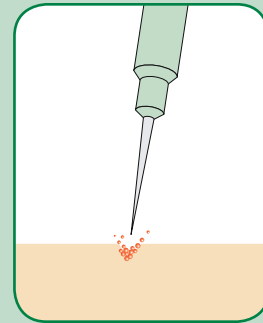
Given the versatility of waveforms available with modern generators, surgeons have the opportunity to create a multitude of tissue responses and results.



**DESICCATION** is direct energy application that slowly drives water out of the cells creating a drying out of the cells. The blood vessels are thrombosed. Desiccation can be achieved with either the cutting or the coagulation current by contact of the electrocautery device with the tissue.



**FULGURATION**, a form of coagulation, is the arcing or sparking of energy above the tissue to create a surface charring. When the spark reaches the tissue, it has a very high current density thus the tissue effect is superficial. Fulguration requires a high enough voltage to produce sparks with a coagulation effect rather than cutting.



**CUTTING** waveforms vaporize the cellular fluid causing cellular explosions, which result in a scalpel like dissection. True electrocautery cutting is a non-contact activity in which the electrocautery pencil is a short distance from the tissue.

# Electrosurgical Generators

## Electrosurgical Generators

There are two types of electrosurgical generators:

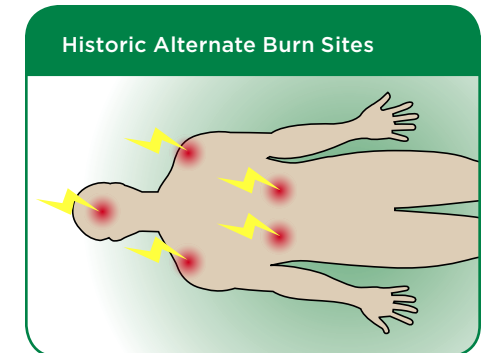
- Ground referenced generators (typically older, outdated units)
- Isolated generators (today's state-of-art technology)

Many of the modern isolated generators also have return electrode contact quality monitoring (RECOM) systems that measure the impedance between the patient's skin and the return pad.

## Ground Reference Generators

The current passes through the patient and returns to the generator, which is linked to ground. The problem is the current can go to any grounded object other than the pad (ECG electrodes, OR bed, metal objects) and cause alternate site burns. If the dispersive pad is forgotten, or is not in contact with the patient, a ground referenced generator will still send current to and through the active electrode and into the patient. If the patient is grounded by any other means, the current goes wherever it finds a path, this may again result in patient burns at alternate sites if current densities are high.

Ground referenced generators are considered to be outdated technology but are occasionally found in some operating rooms.





# Electrosurgical Generators

# Patient Return Pads

## Isolated Generators—Alternate burn sites essentially eliminated



Generators isolate the current from ground and do not allow significant current to seek alternate paths to ground. The current must return through the dispersive pad to the generator.

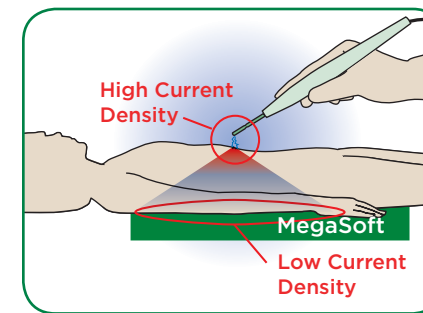
Although isolated generators are a great improvement over ground-referenced generators, they have one limitation. If only a small portion of the patient's sticky return pad is in contact, or if the conductivity of the pad is hampered, pad site burns can occur. This limitation led to the development and incorporation of the RECOM systems for sticky pads and the development of the Mega Soft™ technology.

Choosing the right electrosurgical generator should not be a complex decision. Look for quality, performance, safety and reliability and ease of use.

