

I_p = constant (TA)

Feed Rate (sheet) (constant) : 500 mm²/min

Aluminium sheet thickness : 2 - 4 mm

Wire Tension: (constant) -optimal value (-1000)

Voltage (variable parameter) : 3 values

-> 50, 89, 131

Duty Cycle (variable parameter):

Ton (us)	Toff (us)	Duty cycle
0.3*	10*	2.9 %*
0.6	9	6.25 %
0.8	8	9.09 %
0.9	5	15.25 %
1.050	4	20.79 %

Wire Feed: 2 values (92, 205)

Repeat : 3 times

Total Experiments: 72 times

OUTPUT PARAMS:

- 1) MRR
- 2) Kerf width
- 3) Surface Roughness* (last priority)

Experiment Design

1. Independent Variables (Factors):

The selected factors influence the Material Removal Rate (MRR) and machining performance in Wire EDM:

a. Cutting Speed (mm/min)

Cutting speed directly influences material removal rate and machining efficiency. It can also impact surface quality, tool wear, and machining time. The effect of cutting speed on surface finish and dimensional accuracy should be examined.

b. Voltage (V)

The applied voltage controls the discharge energy in the EDM process, affecting the spark intensity and the material removal rate. Higher voltages generally increase the energy per discharge, which can lead to a faster machining rate but may also impact surface roughness.

c. Pulse Duration (μs)

Pulse duration controls how long the electrical discharge lasts. A longer pulse duration may lead to deeper sparks, affecting material removal and surface finish. It can also influence heat-affected zones and machining accuracy.

d. Wire Material

Different wire materials (brass, copper, tungsten, etc.) have varying electrical conductivity, melting points, and strength, which can significantly impact the EDM process. Wire material may affect both the machining efficiency and surface quality.

e. Wire Diameter (mm)

Why it's relevant: The diameter of the wire affects the precision and accuracy of the cut. A thicker wire can cut faster but may leave a larger kerf width, affecting surface finish and dimensional accuracy. Smaller wires are typically used for precision cutting.

f. Dielectric Fluid Type and Flow Rate

The dielectric fluid plays a crucial role in cooling the workpiece and flushing away debris. The type and flow rate of the fluid affect both machining performance and surface finish.