Unit 5

MACHINING TIME CALCULATION

Content 3: Calculation of Machining Time for Drilling and Boring

Drilling is the process of making holes in work piece by means of a revolving tool called drill. The drilling machine can also be used for some other operations like counter-sinking, counter-boring and threading. The machining time for drilling operation is calculated as follows :

$$\text{Time,} \qquad T = \frac{L}{f \times N}$$

L = Length of drill travel
  = Length of hole + Allowance
f = Feed per revolution
N = r.p.m. of drill
Allowance = 0.3 d for 118° drill point angle

Where,

d = Dia of drill in mm.

If

S = Surface cutting speed of drill in meters/min
N = r.p.m. of the drill
d = dia of the drill

$$S = \frac{\pi d N}{1000}$$

Example 1: Estimate the time taken to drill a 25 mm dia × 10 cm deep hole in a casting. First a 10 mm dia drill is used and then the hole is enlarged by a 25 mm diadrill. Assume:

Cutting speed = 15 m/min.
 Feed for f 10 mm drill= 0.22 mm/rev.   Feed for f 25 mm drill= 0.35 mm/rev.

Solution :

(*i*) To calculate the time to drill £ 10 mm hole — 10 cm deep

$$S = 15 \text{ m/min.}$$
$$f = 0.22 \text{ mm/rev.}$$
$$\text{Dia of drill} \quad D = 10 \text{ mm}$$
$$\text{Length of cut} = 10 \text{ cm} = 100 \text{ mm}$$
$$\text{r.p.m. of drill } N = \frac{15 \times 1,000}{\pi \times 10} = 478$$
$$\text{Time taken} = \frac{\text{Length of hole}}{\text{Feed/rev.} \times \text{r.p.m.}}$$
$$= \frac{100}{0.22 \times 478} = 0.95 \text{ min.}$$

(*ii*) To calculate time for enlarging 10 mm dia hole to 25 mm dia hole

$$\text{Dia of drill} = 25 \text{ mm}$$
$$f = 0.35 \text{ mm/rev.}$$

$$N = \frac{15 \times 1,000}{\pi \times 25} = 190 \text{ r.p.m.}$$
$$\text{Time taken} = \frac{100}{0.35 \times 190} = 1.5 \text{ min.}$$

Total time to drill the hole $= 0.95 + 1.5 = 2.45$ min.

Example 2: Calculate the machining time to drill four 8 mm dia holes and one 40 mm dia central hole in the flange shown in Fig. 5.26.
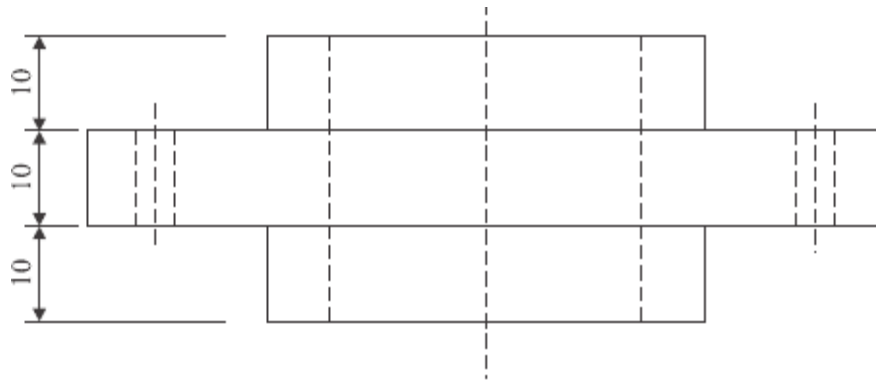
Fig. 5.26

20 mm dia hole is drilled first and then enlarged to 40 mm f hole. Take cutting speed 10 m/min, feed for 8 mm drill 0.1 mm/rev, for 20 mm drill feed is 0.2 mm/rev.and for 40 mm f drill feed is 0.4 mm/rev.

Solution:

(*i*) Time to drill four 8 mm dia holes

$S = 10$ m/min.

Dia of drill $D = 8$ mm.

$$L = 10 \text{ mm}$$

$$f = 0.1 \text{ mm/rev.}$$

$$N = \frac{S \times 1{,}000}{\pi D} = \frac{10 \times 1{,}000}{\pi 8}$$

$$= 398 \text{ r.p.m.}$$

$$\text{Time taken to drill one hole} = \frac{L}{f \times N} = \frac{10}{0.1 \times 398}$$

$$= 0.25 \text{ min.}$$

$$\text{Time to drill 4 holes} = 0.25 \times 4 = 1 \text{ minute.}$$

(*ii*) Time to drill one hole of 40 mm diameter :

This hole is made in two steps :

(*a*) Drill 20 mm f hole — 30 mm long

$$N = \frac{10 \times 1{,}000}{\pi \times 20} = 159 \text{ r.p.m.}$$

$$\text{Time taken} = \frac{30}{0.2 \times 159} = 0.95 \text{ min.}$$

(ii) Enlarge 20 mm f hole with 40 mm f drill

Here
$$N = \frac{10 \times 1,000}{\pi \times 40} = 80 \text{ r.p.m.}$$

$$f = 0.4 \text{ mm/rev.}$$

$$\text{Time taken} = \frac{30}{0.4 \times 80} = 0.94 \text{ min.}$$

Total time taken to drill all the holes $= 1.0 + 0.95 + 0.94 = 2.9$ min.