Design	Safety	Reliability
<p><b>Displays:</b> large and easy to read. Highly visible in the dark &amp; at a distance.</p> <p><b>Cart:</b> tip proof.</p> <p><b>Accommodating:</b> accepts equivalent accessories.</p>	<p><b>Warnings:</b> highly visible and audible.</p> <p><b>Labels:</b> clear &amp; legible.</p> <p><b>Contact:</b> patient &amp; pad contact quality monitoring.</p> <p><b>Power:</b> accurate</p>	<p><b>Warranty:</b> available.</p> <p><b>Loaner Service:</b> replacement loaner service for repairs.</p> <p><b>Experience:</b> long term focus on electrosurgery</p>

## Patient Return Pads

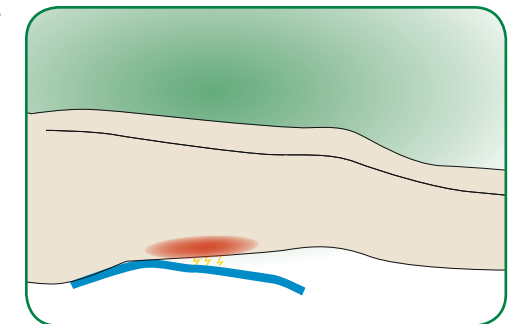
The patient return pad or electrode for monopolar electrosurgery functions as the pathway the current takes back to the generator. Some of the pads are flexible sticky pads that have polymer covering a conductive foil. These pads are referred to as sticky pads because of the adhesive edge that holds the pad in direct contact with the patient.



The pad must be large enough to keep the current density low as the electrical energy exits the patient; otherwise, heat will build up under the pad resulting in a burn. If the contact area is reduced because the pad is too small or is not in full contact such as with tenting, heat will increase. Surface area impedance can also be compromised with sticky pads if the

site of application is impaired. Excessive hair, bony prominences, fluid, scar and adipose tissue and prostheses are some of the situations that can interfere with dispersive needs.

Improper sticky pad application and heat build up

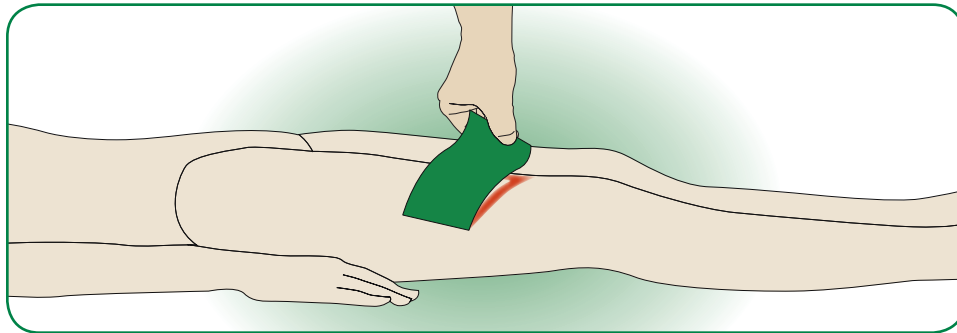


## Patient Return Pads

Because of frequent patient burns at pad sites, the RECQM system was developed. The generator has a microprocessor that monitors the quantity and quality of contact (or impedance) the pad makes with the patient. Monitoring pads are easily identifiable. They have a split foil surface as opposed to a large single sheet of foil on the pad. *With the RECQM system, if pad contact is interrupted the generator will alarm and deactivate. This is becoming outdated with the rapid acceptance of Mega Soft technology.*



Although sticky adhesive patient return pads rarely cause pressure ulcers, the adhesives can contribute to skin problems that break down further during a patient's recovery period.



## Patient Return Pads

Listed below is a table that helps with understanding the differences between the technologies related to patient return electrodes. Health care professionals need to be cognizant of these variables.

It may be beneficial to eliminate the use of single plate "sticky" pads except for those cases where it is the only technology available, such as neonatal procedures. For neonatal procedures, the largest size pad available should be used with the lowest possible power setting.

### Mega Soft™ Reusable Patient Return Electrode

The ideal patient return pad is patient safe, cost effective, and diminishes the chance for patient pressure sores. The Mega Soft pad is filled with viscoelastic polymer and is available in single cord and dual cord configurations.



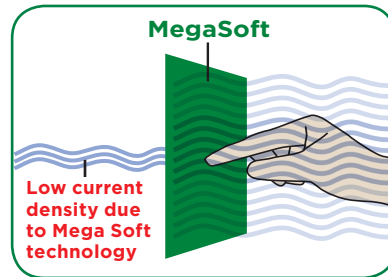
Two cords allow for one pad with two generators

Using a reusable, large patient return electrode containing viscoelastic polymer fill serves multiple critical functions. The primary function is the dispersment of electrosurgical energy and in addition, the polymer prevents pressure points, friction and shearing.

