ELECTROSURGICAL UNIT WITH SPARK-GAP GENERATOR

In realization that many urologists prefer spark-gap generated coagulation current for transurethral resection, FLS continue to provide to the profession such units - in addition to our line of solid-state generators.

**ELEKTROTOM 600 RF**

Powerful valve and spark-gap generators are combined in a water sealed case mounted in a stainless steel mobile cabinet with a storage drawer in the rear. The unit is ideally suitable for all urological procedures including bipolar coagulation procedures.

**THE ELEKTROTOM 600 RF PROVIDES:**

Extremely smooth, non-modulated HF-current, also referred to as "cold" current, for "cold" cutting and "cold" coagulation of great output;

Modulated HF-current for "hot" coagulation;

Blended or mixed current for cutting with precisely variable degrees of

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**TECHNICAL DATA OF ELEKTROTOM 600 RF:**

The unit employs advanced, space-saving, solid state and printed circuits. **No** spark-gap maintenance required.

<table>
<thead>
<tr>
<th>Power Supply:</th>
<th>115 V/60 Hz. - Max. 1500 VA</th>
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<td>Non-modulated 350 Watts, 1.75 MHz.</td>
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<td>Generator II</td>
<td>Modulated 300 Watts, 500 KHz.</td>
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<td>Generator III</td>
<td>Low tension, non-modulated HF-current for micro-coagulation with bipolar forceps - 60 Watts</td>
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**THE ELEKTROTOM 600 RF FEATURES:**

Operation by fingertip pencil or conventional foot switch technique;

MART-O-MATIC, automatic intensity regulation when changing active electrodes;

Safety circuit detects defects in indifferent circuit and prevents its operation in such a condition;

BI-CO-MATIC permits bipolar Micro-Coagulation with special forceps with or without foot switch;

Splash-proof. The generators and all other current carrying components are encased in a sealed, air and water tight compartment.

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**Output:**
- Generator I: Non-modulated 350 Watts, 1.75 MHz.
- Generator II: Modulated 300 Watts, 500 KHz.
  - Mixed 600 Watts
- Generator III: Low tension, non-modulated HF-current for micro-coagulation with bipolar forceps - 60 Watts

Two sockets providing currents for cutting and coagulation.

One socket providing currents with specific tension for T. U. R.

One socket providing current of low tension for bipolar Micro-Coagulation.

Foot switch operates by closing a 4 Volt circuit, activating the HF-relay.

All conventional electrodes and instruments may be connected to unit.

**DIMENSIONS:**
- Height: 36"
- Length: 18"
- Depth: 14"

**WEIGHT:** 121 lbs.
DO YOU PREFER A SPARK-GAP GENERATOR OVER A SOLID-STATE UNIT FOR TRANSURETHRAL RESECTION?

The unique feature of the spark-gap generator and its current is the great spread of the frequency spectrum and output voltages, ranging between almost 0-14,000 Volts, peak to peak, at frequencies between 200 KHz and 600 KHz. This permits the arcing or fulguration in such techniques as are described in the term "spray coagulation". Many urological procedures depend on this high voltage, randomly modulated current for the coagulation of bleeders and resection of tissue inside the bladder, by means of the cutting loop.

State-of-the-art technology has not been able to duplicate this performance with solid-state circuitry and therefore, many urologists prefer the spark-gap generator over the solid-state units. To accommodate those who demand spark-gap performance, we are supplying spark-gap generators.

<table>
<thead>
<tr>
<th>SPARK-GAP CURRENT</th>
<th>SOLID-STATE GENERATOR</th>
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</thead>
<tbody>
<tr>
<td>Frequency: 200 KHz to 600 KHz</td>
<td>Frequency: 600 KHz to 650 KHz</td>
</tr>
<tr>
<td>Non-uniform peak to peak currents</td>
<td>Uniformly modulated, with limited peak to peak currents</td>
</tr>
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The nature of the solid-state generator’s coagulation current waveform limits its capabilities when performing such procedures as transurethral resection. Its uniformly modulated current simply cannot perform on an equal basis, particularly under a heavy impedance load, as encountered in the bladder.
Problems of High-Frequency Surgery in Transurethral Interventions

Transurethral operations are performed for the purpose of removing tissue from the bladder, the proximal urethra or from the prostate, with the aid of an instrument introduced into the urethra, known as resectoscope. In addition, a major electrosurgical unit, an illuminator, presently fiber optic, and irrigation equipment is required.

