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Having an understanding of the principles of electricity is a strong foundation for “best practices” in electrosurgical patient care. Electrosurgical equipment 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

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.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Current</td>
<td>The number of electrons moving past a given point per second, measured in amperes (A).</td>
</tr>
<tr>
<td>Circuit</td>
<td>The path along which electricity flows.</td>
</tr>
<tr>
<td>Voltage</td>
<td>The force that pushes electric current through resistance; electromotive force or potential difference expressed in volts.</td>
</tr>
<tr>
<td>Power</td>
<td>The energy produced over a period of time, typically expressed in Watts.</td>
</tr>
<tr>
<td>Resistance</td>
<td>The lack of conductivity or the opposition to the flow of electric current, measured in ohms.</td>
</tr>
<tr>
<td>Capacitance</td>
<td>The ability of an electrical circuit to transfer an electrical charge from one conductor to another, even when separated by an insulator.</td>
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</table>
In surgery, the generator converts electricity to high frequency waveforms and creates the voltage for the flow of electrosurgical current. 60 cycle current, commonly found in households, 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.
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 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 with limited tissue dissection and creates an increased depth of heating. 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. Blend is a cutting mode. Depressing the coag button/footswitch will deliver the coag or spray coag current.

A fourth mode of electrosurgical cutting has been introduced by Megadyne. It is the Advanced Cutting Effect (ACE). When the ACE Mode of the Mega Power generator is used in combination with the ACE Blade®, the ACE Cutting System provides the surgeon with a scalpel like cutting effect that provides little to no thermal necrosis and no hemostasis. The yellow cut button/footswitch is depressed to activate this mode. The ACE mode uses proprietary software to maintain a constant voltage at the tip of the electrode rather than constant power like traditional Cut modes. The combination of the patented ACE Blade design and proprietary ACE mode provide the surgeon with the ability to use electrosurgery on the skin and achieve equivalent wound healing results while eliminating the use of dangerous sharps.
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.
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.
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**

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 electrosurgical 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 electrosurgical cutting is a non-contact activity in which the electrosurgical pencil is a short distance from the tissue.
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 (RECQM) 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. These “old style” generators are occasionally still found in some operating rooms and should be replaced with safer technology.
Isolated Generators—Alternate burn sites essentially eliminated

Isolated 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 RECQM 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.

<table>
<thead>
<tr>
<th>Design</th>
<th>Safety</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays: large and easy to read. Highly visible in the dark &amp; at a distance</td>
<td>Warnings: highly visible and audible</td>
<td>Warranty: available</td>
</tr>
<tr>
<td>Cart: tip proof</td>
<td>Labels: clear &amp; legible</td>
<td>Loaner Service: replacement loaner service for repairs</td>
</tr>
<tr>
<td>Accommodating: accepts equivalent accessories</td>
<td>Contact: patient &amp; pad contact quality monitoring</td>
<td>Experience: long term focus on electrosurgery</td>
</tr>
<tr>
<td></td>
<td>Power: accurate</td>
<td></td>
</tr>
</tbody>
</table>
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.
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 due to the evidence that has been established which demonstrates that the Mega Soft technology is Safer than RECQM patient return electrodes.

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.
For neonatal procedures, the largest size pad available should be used with the lowest possible power setting. The Mega Soft Pediatric pad can be used on infants weighing between 0.8 lbs (0.35kg) to 50 lbs (22.7kg).

**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.

Using a reusable, large patient return electrode containing viscoelastic polymer fill serves multiple critical functions. The primary function is the dispersement of electrosurgical energy and in addition, the polymer prevents pressure points, friction and shearing.
**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 a better 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. As a result of this technology the Mega Soft line of patient return electrodes is Safer than RECQM pads.

**Mega Soft Economics**

The Mega Soft patient return electrodes are reusable and incorporate pressure reduction capabilities that allow them to provide significant cost savings. The savings are realized on a per-procedure basis because the pads can be disinfected and reused, limiting stocking levels and reducing waste rather than using disposable sticky pads. Savings can also be generated by minimizing the development of pressure sores. The cost of treating a single operating room acquired pressure sore can be significant.

