LOTO-eng

AUTOMATIC DRILLING

SPARK ERODER SEC-500

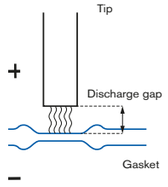
Easy to use, powerful instrument for HP research

How the Eroder Machine works

General principles

The spark eroder machining (spark erosion) is a method involving electrical discharges between an anode (tungsten or copper) and a cathode (tool steel or other tooling material) in a dielectric medium.
The discharges are controlled in such a way that erosion of the tool or work piece takes place.
During the operation, the anode (electrode) works itself down into the gasket, which thus acquires the same contours as the former.
The dielectric, or flushing liquid as it is also called, is ionized during the course of the discharges. The positively charged ions strike the cathode, where upon the temperature in the outermost layer of the steel rises so high (10–50,000°C,18–90,000°F) as to cause the steel there to melt or vaporize, forming tiny drops of molten metal which are flushed out as “chippings” into the dielectric.
The duration and the efficiency of the ablation process depend on several factors which:

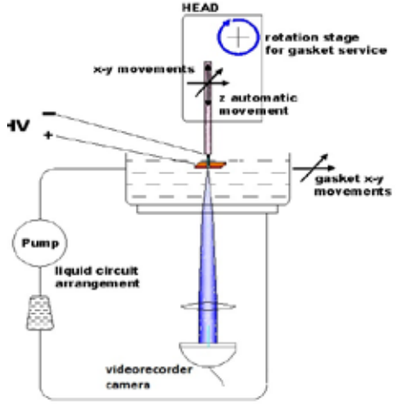
- power and voltage of the discharge
- types of materials used for the tip
- types of materials used for the gasket
- type of used dielectric liquid.



Electrodes discharge

System description

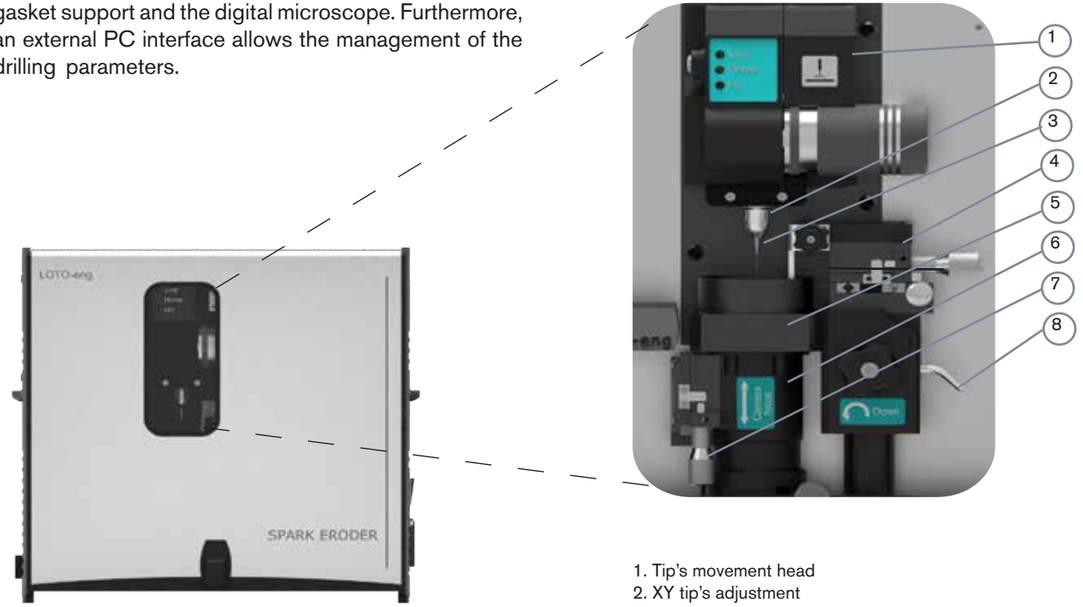
The eroder is driven by a central unit that produces a pulsed electric discharge, the tip (anode) discharges the energy through a dielectric liquid to the gasket (the cathode). A microcontroller manages the advancement of the tip and, by controlling the discharge level, via feedback, allows automatic advancement until the hole is completed. A software controls the drilling functions. Inside, with the door open, the machine with its parts, the working head with the tip, the gasket support with the xy movement system, and the container of the dielectric liquid with the valve and the pump. The camera, positioned under the liquid container, collects the image of the work area. The camera image is visible on the PC monitor.