# Patient Return Pads

## The pad becomes the “Gatekeeper” of current flow.

Placing the patient in direct contact with the pad provides full advantage of the pressure reducing benefit while providing the same level of safety to that of monitoring pads. Should the contact area that the patient has with the pad decrease to a minimal level, the reusable patient return pad limits current flow from the patient to the pad. By limiting the current flow, the current density is kept sufficiently low to prevent heat build up under the pad.



Concern	Single Plate “Sticky” Pad	Split-Plate “Sticky” Pad	Mega Soft Technology
Pad site burn due to tenting, peeling, etc.	YES	SOMEWHAT	NO
Fluids Under Pad Effecting Adhesion of Pad to Patient	YES	YES	NO
Fluids Under Pad Affecting Health of Skin due to Prolonged Exposure	YES	YES	YES
Metal Implants	YES	YES	NO
Placement on a Good Muscular Vascular area void of hair, fat, bone	YES	YES	NO
Placement of Pad with various positioning devices (egg crate foam, gel pads, blankets, etc.)	NO	NO	YES
Alternate Current Pathways	YES	YES	YES
Touching/overlapping of multiple pads	YES	YES	NO
Denuding of skin upon pad removal	YES	YES	NO

# Patient Return Pads

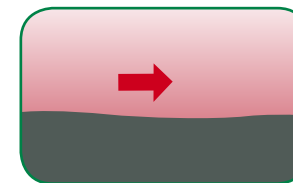
## Mega Soft Economics

The fact that the pad helps reduce postoperative pressure sores and is reusable brings forth cost savings. The savings are realized not only per procedure because the pad can be disinfected and reused; but also, for those post operative patients who would have had the additional care costs related to pressure sores and ulcerations.

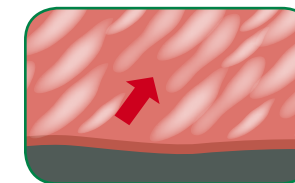
## Pressure Sores and Decubitus Ulcers

Many factors contribute to the potential for pressure sores or decubitus ulcers and some of these factors begin during the patient’s surgical procedure. The patient’s position needed for the correct anatomical approach, the age and general health of the patient and the procedural length of time are all contributing factors. Actions that frequently occur during the positioning that lead to patient pressure sores include:

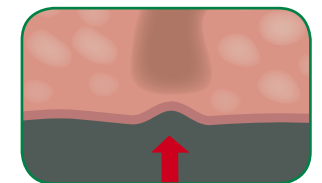
Friction



Shearing



Direct Pressure

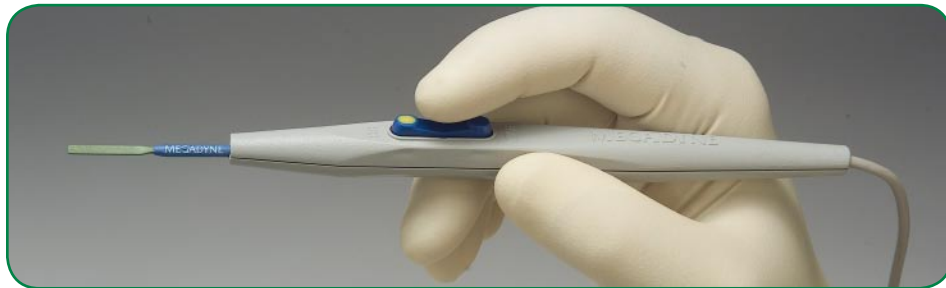


Friction can occur when the patient’s skin is pulled or rubbed over a stationary object. Shearing occurs when the patient’s skin is fixed while the underlying tissue shifts or is moved without support to the skeletal system. Direct pressure or weight applied over time to specific areas causes an ischemic reaction in deep tissue. Damage occurs as the bone pushes against the muscle and ischemia extends outwardly to the soft tissue layers of the dermis. The tissue is deprived of blood and oxygen and eventually necrosis will result. Pressure can also result in nerve damage.

## Active Electrodes

### Active Electrodes

The active electrode delivers the RF current from the generator to the surgical site.



**Pencil Active Electrode—Hand Controlled**

The pencil handpieces can be controlled directly by pushing the desired button or by activating the foot pedal. The yellow switch will turn on the “cut” or “blend” mode selected on the generator while the blue switch will deliver the “coag” mode selected.

Pencil pieces can be purchased as disposable or reusable. Cost conscious surgical managers report that the reusable pencils are more economical per procedure.

