CHAPTER - IV

SYSTEM IMPELEMENTATION

4.1 DECISION REGARDING NO. OF CUTS

For Completing any job three different modes of material removals namely Roughing, semi-finishing & finishing can be made use of.

The ultimate choice is primarily guided by the desired surface finish.

If the target surface roughness is between 0.4 μm to 1.4 μm three machining operation modes Roughining, Semi-finishing & Finishing are to be adopted except for small holes where two operation mode only will be necessary.

If the surface roughness required is between 1.4 μm to 2.2 μm two or three machining operation depends comparing the manufacturing cost of a third electrode to the again resulting from the reduction of time by a medium machining stage i.e. semi-finishing.

If the surface roughness required is above 2.2 μm in theory, two operation mode i.e. One Rough cut and one Finish cut will be sufficient. Surface roughness required more than 10 μm can be done by a single cut operation.

The difference between the various surface roughness values of the selected settings will be smaller between finishing and semi-finishing than between semifinishing & roughing.

BASIC FORMULA TO CALCUALTE MACHINING TIME FOR EDM OPERATION

$$\text{Machining Time} = \frac{\text{Material Valume to be removed in } mm^3}{\text{Material Removal rate in } mm^3 / min. \text{ (MRR)}}$$

$$= \frac{V\ mm^3}{M\ mm^3 / min}$$

Where V representes material volume to be removed in mm^3 and M represent Material removal rate in mm^3/min.

A mathmatical model for Material Removal rate for different electrode with work piece material as steel is shown in table 3 (page-51) which has been developed by using Regression analysis in form which Machining time for spark erosion machine is easily calculated.

Similarly a mathmatical model for different work piece material with electrode as Brass is shown in table 4 (page-52) which has been develoo 'ped by using Requression Analysis with the original datas obtained from General Electric Company, Calcutta, from which machining time for wire out machines is easily calculated.

Cost of wirecut of EDM machinies is Rs. 500 / hr. where as cost of spark erosion EDM machines is Rs. 300 / hr. approximatly.

Material wolume to be removed ($V\ mm^3$) = Frontal area x Machining Depth.

Distance between the electrode and workpiece not at right angle to the axis of electrode penetration is known as Frontal gap. The area generated by this gap is known as Frontal area.

Material reomval rate ($M\ mm^3 / min$) are the maximum values which can be obtained only when the Frontal area is enough to accept maximum current.

FOR ROUGHING OPERATION

Frantal area = Total Frontal area - pre machining Frontal area.

FOR FINISHING OPERATION

$$\text{Frontal are} = \left(\frac{\text{Safety cut}}{2}\right) +$$

$$\left(\frac{\text{Dia. limit sparking dist - Dia mean sparking dist}}{2}\right)$$

x Perimeter of Machined Hole.

DIA LIMIT SPEARKING DISTANCE

The difference between the dimension of the electrode and dimension of the cavity, measured at bottom of the oraters.

DIA MEAN SPARKING DIST

The difference between the dimension of the electrode and dimension of the cavity, measured on the median line of creater is known as dia. mean sparking distance.

4.2 INTENSITY LEVEL

Different intensity levels can be selected with generator (Ref. Charmlles D-10 Model). Intesity level allows a mean current of 25A maximum to pass between electrode and Workpiece. Intensity level $^1/_2$, $^1/_4$, $^1/_8$, $^1/_{16}$, $^1/_{32}$ correspondintly represents a mean current of 12.5, 6.25, 3.1, 1.5 and 0.75 amp maxm. to pass between electrode and work piece. The Frontal area between electrode and workpiece is used as a guide in selectiog intensity level as shown in Table 2 (page-50). Recommended intensity level with electrode having different frontal area bas been represented as shown in Table 1 (page-49).

4.3 POLARITY

Machining polarity is always defined by the polarity to which the electrode in connected.

The influence of ploarity depends upon the electrode and work piece material being used.

4.4 SAFETY MARGIN OR SAFETY CUT

An increase in the under-sizing of roughing and semifinishing elictrodes calculated according to the technology to take into account any possible error between axis and shapes of roughing, semi-finishing and finishing electrodes.

4.5 INJECTION / SUCTION, FLUSHING

Circulation of dieelectric fluid in the gap due to a pressure higher than the atmospheric pressure is known as Injection Flushing.

Circulation of dicleetic fluid in the gap due to a pressure lower than the atmospheric presure is known as suction flushing.

TABLE - 1

Frantal area	Recommended intensity level with Electrode	
	Gr + Gr -	Cu + Cu -
0 to 0.1 cm^2	1/8 to 1/4	1/8 to 1/4
0.1 to 0.25 cm^2	1/4 to 1/2	1/4 to 1/2
0.25 to 1 cm^2	1/2 to 1	1/2 to 1
1 to 4 cm^2	1 to 2	1/2 to 2
4 to 16 cm^2	2 to 4	1 to 2
16 to 64cm^2	4 to 8	1 to 2
64 cm^2 and above	8	1 to 2

TABLE - 2

Intcnsity Level	Maximum Current
1/8	3.10 amp
1/4	6.25 amp
1/2	12.50 amp
1	25.00 amp
2	50.00 amp
4	100.00 amp
8	200.00 amp
16	400.00 amp

TABLE - 3

Electrode	Work pice material	Material Remuval rate (mm^3 / min)
Graphite (+ve)	Steel	$X_1 = 295 (X_2)^{0.89} . (X_3)^{0.6}$
Graphite (-ve)	Steel	$X_1 = 295 (X_2)^{.83} . (X_3)^{0.8}$
Cupper (+ve)	Steel	$X_1 = 2089 (X_2)^{1.17} . (X_3)^{1.02}$
Cupper (-ve)	Steel	$X_1 = 0.158 (X_2)^{0.26} . (X_3)^{1.82}$

X_1 ➪ Material Removal rate

X_2 ➪ Surface Roughness required in mm

X_3 ➪ Maxm current in amp.

TABLE - 4

Electrode	Work piece material	Machining speed. (mm^3 / min)
Brass	High Carbon High Cromium (HCHCR)	$X_1 = 2.23 - .027 (X_2)$
Brass	Brass	$X_1 = 3.83 - .041 (X_2)$
Brass	Tungsten Carbide.	$X_1 = 0.41 - .002 (X_2)$
Brass	Steel	$X_1 = 0.45 - .005 (X_2)$

X_1 ⇨ Machining speed

X_2 ⇨ Profile Depth in mm.

$$\text{Machining Time} = \frac{\text{Perimeter of the job to be profiled}}{\text{Machining Speed}}$$