CASE STUDY
AEROSPACE APPLICATION

INTRODUCTION

All companies producing high technology components make efficiency and productivity top priorities. SNECMA wanted to rationalise the operations and the large amount of different tooling required to produce turbine blade & vane cooling holes in civil engines. This applied in particular to the EDM machining of 'shaped' or 'diffuser' holes that have a 3D conical profile at the hole entrance tapering to a cylindrical through hole. Such holes provide more efficient cooling but their shapes are becoming increasingly complex. SARIX's Micro EDM Milling technology and fast hole EDM proved ideally suited to achieving these aims.

OBJECTIVE

The objective was to reduce the number of 3D shape machining operations that require many different tools by using the recently developed SARIX technology of micro-milling and micro-erosion and by using a single electrode diameter. Moreover, compared to present drilling techniques, Micro EDM Milling guarantees a more precise cooling flow by keeping the cylindrical hole in the axis of the conical hole without any significant steps.

SOLUTION IMPLEMENTED

The 7-axis version of the SARIX SX-200 machine has demonstrated both the feasibility and stability of the complete micro EDM process as applied to shaped, conical holes. The choice was confirmed from the very first test that showed it met SNECMA requirements for geometrical shapes, surface quality and above all, airflow. The stability and repeatability of micro-milling is now integrated into production, and has now also been extended to the drilling of all holes of different diameters in a single component using a single diameter electrode.

SPECIFICATIONS

The diameter of the electrode used for the cylindrical holes can vary from 0.20 mm to 0.80 mm. The conical shape is obtained using the same electrode in micro-milling mode with a continuous in process check on its wear and tear. The different conical hole geometries required for improved cooling flow diffusion are controlled by the SX-µEDM-CAM-AERO Micro-Milling application programme.

PRODUCTIVITY

To ensure efficient continuous operation the SX machine uses an integrated electrode changer. The use of only one electrode diameter for all holes was key to the reduction of direct and indirect costs.

The efficiency of this Micro Machining, of which the results meet the productivity targets for the production of this blade, has already put in place the complete drilling of the HP blade of this engine.

SNECMA - Site de Gennevilliers
France - 92702 Colombes
Tel: + 33 1 47 60 72 06

Snecma
Groupe SAFRAN

THE ECONOMICS OF µEDM

SARIX offers automated industrial turn-key µEDM equipment, that compete with traditional process, while having all the advantages of the Micro EDM Machining.
SARIX MICRO EDM machines demand that the operator define the work piece material, electrode material and hole depth. Once it has been set up the machine controls and optimises the process automatically the permanent presence of an operator is not needed and the machine can work as an autonomous production cell.
Parts machined through the µEDM process can be immediately used with no additional finishing.

ABOUT SARIX SA

SARIX designs, manufactures and markets highly efficient Micro-EDM Equipment typically used in many industries such as: die-making, microelectronics, medical, watchmaking, automotive and aerospace as well as research centres and universities.
The SARIX SX-100 and SX-200 product line is designed for use in various Micro EDM Machining modes offering users the highest level of flexibility including Micro-Drilling, Micro-Milling and Micro-Sinking.

THE BEST MICRO EROSION TECHNOLOGY
SARIX
3D Micro - Milling

For additional product information
contact SARIX + 41 91 785 81 71
or visit us @ www.sarix.com

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HIGH PRODUCTIVITY OVER MICRO EDM

Contrary to common belief Micro EDMing is not only used for research and tooling use, but it is also very efficient for production work in specific applications. While cycle time is always an issue to be competitive and most of it to compete with traditional process, SARIX as world leader in Micro EDM Machining and our advanced engineering team has continued to develop and add specific product solutions to meet high volume production requirements.
SARIX offers the advantages of burr-free machining, non material alteration with high surface finishing and superior geometry accuracy and repeatability.
The SARIX µ**EDM** high production machine is recognised to be a technically and economically viable machine for high volume production, capable of meeting the highest technical specifications of the automotive and aircraft industries.