## Active Electrodes



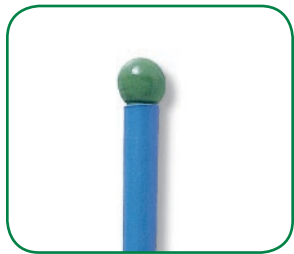
**Reusable Steam Sterilizable E-Z Pen™ with counting mechanism and E-Z Clean Active Electrodes**

The electrosurgical pencil should be used in a manner that minimizes the risk of injury to the surgical patient. Patient injury may result from unintentional activation, incomplete circuitry and incompatibility of the generator and the active electrode. Inspect each pencil prior to use. To minimize the risk of inadvertent activation place the electrode in a safety holster when not in immediate use.

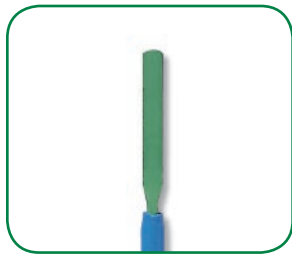
## Active Electrodes

### Active Electrode Tips

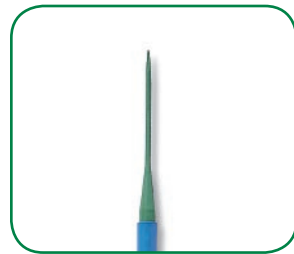
The current to tissue action at the tip of the active electrode is high electron flow over a small area. As resistance is encountered heat is produced. The current density is high but differs for each tip based on the size and shape of the tip.



Ball Tip



Blade Tip



Needle Tip

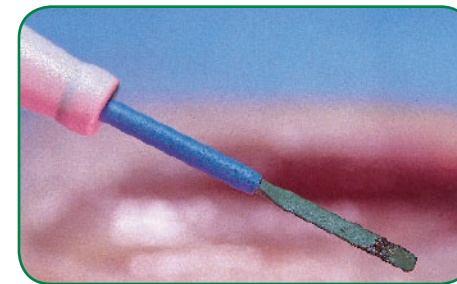
Needle tip active electrodes require a lower power setting than blade or ball electrodes because the current is concentrated on a very small area at the tip of the electrode.

Active electrode tips manufactured from stainless steel have the disadvantage of eschar build up which results in increased resistance. This resistance interferes with the desired tissue effect and can become a fire hazard. These tips have to be cleaned frequently with a scratch pad. Scratching off the eschar roughens the surface of the electrode, which promotes the build up of more eschar. This action adds time and hassle to the procedure.

## Active Electrodes

### Coated Active Electrode Tips—E-Z Clean®

Polytetrafluoroethylene (PTFE) coating on stainless steel tips makes them eschar-resistant and easy to clean during surgical applications.



Megadyne E-Z Clean



Stainless Steel

#### Benefits of PTFE Coating

- Resists eschar
- Easily cleaned
- Non-stick properties
- Resistant to high temperatures
- Bendable
- Cutting edge performance
- More durable than silicone
- Decreased thermal necrosis

Silicone has been used to coat active electrode tips but has not been as successful because of intolerance to high temperatures. PTFE is a slippery polymer surface that allows for high degrees of heat while preventing molecular adherence and thus slides through tissue without build up. PTFE creates such a strong bond that it can be found in the Guinness Book of World Records as the most slippery material available.

## Active Electrodes

### Specialty Active Electrode Tips

Large Loop Excision of the Transformation Zone—electrodes come in a variety of sizes for precise excisions.

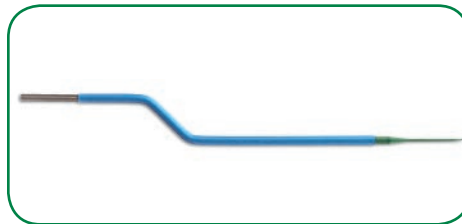


**Lletz Loop Electrodes Provide a precise specimen by using a high current density.**

Bayonet needle tips allow the surgeon improved visibility past the pencil to the operative site. Blunt needle tips have the benefit of a needle-type current concentration without the risk of vessel or nerve puncture injuries.