Only distilled water (electrolyte-free solution) can be used for irrigation, otherwise cutting and coagulation will be impossible.

In 1926, Maximilian Stern developed the first electric resection instrument, which some years later in 1932 was improved by MacCarthy and become the prototype of all resectoscopes. In 1910, E. Beer was the first to remove a papilloma of the urinary bladder electrosurgically with an instrument developed by Reinhold Wappler.

The electrosurgical unit, suitable for transurethral resection, must satisfy two prime requirements:

a) smooth and rapid cutting
b) quick and reliable coagulation.

Cutting with spark-gap current (Bovie) is not recommended, because when viewing such tissue under the microscope, deep necrosis with heat vacuoles can be seen. The cut achieved with this type of current is blunt, and tissue differentiation during resection is difficult, because of the necrosis. The healing is slow. Animal experiments showed that after resection of the prostate in dogs with spark-gap current, about 9 to 12 weeks were needed for the wound to heal (Krebs, 1971). As the spark-gap current causes deep carbonization, it is difficult to make a repeat cut into the same tissue because the loop too is quickly covered with a layer of carbonized tissue producing an insulating effect.

For smooth cutting, a high frequency (1.7 MHz) undamped tube current should be used, even though, more bleeding may occur (Clark, Kauffman). In test animals the resection wound produced with such radio current healed within 6 weeks. (Krebs, 1971).

Whether a good or bad cut through tissue is obtained depends not only on the instrument, but also on the tissue itself. The homogenous cancer tissue of the prostate allows very good cutting, while a smooth cut is difficult with benign enlargements of the prostate. Applying pressure to the loop is not recommended, because it is too dangerous with bladder tumors on account of the risk of cutting through the bladder wall. Selecting the proper current and intensity will make effortless cutting possible.

While the high frequency radio current permits elegant cutting, it is unsuitable for coagulation. Attempts to modulate this current, producing damped waves, were made as early as 1955 (Siemens) and more recently by manufacturers of solid state equipment. All these attempts are generally not satisfactory for coagulation in transurethral interventions.
The **ESU 70 B** is a modern electrosurgical unit for minor and specialty surgical interventions for the general surgeon, dermatologist, gynecologist, proctologist, **urologist** and E.N.T. specialist, as well as the outpatient department of the hospital. The relatively high output permits the employment of all kinds of cutting and coagulation electrodes, including wire loops up to 10 mm 0, as well as snares, suction coagulators, biopsy punches, coagulation forceps and many specialty instruments. The **ESU 70B** provides a bipolar output for precise coagulation.

![ESU 70 B Electrosurgical Unit](image)

**List No. 5196  ESU 70 B, ELECTROSURGICAL UNIT with**

SMART-O-MATIC circuit (select accessories as required)

Printed and solid state circuits, representing the state-of-the-art technology, permit this compact design and makes service an easy task.

**THE ESU 70 B PROVIDES**

- Extremely smooth, non-modulated, rectified RF-current for scalpel-like cutting and contact coagulation
- Blended current for cutting with pronounced coagulation On Blend II spray
  coagulation with ball electrodes is also possible
- Sufficient output, continuously adjustable for all minor specialty surgical procedures in the office and ambulatory surgery

Available are a wide selection of accessories such as needle, lancet, knife, ball, and loop electrodes and forceps. By means of adapters, all other competitive electrodes and instruments may be used

- Bipolar output socket takes conventional bipolar cable and footswitch operated bipolar forceps
**ADVANTAGES OF ELECTROSURGERY WITH THE ESU 70 B**

- Cuts with smooth current, permitting first intention healing
- Sterilizes the tissue surface as it cuts, seals lymphatic vessels and capillaries and thus, prevents absorption of toxic substances and postoperative bleeding
- Bipolar output accepts standard bipolar accessories
- Hemostasis while cutting, reducing blood loss
- Biopsies suitable for pathological examinations
- Excellent cosmetic results
- Simple operation
- Durability with advanced digital and solid state circuits

SMART-O-MATIC, automatic compensation circuit which provides the desired output for all electrodes or tissue conditions. The automatic range control, which is divided into ten steps, requires no readjustment within the set range.

