Chapter 14- Single Station Manufacturing Cells

Example 1

A total of 800 parts must be produced in the lathe section of the machine shop during a particular 40-hr week. The average machine cycle time to produce a shaft is 11.5 min. How many lathes are required during the week?

$n = \frac{WL}{AT}$ — n: number of machine, AT = Available time, WL = Workload

$WL = Q \cdot T_c$

$AT = 40hr.$

Given $Q = 800$ shafts

$T_c = 11.5$ min/shafts

$WL = 800 \cdot (11.5\ min) = 9.200\ min = 153,3hr.$

$n = \frac{9.200(1/60)}{40} = 3.83$ lathes $\Rightarrow$ 4 lathes.

Several factors present in most real life manufacturing systems complicate the computation of the number of the workstations. These are setup time, Availability (reliability), utilization (Job sche), Defect rate

These factors affect how many W.S and/or worker are required

Example 2

A total of 800 parts must be produced in the lathe section of the machine shop during a particular 40-hr week. The parts are of 20 different styles, and each style is produced I its own batch. Average batch quantity is 40 parts. Each batch requires a setup and the average setup time is 3.5 hr. The average machine cycle time to produce a shaft is 11.5 min. Availability on the lathes is 100%. How many lathes are required during the week?

Given $Q = 800$ shafts

$m = 20$ different types of shafts

average batch size 40 parts

$T_s = 3.5hr.$

$T_c = 11.5h.$

$WL = (Q \cdot T_c) + (T_s \cdot \text{number of batches})$

$= 153.3 + (3.5 \cdot 20) \Rightarrow 223.33hr$

$n = \frac{WL}{AT} = \frac{223.33}{40} \Rightarrow 5.58$ lathes

In this example we know the number of set up time. Let's see if we don't know the number of set up.

Example 5

A stamping plant must be designed to supply an automotive engine plant with sheet metal stampings. The plant will operate one 8 hour shift for 250 days per year and must produce 15,000,000 good quality stampings annually. Batch size = 10,000 good stampings produced per batch. Scrap rate = 5%. On average it takes 3.0 sec to produce each stamping when the presses are running. Before each batch, the press must be set up, and it takes 4 hr. to accomplish each setup. Presses are 90% reliable during production and 100% reliable during setup. How many stamping presses will be required to accomplish the specified production?

$WL = 13,157.9$ hr.

11 press.

$$WL = \frac{15,000,000(3/3600)}{1 - 0.05}$$

$AT = 250(8)(0.90) = 1800$ hr/yr. per press

Setup: number batches/yr $= \frac{15,000,000}{10,000} = 1500$ batches $= 1500$ setup

$WL = 1500(4) = 6000$ hr/yr

$AT = 250(8) = 2000$ hr/per press

$$n = \frac{13,157.9}{1800} + \frac{6000}{2000} = 7.31 + 3.0 = 10.31$$

$= 11$ press

Example 7

A machine shop has many CNC lathes that operate on a semiautomatic cycle under part program control. A significant number of these machines produce the same part, with a machine cycle time= 2.75 min. One worker is required to perform unloading and loading of parts at the end of the cycle. This takes 25 sec. determine how many machines one worker can service if it takes an average of 20 sec to walk between the machines and no machine idle time is allowed.

$$n = \text{max integer} \leq \frac{T_m + T_s}{T_s + T_r}$$

T_m = Machine cycle time
T_s = Service time
T_r = repositioning time.

Given $T_m = 2.75\,\text{min}$

$T_s = 25\,\text{sec} \Rightarrow 0.4167\,\text{min}$

$T_r = 20\,\text{sec} = 0.\overline{33}\,\text{min}$

$$n = \text{max integer} \leq \frac{2.75 + 0.4167}{0.4167 + 0.3333} = \frac{3.1667}{0.75} = 4.22$$

4 machines.