**Blunt Needle Electrode**



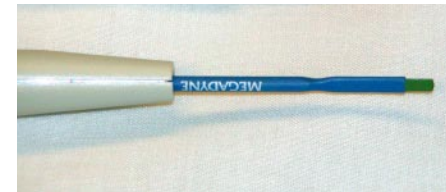
**Bayonet Needle Electrode**

### Mega Fine™ Needle Electrodes

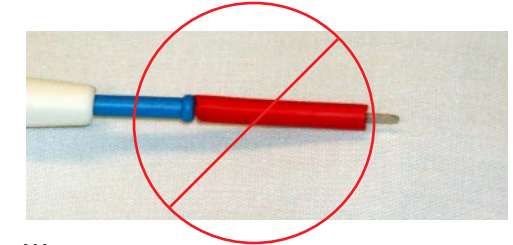
Extremely sharp needles create very high current densities. These high current densities allow the surgeon to use lower power settings which minimize thermal damage to tissue. The Mega Fine needles can be used at power settings below 10 watts and are typically used by plastic and ENT surgeons.

## Active Electrodes

### Active Electrode Hazard



**Right**



**Wrong**

Do not modify active electrodes. On occasion, nurses and surgeons have altered the active electrodes and unknowingly put their patients at risk. For example, do not use red rubber catheters over the tip of the electrode to minimize the chance of secondary burns to tissue. This practice increases the risk of a fire hazard and is not recommended. Sparks and leakage can and will occur at the juncture of the catheter and the insulation on the tip. The high temperature of the electrosurgical active electrode can melt the red rubber catheter.

The practice of modifying frequently takes place and is often because the appropriate tip is not available. Also, there is a perception that the use of a red rubber catheter saves money when in fact using a red rubber catheter costs more than purchasing the fully insulated tip. The attempt at saving a few pennies is not worth the risk of increasing the fire potential. Be sure to have the right tip and improve the safety by being sure that the tip is PTFE coated to minimize sparking and charring.

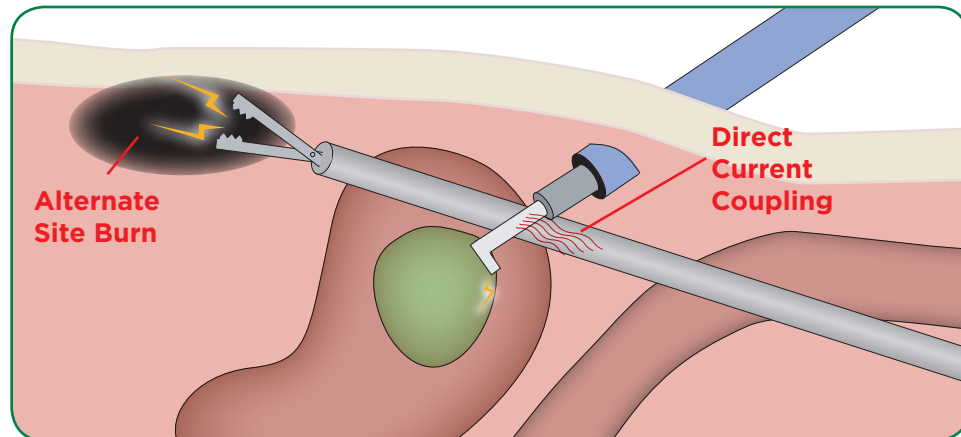
## Active Electrodes

### Considerations during monopolar endoscopic electrosurgery

Three unique problems related to monopolar electrosurgery use during endoscopic procedures are direct coupling, insulation failure and capacitive coupling.

#### Direct coupling

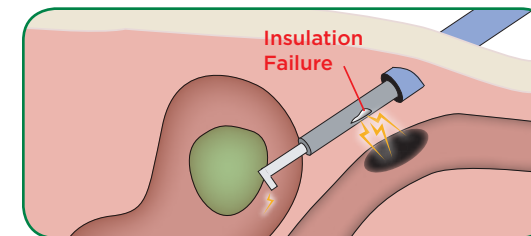
Direct coupling occurs when the active electrode touches another metal instrument. The electrical current flows from one to the other and then proceeds to tissue resulting in unintended burn. This can also occur if an active electrode is activated while in contact with a metal clip. The prevention of this occurrence is with the surgeon who is in control of the instrumentation. The best way surgeons can avoid this problem is to refrain from activating the active electrode until the intended tissue is in the field of vision and the electrode is in direct contact with the tissue and NOT in contact with any other metal object.



## Active Electrodes

### Insulation failure

Insulation failure can occur when the insulation covering of an endoscopic instrument has been damaged. Cracks or breaks in the shaft's insulation allow the electrical energy to escape and burn unintended tissue.



