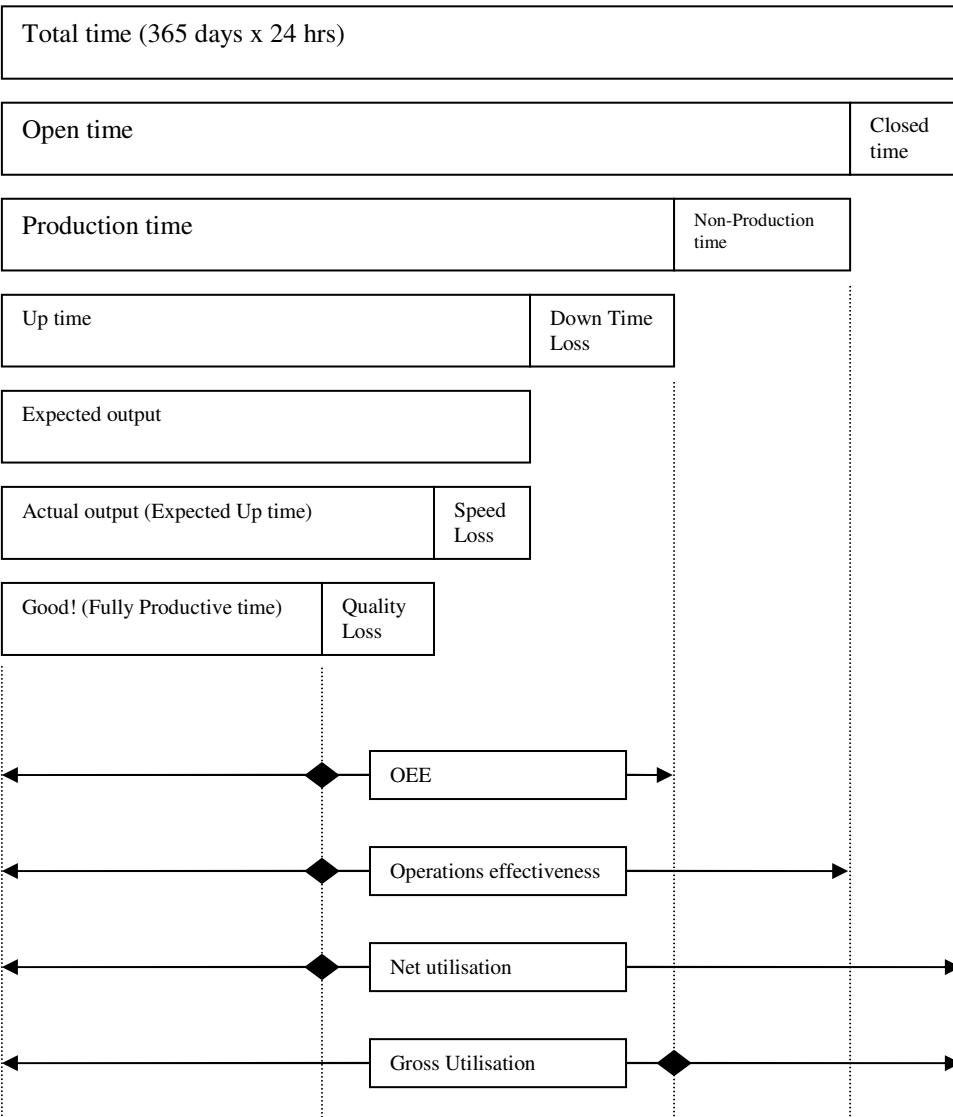


Production Effectiveness

aspectpl



World Class OEE		Six Major Losses	
Availability	90.0%	Breakdowns	Down time loss
Performance	95.0%	Setup and Adjustments	Down time loss
Quality	99.9%	Small Stops/Idling	Speed loss
OEE	85.0%	Reduced Speed	Speed loss
		Startup Rejects	Quality loss
		Production Rejects	Quality loss

Closed times are those times where the plant or equipment is inactive i.e. ‘not open for business’ e.g. weekends, holidays, night shift.

Non-production is the category of time where there is no intention of producing saleable material (e.g. scheduled maintenance, periods where there is nothing to produce, or test/trial runs).

Up time is the category of time when something is coming out of the equipment, regardless of the amount, speed or quality. Down Time loss occurs due to changeover times, equipment failures, material shortages, no operator, waiting for paperwork etc.

$$\text{Availability} = \frac{\text{Up time}}{\text{Production time}}$$

Speed loss includes any factors that cause the process to operate at less than the maximum possible speed, when running. Examples include machine wear, substandard materials, short stops, and operator inefficiency.

$$\begin{aligned} \text{Performance} &= \frac{\text{Actual output}}{\text{Expected output}} = \frac{\text{Expected Up time}}{\text{Up time}} \\ &= (\frac{\text{Actual output}}{\text{Theoretical Cycle time}}) \times \text{Up time} \end{aligned}$$

Quality loss occurs when produced material do not meet quality standards, including pieces that require rework i.e. Quality measurement is based on first time through quality.

$$\text{Quality} = \frac{\text{Good output}}{\text{Actual output}} = \frac{\text{Fully Productive time}}{\text{Expected Up time}}$$

Overall Equipment Effectiveness (OEE) is a manufacturing measurement of equipment performance which indicates Down Time, Speed and Quality losses

$$\text{OEE} = \text{Availability} \times \text{Performance} \times \text{Quality} = \frac{\text{Fully Productive time}}{\text{Production time}}$$

Operations effectiveness is a measure of how effectively the open time is being used to produce good output.

$$\text{Operations effectiveness} = \frac{\text{Fully Productive time}}{\text{Open time}}$$

Net utilisation is a measure of how effectively the total time is being used to produce good output.

$$\text{Net utilisation} = \frac{\text{Fully Productive time}}{\text{Total time}}$$

Gross utilisation is a measure of time spent making good and bad output in relation to the total time.

$$\text{Gross Utilisation} = \frac{\text{Production time}}{\text{Total time}}$$

A machine’s OEE over several jobs is calculated by translating each job to its various time portions as shown on the left and then adding up the corresponding portions before calculating the availability, performance, quality and OEE. Different techniques have been suggested, however this method was used because the common denominator across all jobs is time and the three losses can be identified using time which then can be expressed as hourly rate losses. Theoretical maximum speed (Theoretical cycle time) for a product on a machine should be set at such a value that it is impossible for the performance to exceed 100%. Performance will be capped at 100% so that it does not disguise the availability and quality.