SARIX OFFERS A COMPLETE FAMILY OF FEATURES

- High Pulse Shape Generator
- W-axis for guide position
- A/B indexing axis
- Automatic electrode feeding spindle
- Automatic Electrode changer
- Break Through Detection Device
- High capacity filtering tank & high pressure flushing
- CAM AERO Software

THE BEST MICRO EROSION TECHNOLOGY
SARIX
newsletter 3

Dear Readers,

In the last issue we review the features and the capability of the versatility of the SARIX machines for the prototyping and the tooling users.
In this Newsletter we are focusing in the high productivity performance as well as the machine configuration.
We describe some of the ways the machine can be configured to provide high volume drilling production.

SUMMARY OF CURRENT ISSUE

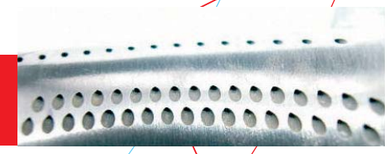
REQUIREMENTS vs. MICRO EDM FEATURES

SARIX develops many products according to customer requirements. High volume SARIX µ**EDM** machines have been created together with several partners in response to rising demand for cost-effective multi-hole applications. The primary requirements of high volume production machines include:

- **High degree of automation**
- **Major autonomy**
- **Production Flexibility**

In recent years, SARIX has developed a large family of feature capable of offering multiple solutions to meet those requirements.
By utilizing the appropriate features, SARIX can provide a tailored individual solution for high production drilling. In this way, each machine is configured to guarantee the maximum throughput ensuring the lowest cost per part.

UNLIMITED HOLE PRODUCTION



The SARIX µ**EDM** technology distinguishes itself by high process reliability and repeatability. The SARIX production machine is generally used for hole sizes between 50 microns and 3 mm.
In addition to round and cylindrical holes, SARIX offers the possibility to drill enhanced hole patterns for very exigent applications.
The illustrations here above show typical examples of shaped-hole and cylindrical hole in drilling production (see Case Study)

BASIC FEATURES OF HIGH PRODUCTION

The accompanying illustration shows how the basic features are integrated onto the machine for enhanced productivity

FEATURES	BENEFITS
High Pulse Shape Generator	• High drilling rates • Higher productivity
W-axis for guide position (available for SX-200)	• Electrode guide for maximum accuracy • Allows different heights of hole position
A/B indexing axis	• Enables two axis rotation of the work piece
Automatic electrode feeding spindle	• High degree of automation • Higher process stability
Automatic electrode changer	• High degree of automation • Higher productivity
Break Through Detection device	• Perfect exit control • Non back wall impact
High capacity filtering tank & high pressure flushing	• Efficient filtering and cooling • Higher process stability
SX-CAM Aero (suitable for complex geometry shapes)	• Reduce programming time • Superior drilling consistency

The choice of any particular features including workpiece holder depends on individual requirements which need to be weighed together with customers to define the most appropriate machine configuration for any given application.

SARIX 3D Micro - Milling

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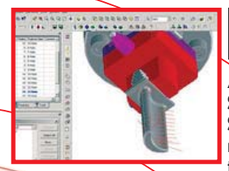
HIGH PULSE SHAPE GENERATOR

The **SX-HPS** allows higher material removal rate. It is the core element for achieving high drilling rates and for when the amount of material to be removed is greater.

SX - CAM AERO



As 3D Model integration module, part of the **SX-µEDM-Milling-CAM** software, the **SX-CAM-AERO** is very useful for positioning rows of holes along complex curve contours. It includes several functions that allow customers to reduce significantly programming time and contribute to accurate hole placement.

W-AXIS FOR GUIDE POSITION

The **SX-200** machine offers the ability to integrate an additional vertical axis (W-axis) for the programmation of the electrode guide height. Users can take advantage to drill complex work pieces by reaching different heights of hole position.