The insulation of endoscopic instruments must be inspected before, during and after each use. Most damage to insulation occurs during instrument processing, specifically during sterilization. Heat with

subsequent cooling causes insulation to shrink and then expand. During this process cracks and breaks can occur. Insulation failure will result in instantaneous, irreversible death to tissue because of the high density current at the point of exit from the shaft insulation break.

The Megadyne resposable and reusable Indicator Shaft® is an innovative design with a dual insulation layer. The underlying surface is yellow, which allows for immediate identification of cracks and breakage. When the yellow is visualized, the shaft needs to be replaced.

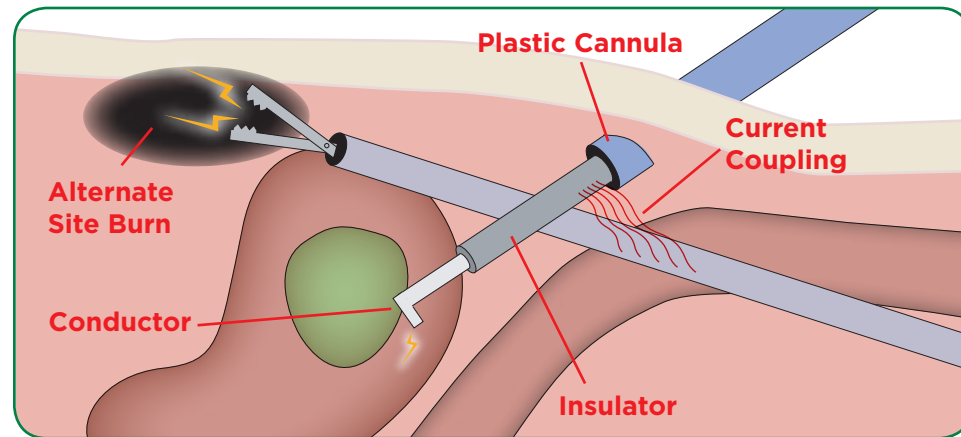


The Megadyne Indicator Shaft clearly shows when insulation damage has occurred and replacement is required.

## Active Electrodes

### Capacitive coupling

Capacitive coupling is a natural occurrence that can happen when energy is transferred through intact insulation to conductive materials. The current leaks from a conductor through insulation to another conductor.



AORN recommends that equipment should be designed to minimize the risk of capacitive coupling injuries during minimally invasive procedures.

The best way to eliminate this potential hazard is to avoid the use of hybrid (plastic and metal) instruments or trocars. Endoscopic trocar cannula systems should meet safety criteria established for the practice setting. When an all-metal system is used, capacitive current is safely dispersed through the greater surface area provided by the chest or abdominal wall, thereby reducing current concentration. Metal cannula systems are best for the port of electro-surgical instruments. An all-plastic system is another alternative.

The lowest power setting minimizes the potential for capacitive coupling. Use the lower voltage setting such as "Cut," or "Coag" rather than "Spray Coag."

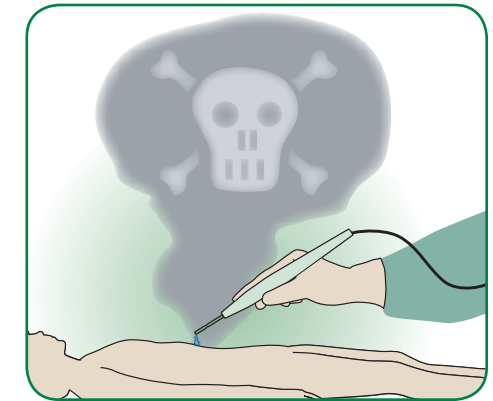
## Active Electrodes

### Surgical Smoke

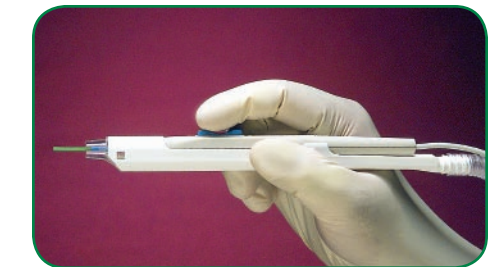
Surgical smoke is generated when the fluid within the tissue cells heats to the point of coagulum or vaporization. Smoke from tissue, no matter the heating source, is noxious and harmful to anyone who inhales the contents.

Various researchers have identified carcinogenic, toxic, mutagenic and poisonous contents. The smoke can also contain and transmit bacteria and viruses.