Inside the machine

The eroder is made up of three main components, an electrical component used to manage the discharge and an electronic component for managing the process, in the rear part of the machine. The front part contains the movement of the tip, the hydraulic circuit with the gasket support and the digital microscope. Furthermore, an external PC interface allows the management of the drilling parameters.

SEC-500 spark eroder uses a manufacturing process to realize precise micro-holes on gasket used in high pressure DAC cell using an electrical discharge.



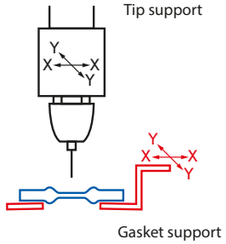
1. Tip’s movement head
2. XY tip’s adjustment
3. Tip
4. XY gasket movement
5. Liquid vessel
6. Digital microscope
7. Focus adjustment
8. Exausted liquid

Easy to use, powerful instrument for HP research

The main components

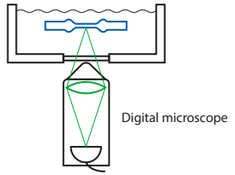
Tip and gasket's adjustment

The tip is the electrode (-) during the discharge which allows the hole in the gasket and is moved on the Z axis. A micromovement on the **x-y** plane allows the centering of the tip in the center of the optical system. The gasket is the (+) electrode and with its support it is moved on the **x-y** plane through a micro translation stage.



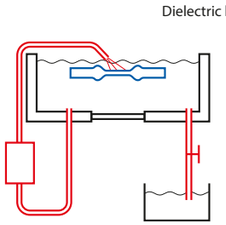
Digital microscope

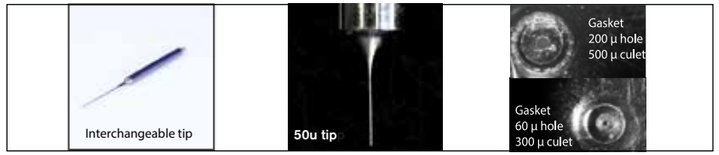
A digital microscope allows you to visualize the surface of the tip or gasket and through a fine movement of the optics it allows you to precisely establish the alignment focal plane.
An optical window allows viewing of the surface through the di-electric liquid.



Dielectric liquid circuit

The dielectric liquid is the medium in which the electrical discharge occurs and controls its uniformity.
The liquid is managed by a hydraulic system that allows the work area to be sprayed through a micropump. The replacement of the same once exhausted is also managed.

