Valleylab Force FX periodic testing

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

What tests should be done?

1. Output tests in each different mode; cut, coag and bi-polar.
2. REM high and low trip points
3. RF Leakage test

Different loads for different modes.

Usually bi-polar mode is tested at 100 ohms load, cut mode at 300 ohms and coagulation mode at 500 ohms. Measure the current, not the watts. RF power output circuitry is 1 to 6 N channel MOSFET's in parallel. With age and thermal damage, they begin to fail and the output voltage drops. Circuitry compensates by increasing the current thru the MOSFET's. Current times voltage equals wattage. Measuring wattage will not detect the drop in voltage, but measuring current will detect the voltage drop. Valleylab specifically states to test for current under specified load.

ESU Math, not quite rocket science

$\sqrt{}$ Watt setting of ESU / Load setting of tester = desired test result

Bi-Polar $\frac{10 \text{ Watts}}{\sqrt{100\ \Omega}} = \sqrt{.1} = .316$ amp = 316 mA

Coag $\frac{30 \text{ W}}{\sqrt{500\ \Omega}} = \sqrt{0.06} = .245$ A = 245 mA

Cut $\frac{75\text{W}}{\sqrt{300\ \Omega}} = \sqrt{.25} = .5\text{A} = 500\text{mA}$

REM testing

- Testing must be done with the middle pin of the r.e.m. connector present. Without the pin, the e.s.u. switches to non r.e.m. circuitry.
- If an e.s.u. is sent to mfr. for repair with a r.e.m. fault, testing must be done with the actual patient pad.
- Normal power output testing bypasses r.e.m. circuitry.

ESU Vocabulary page one

1. **Current**
   The number of electrons moving past a given point per second, measured in amperes.
2. **Current Density**
   The amount of current flow per unit of surface area; current concentration directly proportional to the amount of heat generated.
3. **Current Division**
   Electrical current leaving the intended electrosurgical circuit and following an alternate path of least resistance to ground; typically the cause of alternate site burns when using a grounded generator.
4. **Cut**
   A low-voltage, continuous waveform optimized for electrosurgical cutting.
5. **Cutting**
   Use of the cut waveform to achieve an 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.

ESU Vocabulary page two

1. **Desiccation**
   The electrosurgical effect of tissue dehydration and protein denaturation caused by direct contact between the electrosurgical electrode and tissue. Lower current density/concentration than cutting.
2. **Diathermy**
   The healing of body tissue generated by resistance to the flow of high-frequency electric current.
3. **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.
4. **Direct Current**
   A flow of electrons in only one direction.

ESU Vocabulary page three

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

2. **Generator:** The machine that coverts low-frequency alternating current to high-frequency electrosurgical current.

3. **Ground, Earth Ground:** The universal conductor and common return point for electric circuits.

4. **Grounded Output:** The output on a electrosurgical generator referenced to ground.

ESU Vocabulary page four

- **Impedance:** A form of electrical resistance observed in an alternating current that is analogous to the classic electrical resistance that occurs in a direct current.
- **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.
- **Leakage Current**: Current that flows along an undesired path, usually to ground; in isolated electrosurgery, RF current that regains its ground reference.

ESU Vocabulary page five

- **Monopolar Output:** A grounded or isolated output on an electrosurgical generator that directs current through the patient to a patient return electrode.
- **Patient Return Electrode (PRE)**: A conductive plate or pad (dispersive electrode) that recovers the therapeutic current from the patient during electrosurgery, disperses it over a wide surface area, and returns it to the electrosurgical generator.
- **Power**: The amount of heat energy produced per second, measured in watts.
- **Power Efficiency Rating (PER)**
  A measure of the ability of an electrosurgical generator to accurately deliver the selected power into a wide range of tissue types.

ESU Vocabulary page six

- **Radio Frequency (RF**): An electrical current that alternates the poles in the radio frequency range (300 kHz–36 Hz); the high-frequency current used in electrosurgery.

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

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

- **Watt**

  The unit of measurement for power.

Test jigs used for preventative maintenance

- Calibrated ESU analyzer
- Return/dispersive/patient cable
- Active/output cable
- Variable 1 to 150 ohm resistor

Preventative Maintenance

Factory recommended schedule every 6 months refer to p 5-19, 5-24

Bipolar output test (page 5-18)

1. Set analyzer load resistance to 100 ohms.
2. Set bipolar power to 10.
3. Press footswitch and measure current in all 3 modes. (Current delivered should be 315 mA +/- 24 mA rms)

Cut mode output test (page 5-19)

1. Set the analyzer load resistance to 300 ohms.
2. Set CUT power to 75 watts.
3. Press CUT footswitch and measure current in the *Pure, Low & Blend* modes. (Current delivered should be 499 mA +/- 38 mA.)
4. Repeat this test on the MONOPOLAR 2 using a hand piece.

Coag output test (page 5-20)

1. Set the analyzer load resistance to 500 ohms.
2. Set CUT power to 75 watts.
3. Press CUT footswitch and measure current in the *Pure, Low & Blend* modes. (Current delivered should be 245 mA +/- 19 mA.)
4. Repeat this test on the MONOPOLAR 2 using a hand piece.

Comment to previous page:

According to the service manual the settings should be: 80W (Low, Med, High), 500ohms, 400mA +/-28mA.

Return **E**lectrode **M**onitoring testing

1. Set var. resistor to 120 ohms and connect to REM jack.
2. Slowly increase resistance until led turns RED and alarms sounds, record trip point. (135 =/- 5 ohms)
3. Disconnect, set to 20 ohms, connect.
4. Slowly decrease resistance until red led and alarm, record trip point. (3-6 ohms)

RF Leakage Testing

refer to page 5-23 “Checking monopolar High Frequency leakage current”

1. Set load to 200 ohms, set cut to 300 watts & pure mode, set coag to 120 watts and spray mode.
2. Activate footswitch in 4 different settings: Open/Closed and Active/Dispersive
3. Record highest current, should not exceed 150 mA

If High Frequency leakage is high:

1. Check REM pad socket connector
2. P.N. S202701854, $160
3. Compare your result with past tests and other similar units