The safest means of eliminating the hazards contained within surgical smoke is to use a high efficiency filtration smoke evacuation system. Capturing the smoke requires that the wand be placed as close as possible to the origin of the smoke with sufficient flow to remove the smoke from the field. Mega Vac™ provides excellent smoke capturing by utilizing a patented nose cone that creates a Venturi "tornado" effect resulting in a high velocity flow rate.



Mega Vac™ smoke evacuator



AORN and OSHA recommend that surgical smoke exposure should be avoided.



## Summary

### Summary

Regardless of the frequent use and familiarity of surgical team members with electrosurgery units and devices, safety issues and operational concerns continue to exist.

Megadyne is committed to quality products and concentrates on patient safety through product design and surgical team member education. Our dedicated representatives are willing to provide inservice device training as well as professional continuing education on safety and science related to the application of electrosurgery. We are committed to best practices in electrosurgery.

## About Megadyne

### MEGADYNE MEDICAL PRODUCTS, INC. CORPORATE PROFILE



**Established:** 1985

**Headquartered:** 11506 South State Street Draper, Utah, 84020

**Customers:** More than 4,000 hospitals, surgical centers, healthcare providers, distributors and kit packers worldwide

**Ownership:** Privately Owned

**URL:** [www.megadyne.com](http://www.megadyne.com)

### **Megadyne is the recognized authority in electrosurgery.**

The electrosurgical products company was founded in 1985 with the launch of the E-Z Clean® line of non-stick, eschar-resistant, PTFE-coated electrodes. Co-founders Dr. G. Marsden Blanch, an ENT surgeon; Gary R. Kehl an entrepreneur and visionary; and Matthias R. Sansom, an experienced medical device executive, established Megadyne to facilitate the research and development of high quality, cost effective medical products for surgeons and nurses.

Today, Gary Kehl serves as the Company's Chief Executive Officer, Matt Sansom as President and Chief Operations Officer. Dr. Blanch remains involved in Megadyne's product research and development serving as the Company's chairman of the board and medical director.

## About Megadyne

After more than two decades of innovation, Megadyne's research and development team has continued to develop and bring to market innovative electro-surgical devices and accessories for the changing needs of healthcare professionals.

To help ensure high standards of training, Megadyne provides grant funds to support continuing nurse and surgeon education through independent study courses.

Megadyne maintains a certified Quality System that is substantially compliant with ISO 9001, EN 46001, ISO 13485, the EU Medical Device Directive 93/42/EEC, Canadian Medical Device Requirements, and 21 CFR part 820.

### **E-Z Clean® Products:**

- E-Z Clean® non-stick electrodes feature a patented and proprietary polytetrafluoroethylene (PTFE) coating that reduces eschar build-up during surgical procedures, enabling surgeons to use lower power settings. Lower power settings mean less thermal necrosis to surrounding tissue and a further reduction in eschar build-up;
- E-Z Pen™ Electro-surgical Pencil is lightweight and ergonomic. The 12-time use E-Z Pen has a built-in count down mechanism which displays the number of uses left and the "lock-out" failsafe function prevents additional use once the lifespan has expired;
- MEGAfine™ Line of extra sharp, precision needles designed for clean, fast, safe electro-surgery. Configurations include 2-inch and 2.5-inch long needle electrodes, with 45 and 90-degree angled styles, and a 6-inch extended version;

## About Megadyne

- Disposable Laparoscopic Electrodes provide a new fully insulated instrument for each case, minimizing the risk of stray current and unwanted burns. Featuring E-Z Clean, they require no reprocessing and come in varying configurations of tip styles, and include either foot or pencil control;

- Resposable Laparoscopic Electrode includes disposable MegaTips® with E-Z Clean coating to minimize eschar build-up, rendering surgical procedures cleaner, faster and safer. It also features the patented Indicator Shaft® technology with two layers of insulation to minimize the risk of burn due to stray current from damaged insulation. The patented yellow inner "Indicator" layer shows through when the black outer layer is nicked or worn away to alert clinicians to discard and replace the electrode;

- Reusable Stainless Steel Laparoscopic Electrodes also feature Indicator Shaft technology and come in varying configurations. Each instrument provides excellent dissection and coagulation for a variety of laparoscopic applications; and;

- All-In-One® Hand Control, which provides finger controlled on/off cutting and coagulation, suction and irrigation for laparoscopic procedures.

