

★ LOSS 구조도의 변형에 의한 설비종합효율 산출법 ★

TPM컨설턴트/품질기술사 권오운

Time available 카렌다시간(24h=T)	
Planned runtime 부하(조업)시간	Planned stop time 계획휴지시간
Production time 가동시간	Change time(color, tools, test) 준비, 조정, 교체시간
Net Production time 정미가동시간	Unplanned stop time 정지시간
Usable Production time 유효가동시간	Time loss 기타 손실시간(성능로스시간 : 잠깐정지, 속도저하)
Net Production time 가치가동시간	Time to produce shrinkage 불량발생시간

시간 구조 ▶ Time available 카렌다시간 → 24h=T
 Planned runtime 부하(조업)시간 → T-T Stop
 Production time 가동시간 → T-T Stop-T Prep.
 Net Production time 정미가동시간 → T-T Stop-T Prep.-T Trouble
 Usable Production time 유효가동시간 → T-T Stop-T Prep.-T Trouble-T Loss
 Net Productive time 가치가동시간 → T-T Stop-T Prep.-T Trouble-T Loss-T Defect

LOSS 시간 ▶ Planned stop time 계획휴지시간 → T Stop
 Change time(color, tool, test) 준비, 조정, 교체시간 → T Prep.
 Unplanned stop time 정지시간 → T Trouble time
 Time to produce shrinkage 불량발생시간 → T Defect
 Time loss 기타손실시간(성능로스) → T Loss

★ 설비효율산출 공식(한국 및 일본식과의 대비 설명)

$$Benefit(TPM) = \frac{Availability(T) - Planned\ Stop\ Time(T_{STOP})}{Availability(T)} \times 100$$

$$부하율 = \frac{부하시간}{카렌다시간} \times 100$$

$$Planned\ Availability = \frac{Runtime(T - T_{STOP}) - Change\ Time(T_{PREP})}{Runtime(T - T_{STOP})} \times 100$$

$$계획가동률(시간가동률) = \frac{가동시간}{부하시간} \times 100$$

$$Production\ readiness = \frac{Operating\ time(T - T_{STOP} - T_{PREP}) - Unplanned\ Stop\ Time(T_{TroubleTime})}{Operating\ time(T - T_{STOP} - T_{PREP})} \times 100$$

$$생산준비율 = \frac{정미가동시간}{가동시간} \times 100$$

$$Quality\ rate = \frac{Usable\ operating\ time(T - T_{ST} - T_{PR} - T_{TT} - T_L) - Time\ to\ produce\ shrinkage(T_{DEFECT})}{Usable\ operating\ time(T - T_{ST} - T_{PR} - T_{TT} - T_L)} \times 100$$

$$양품률 = \frac{가치가동시간}{유효가동시간} \times 100$$

$$Productivity = Planned\ Availability \times Production\ readiness$$

$$생산성 = 계획가동률 \times 생산준비율$$

$$OEE = Productivity \times Performance\ effectivity \times Quality\ rate$$

$$= \left(\frac{가동시간}{부하시간} \times \frac{정미가동시간}{가동시간} \right) \times \frac{유효가동시간}{정미가동시간} \times \frac{가치가동시간}{유효가동시간} = \frac{가치가동시간}{부하시간}$$

$$OEE = Overall\ equipment\ effectivity \quad \text{설비 종합 효율}$$

OLE = Overall equipment effectivity **설비종합효율**

$$= \frac{\text{Net production time(가치가동시간)}}{\text{Planned runtime(부하시간)}} \rightarrow \text{What is the effectivity during production}$$

$$NEE = \text{Production readiness(생산준비율)} \times \text{Performance effectivity(성능가동률)} \times \text{Quality rate(양품율)}$$

$$= \frac{\text{순가동시간}}{\text{가동시간}} \times \frac{\text{유효가동시간}}{\text{정미가동시간}} \times \frac{\text{가치가동시간}}{\text{유효가동시간}} = \frac{\text{가치가동시간}}{\text{가동시간}}$$

$$NEE = \text{Net equipment effectivity} \quad \text{정미설비효율(순설비효율)}$$

$$= \frac{\text{Net production time(가치가동시간)}}{\text{Production time(가동시간)}} \rightarrow \text{What is the machine doing during runtime}$$

$$TEEP = \text{Benefit(부하율)} \times \text{Productivity(생산성)} \times \text{Performance effectivity(성능가동률)} \times \text{Quality rate(양품율)}$$

$$= \frac{\text{부하시간}}{\text{카렌다시간}} \times \left(\frac{\text{가동시간}}{\text{부하시간}} \times \frac{\text{정미가동시간}}{\text{가동시간}} \right) \times \frac{\text{유효가동시간}}{\text{정미가동시간}} \times \frac{\text{가치가동시간}}{\text{유효가동시간}} = \frac{\text{가치가동시간}}{\text{카렌다시간}}$$

$$TEEP = \text{Total effective equipment productivity} \quad \text{종합유효설비생산성(플랜트종합효율)}$$

$$= \frac{\text{Net production time(가치가동시간)}}{\text{Time you have machine(카렌다시간)}} \rightarrow \text{Machine condition and capacity(설비상태 및 성능)}$$