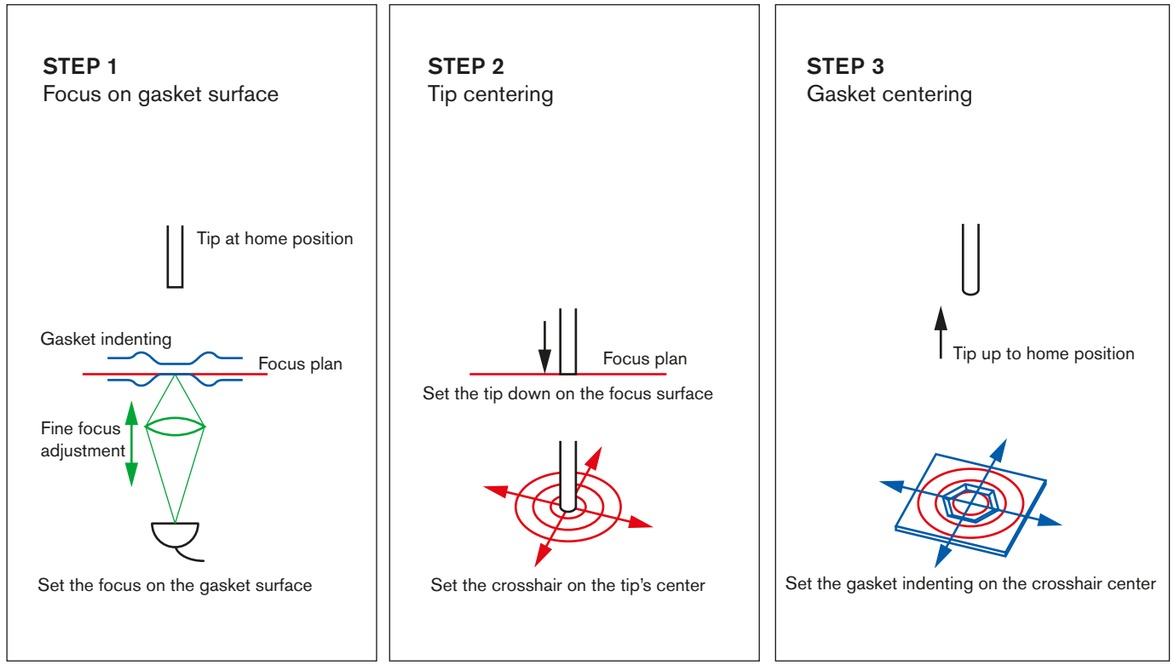




The alignment

The alignment system allows precise completion of the hole that must be made in the center of the gasket indenting. The success of this objective is achieved through three individual steps. **1-Positioning of the focal plane** through fine adjustment of the contrast of the gasket surface image. This is achieved through the micrometric movement of the microscope objective.

2-Positioning the tip on the focal plane and positioning the reference crosshair precisely in the center of the tip. **3-Movement of the tip from the focal plane** and replaced with the gasket which must be positioned in the reference center of the target by means of the micrometric movements that regulate the x-y of the gasket.



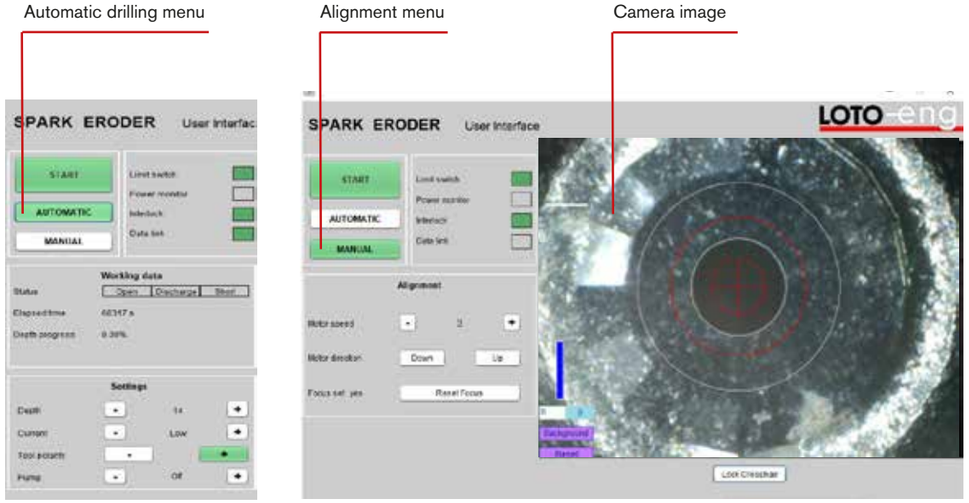
The software

The software installed on a PC manages the motion of the tip and the level of discharge. Then, through a feedback signal, it keeps the tip over the gasket until complete drilling.

The image on the monitor permits to control the alignments of the tip on gasket indenting. Moreover, it allows to visualizing the realization of the hole.

Drilling with small tips means being very careful to the alignment. This is the way to make discharge circular and the hole precise. You can check in the display video

PARAMETERS CONTROL:
-Electrical Discharge
-Automation and feedback
-Precise tip alignment
-Focus plan control
-Polarity inversion



The feature

Technical data

Device name	SEC 500
Application	DAC's Equipment
Electrical spec. 1	Operating V. 100 or 230 VAC 50/60Hz
Electrical spec. 2	High V oltage 300v
Electrical spec. 3	Absorbed power 120 W
Dimensions	240 mm x 13 mm x 230 mm (9.5" x 5.1" x 9") (LxWxH)
Weight	5 kg (11 lbs)
Software	Proprietary
Opearating System	Windows 8-10
Accuracy	0,005 mm (5 micron)
Used material to drill	Steel, Rhenium, Be Cu (conductive)
Tip	Wire 50-500 microns
Dielectric liquid	Eroder machine oil
Camera magnification	100x /200x function fo resolution
Regulatory Compliance	CE
Operat. Environment	Temp: 17°C-26° C(66°F-79°F) ; Relative Humidity: 28-75 %

Makes it easy

Excellent performance are offered by the Spark eroder:

-Easiness in tip alignment to produce precise hole.
-Reduced times in drilling process
-Easy and intuitive software
-Manual and automatic procedure control
-Innovative mechanical solutions
-Totally portable
-Online service

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LOTO-eng develops and manufactures high-quality devices that has always enjoyed a great reputation for durability and reliability.
Our experts work with our customers to develop innovative solutions to support scientists during the HP DAC's experiments.

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