**TECHNICAL DATA OF THE ESU 70 B**

The generator employs modern and sophisticated, space-saving printed solid state circuits for long, trouble-free service.

**Output Power:**

<table>
<thead>
<tr>
<th>Monopolar Generator:</th>
<th>Sufficient output for all cutting and coagulation procedures, precisely adjustable</th>
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<tbody>
<tr>
<td>Pure Mode:</td>
<td>70 Watts at 350 Ohm load (non-modulated current)</td>
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<tr>
<td>Blend I Mode:</td>
<td>70 Watts at 350 Ohm load (modulated current)</td>
</tr>
<tr>
<td>Blend II Mode:</td>
<td>55 Watts at 350 Ohm load (modulated current)</td>
</tr>
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| Bipolar Generator:  | Isolated (floating) output of extremely low tension RF, (maximum 370 Volts, 50 Watts at 50 Ohms, precisely adjustable) |

**Frequency:** 1.7 MHz, RF (Radio Frequency current)

**Power Supply:** 117 V/60 Hz, other voltages available on request

**Dimensions:** 13" W x 11" D x 5" H

**Weight:** 9 lbs

**Optional Accessories:**

- **List No. 5707** Single pedal footswitch, lever action
- **List No. 5010** Handle, monopolar, for footswitch operation
- **List No. 5021** Monopolar RF-cable for handle List No. 5010
- **List No. 5230** Bipolar RF-cable for forceps
- **List No. 5990** Bipolar RF-cable for forceps with two-pin connector

Select electrodes, monopolar accessories, bipolar accessories and patient return accessories from their respective data sheets.

Unit meets latest electrical safety standards of UL 544, CSA, NFPA, and IEC proposed standards.
The spark-gap generator with its wide frequency band, large voltage spread and extremely high voltage peaks, permits spray coagulation and quick hemostasis without risking accidents by perforating the bladder wall.

The automatic intensity compensator (MART-0-MATIC) more recently introduced, (ELEKTROTOM) permits effortless cutting and reliable coagulation without changing the intensity setting during the procedure.

The isolated RF-output (not to be confused with floating output), which reduces the low frequency component with its undesirable faradization effects, is another helpful technical accomplishment (ELEKTROTOM). It reduces the muscle twitching.

The gas and air bubbles that frequently develop during resection can be very unpleasant, as they interfere with vision. They accumulate on the "roof" of the operating area and hamper vision during a resection in the area of the anterior commisure or during transurethral work on the roof of the bladder. These air or gas bubbles originate partly from the supply hose of the irrigation system and partly from air entering the resection shaft during emptying of the bladder. Partly they are also caused by arcing and heat during coagulation. While the first mentioned causes can easily be prevented by the proper technique, the formation of gas, occasionally fulminating gas by the high frequency current, is still an unresolved problem.

Cables, footswitch and patient plate belong to the accessories of the high frequency unit. The patient plate, which should be plyable, must be firmly applied to the patient. It should be strapped or taped to the thigh and not placed under the patient.

It is also important that all electrical circuits, the electrosurgical unit, fiber optic instrument, irrigation equipment, operating table, patient monitor and the grounding conductor of the floor, are connected to a common and proper earth ground, otherwise serious accidents may result. Units with floating output (some solid state) may not eliminate this requirement.

When a patient monitor is used during transurethral resection, both the electrosurgical unit and the patient monitor should be connected to the patient plate (common ground).

Although the commercially available electrosurgical units are unlikely to break down easily, it nevertheless remains a basic prerequisite that a resection must not be carried out unless a stand-by unit is available in the hospital. A sudden failure of a unit during a transurethral operation can create a life-endangering situation for the patient. The availability of a second unit in the same clinic appears indispensable. While in the case of open operations other instruments such as scalpels and ligatures are available for the cutting of tissue or for the arrest of a haemorrhage, in transurethral operations the surgeon entirely depends on the proper functioning of the electrosurgical unit.