**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 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.

*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.*

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

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

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 and environmentally friendly.

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 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.

![Active Electrode Tips](image)

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. The ACE Blade used with the ACE mode of the Mega Power generator produces very high energy densities due to the very focused edge on the blade and the constant voltage at the tip.

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.
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.

Benefits of non-stick PTFE Coating

- Resist eschar buildup. Eschar can slow down a procedure and create a fire hazard.
- Are easily cleaned with a damp sponge to speed the procedure.
- Can withstand high temperatures to insure the coating lasts the length of the entire procedure.
- Is bendable so that flaking of the non-stick material is not a concern.
- More durable than silicone so it lasts the entire case.

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.
**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.

**Modified Tip Electrodes**

Modified tip electrodes are ideal for reducing the risk of alternate site thermal injuries in procedures where operating space is limited.

- Only 4 mm of the distal tip is exposed, thus minimizing the likelihood of collateral thermal injuries.
- Megadyne modified tips have advanced PTFE insulation that resists splitting in temperatures beyond 700 °F.

**Protective Nose Cone Electrodes**

Protective nose cone electrodes provide patient safety in procedures performed in moisture-rich areas and confined spaces by minimizing the chance of alternate site injuries. This protection is achieved by the protective nose cone fitting snugly over the pencil and minimizing the chances of moisture wicking into the handpiece.

**Suction Coagulators**

Suction coagulators provide precise coagulation with controlled fluid evacuation. Designed with the ENT surgeon in mind this product is typically used in tonsillectomy and adenoidectomy procedures.
Active Electrodes

**Lletz Loops**
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 and Blunt Tips**
Bayonet electrodes 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 sharps.

Blunt Needle Electrode

Modified Bayonet Needle Electrode
Active Electrode Hazard

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.

Unfortunately, the practice of modifying frequently takes place 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 modified tip and improve the safety by being sure that the tip is PTFE coated with PTFE insulation to minimize sparking and charring when working in confined spaces.
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.
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.
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.

In order to eliminate this potential hazard, do not use hybrid (plastic and metal) instruments or trocars. Endoscopic trocar cannula systems should meet safety criteria established for the practice setting. When a conductive trocar system is used, capacitive current is safely dispersed through the greater surface area provided by the chest or abdominal wall, thereby reducing current concentration. Conductive trocar systems are best for the port of electrosurgical instruments.

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

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

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 and a mission of facilitating the research and development of high quality, cost effective medical products for surgeons and nurses.

After more than 25 years of innovation, Megadyne’s research and development team continues to develop and bring to market innovative solutions that improve patient safety and outcome, are simple and easy to use, and offer superior value. The company’s commitment to service, our customers, communities, employees and environment has established Megadyne as the Trusted Electrosurgical Authority.
Megadyne maintains a quality management system which conforms to the requirements of 21 CFR Part 820 (FDA Quality System Regulations), and is certified to ISO 13485, Canada Medical Device Requirements, and Japan MHLW Ordinance No. 169. In addition, devices we manufacture are certified to meet the requirements of the European Medical Device Directive 93/42/EEC and bear the CE mark.

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.

- ACE Cutting System is a single, innovative instrument which—when combined with the ACE Mode of the Mega Power Generator—effectively cuts, coagulates and dissects, reducing the need to pass dangerous scalpels and conventional electrosurgical blades back and forth. ACE Blade® glides through tissue and safely performs skin incisions with wound healing equivalent to a scalpel.

- E-Z Pen™ Electrosurgical 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.

- Mega Fine® Line of extra sharp, precision needles designed for clean, fast, safe electrosurgery. 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.

- Reposable 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.

- 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™ Electrosurgical 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.

• 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.

Coagulation The electrosurgical effect that causes cells to rupture and allow their interstitial fluid to cool over a vessel to achieve hemostasis.

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.
**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.
**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.