### **In addition to the E-Z Clean® Products, Megadyne offers:**

- The Mega Power™ Electro-surgical Generator is designed for its simple elegance. The Mega Power features large, easy to read displays and is driven by Constant Control Technology™ that automatically monitors tissue impedance and adjusts power to reduce tissue damage and drag. The result is a smooth, clean, accurate cutting and coagulation effect at the lowest possible settings for maximum patient safety;

- Mega Soft™ Line includes safe, reusable patient return electrodes that are easy to use and provide cost savings for the hospital. The Mega Soft incorporates this innovative technology with an OR table pressure reduction pad providing added patient protection against pressure sores;
- The Mega Soft Dual Cord provides clinicians with the ability to attach two separate generators to a single patient return electrode, eliminating the hassle of looking for, and prepping, two sites to place sticky return electrodes; and
- Mega Vac™ Smoke Evacuation System to protect surgeons, nurses, patients and other O.R. staff from breathing hazardous electrosurgical smoke. The Mega Vac creates effective suction with less noise during electrosurgical procedures and enables the surgeon to easily capture smoke while comfortably performing surgery.

### Pencils and Accessories:

- LEEP/LLEETZ loop electrodes
- Electrosurgical cables
- Disposable electrosurgical pencils

**PRODUCTS:** Megadyne's products have been proven in thousands of operating rooms worldwide. Its flagship E-Z Clean® line of non-stick electrosurgical tips and electrodes come in a variety of sizes, shapes and configurations that can be easily wiped clean with a sterile sponge.

**USERS:** Megadyne's Mega Soft technology has been used in millions of electrosurgical procedures worldwide and its active electrodes are used by hospitals in millions of procedures each year. In addition to hospitals and surgical centers, its customers include healthcare group purchasing organizations and supply companies in most regions of the world.

### Glossary

**Active Electrode** An electrosurgical instrument or accessory that concentrates the electric (therapeutic) current at the surgical site.

**Bipolar Electrosurgery** Electrosurgery where current flows between two electrodes that are positioned around tissue to create a surgical effect (usually desiccation). Current passes from one electrode, through the desired tissue, to another electrode, thus completing the circuit without entering any other part of the patient's body.

**Capacitive Coupling** The condition that occurs when electrical current is transferred from one conductor (the active electrode), through insulating materials, into adjacent conductive materials.

**Circuit** The path along which electricity flows.

**Contact Area w/Mega Soft** Weight-bearing portion of the Mega Soft Reusable Patient Return Electrode

**Current** The number of electrons moving past a given point per second, measured in amperes (A).

**Cutting** The electrosurgical effect that results from high current density in the tissue causing cellular fluid to burst into steam and disrupt the structure. Voltage is low and current flow is high.



## Glossary

**Direct Coupling** The condition that occurs when one electrical conductor (the active electrode) comes into direct contact with another secondary conductor (scopes, graspers). Electrical current will flow from the first conductor into the secondary one and energize it.

**Electrosurgery** The passage of high frequency electrical current through tissue to create a desired clinical effect.

**Fulguration** Using electrical arcs (sparks) to coagulate tissue. The sparks jump from the electrode across an air gap to the tissue.

**Insulation Failure** The condition that occurs when the insulation barrier around an electrical conductor is breached. As a result, current will travel outside the intended circuit.

**Isolated Output** The output of an electrosurgical generator that is not referenced to earth (ground).

**Monopolar Electrosurgery** A surgical procedure in which only the active electrode is in the surgical wound; electrosurgery that directs current through the patient's body and requires the use of a patient return electrode.

**Patient Return Electrode** A plate or pad (dispersive electrode) that recovers the therapeutic current from the patient during electrosurgery and returns it to the electrosurgical generator.

## Glossary

**Resistance** The lack of conductivity or the opposition to the flow of electric current, measured in ohms.

**Return Electrode Contact Quality Monitoring** A system that actively monitors tissue impedance (resistance) at the contact between the patient's body and the patient return electrode and interrupts the power if the quality of the contact is compromised.

**Voltage** The force that pushes electric current through resistance; electromotive force or potential difference expressed in volts.



**MEGADYNE**<sup>®</sup>

The Electrosurgical Authority™

11506 South State Street

Draper, Utah 84020

1-800-747-6110

[www.megadyne.com](http://www.megadyne.com)

3000114-01 REV A 2005-07-01