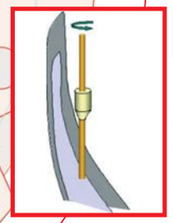
HIGH CAPACITY FILTERING TANK & HIGH PRESSURE

The dielectric unit, **SX-DA**, is a key feature in **µEDM** process. While for prototyping and low volume production a small size tank is used, for high volume production, a high capacity tank is added to ensure higher filtering efficiency and optimum cooling performance. A high pressure flushing circuit is commonly used to optimise cycle times.

A/B INDEXING AXIS

The double A/B indexing axis **SX-AB100C** with an automatic chuck holder 3R or Erowa allows the work piece to be positioned in 5 axis.

BREAK THROUGH DETECTION DEVICE

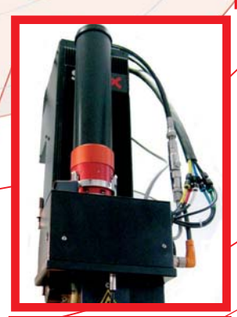


The Break Though Detection feature, **SX-BTD**, detects and controls accurately the electrode break through position during the drilling exit phase. It is especially useful when wall thicknesses are variable such as in cast parts to avoid any back wall touch. The **SX-BTD** warranty the non impact drilling on the back wall inside the cavity of the work piece.

AUTOMATIC ELECTRODE FEEDING SPINDLE

The **SX-344** rotation spindle series includes an automatic electrode feeding system to compensate the electrode wear. Associated with the SX-Revolver, it constitutes an indispensable feature for continuous drilling production

AUTOMATIC ELECTRODE CHANGER



The **SX-Revolver** allows for automatically feeding tool electrodes. It provides major operational autonomy that helps to enhancing automatic drilling operations and machine productivity.

FEATURES & BENEFITS

Major operational autonomy

•

Rods and tubular electrodes

•

Fast and simple set up

•

Seamless integration

AUTOMATIC ELECTRODE CHANGER

The SX-Re-volver is a fully automatic electrode changer providing major operational autonomy and a high degree of automation. Associated with the automatic electrode-feeding system built in to the SX-344 series, the SX-revolver allows automatic feeding of new electrodes with no machine interruptions. It is especially suitable for medium/high volume production enabling to continous operation without the permanent presence of an operator.

The SX-Revolver unit includes a mechanical indexing device and 8-position electrode cartridge. While the cartridge contains tool electrodes, the indexing device automatically positions the cartridge in such way that a new electrode is fed into the rotation spindle ensuring continuous operations.

Depending upon electrode lengths used, two cartridge versions of 300 and 600 mm are available. For any of these lengths the SX-Revolver can handle rods and tube electrodes from 50 micron up to 1.7 mm diameter. The SX-Revolver is designed to be used with high pressure flushing up to 70 bars either with de-ionised water or oil. The chart below is a reference guide showing main technical specifications.

The **SX-Revolver** is designed as a quick swap item, allowing fast electrode cartridge exchanging.
Just a simple clamping and unclamping are needed for mounting and removing the cartridge, minimising downtime and providing great convenience for the operator.
The SX-Revolver is fully managed and monitored using the command panel, SX-MMI.

SX-Revolver model	Standard	Long
Length of electrode	300mm	600mm
Electrode diameter	0.05 – 1.7 mm	0.5 – 1.7mm
Number of electrodes	Max. 8	
Electrode type	Rod/Tubular electrode	
Electrode material	Brass/ Copper / Solid carbide	
Flushing	High pressure de-ionised water / Oil	

SX - REVOLVER EXTENDED MACHINING

The optimum benefit of the electrode changer is achieved when using a second cartridge set. This makes it possible to fill the cartridge with new electrodes outside the machine where there is better accessibility. When using two sets of cartridge the downtime of the machine can be further reduced and productivity considerably improves. The advantages of the SX-Revolver are especially evident when drilling production capacity is needed.