

# Maintenance Performance Measures



## Maintenance Performance

Management needs information of maintenance performance for planning and controlling the maintenance process. The information needs to focus on the effectiveness and efficiency of the maintenance process, its activities, organization, cooperation and coordination with other units of the organization.

## OEE

Maintenance Performance Measurement (MPM) is the multidisciplinary process of measuring and justifying the value created by maintenance investment, and taking care of the organization's stockholder's requirements viewed strategically from the overall business perspective.

## Example

# Maintenance Performance Measures

## Maintenance Performance

Maintenance productivity aims at minimizing the maintenance cost dealing with the measurement of overall maintenance results/performance and maximizing the overall maintenance performance

Some of the important measures of maintenance productivity are:

Total cost of maintenance/total production cost;

- A (availability)
- Mean time to repair (MTTR)
- Mean time between failure (MTBF)
- Overall Equipment Effectiveness (OEE)

OEE

Example

# Maintenance Performance Measures



Maintenance  
Performance

OEE

- ❑ (OEE) is a way to monitor and improve the efficiency of your manufacturing process.
- ❑ OEE has become an accepted management tool to measure and evaluate plant floor productivity.
- ❑ OEE is broken down into three measuring metrics of Availability, Performance, and Quality.

$$\text{OEE} = \text{Availability} \times \text{Performance} \times \text{Quality}$$

Example



Maintenance  
Performance

$$\text{Availability} = \text{Run Time} / \text{Total Time}$$
$$= \text{Operating Time} / \text{Planned Production Time}$$

OEE

Percentage of the actual amount of production time the machine is running to the production time the machine is available.

The total run time of the machine subtracting all unplanned downtime

Scheduled maintenance, planned downtime events, or equipment trials are not considered to be part of the time that machines are available for production

Example



Maintenance  
Performance

OEE

$$\begin{aligned} \text{Performance} &= \text{Total Count} / \text{Target Count} \\ &= \text{Ideal Cycle Time} / \text{Operating Time} \\ &= \text{Ideal Cycle Time} / (\text{Operating Time} / \text{Total Pieces}) \\ &= (\text{Total Pieces} / \text{Operating Time}) / \text{Ideal Run time} \end{aligned}$$

Percentage of total parts produced on the machine to the production rate of machine.

How well a machine is running when it is running

Example



Maintenance  
Performance

$$\text{Quality} = \text{Good Count} / \text{Total Count}$$

Percentage of good parts out of the total parts produced on the machine.

**OEE**

How many good parts versus bad parts a machine has produced

Example

# Maintenance Performance Measures



Maintenance Performance

OEE

Example

OEE Loss Category	OEE Metric	Loss Category Examples
Down Time Losses	Availability	<ol style="list-style-type: none"> <li>1. Equipment Failures</li> <li>2. Tooling Damage</li> <li>3. Unplanned Maintenance</li> <li>4. Process Warm Up</li> <li>5. Machine Changeovers</li> <li>6. Material Shortage</li> </ol>
Speed Losses	Performance	<ol style="list-style-type: none"> <li>1. Product Misfeeds</li> <li>2. Component Jams</li> <li>3. Product Flow Stoppage</li> <li>4. Level of Machine Operator Training</li> <li>5. Equipment Age</li> <li>6. Tooling Wear</li> </ol>
Quality Losses	Quality	<ol style="list-style-type: none"> <li>1. Tolerance Adjustments</li> <li>2. Warm Up Process</li> <li>3. Damage</li> <li>4. Assembled Incorrectly</li> <li>5. Rejects</li> <li>6. Rework</li> </ol>

# Maintenance Performance Measures



Calculate OEE for the following machine information

Maintenance  
Performance

OEE

Item	Data
<b>Shift Length</b>	8 hours = 480 min.
<b>Short Breaks</b>	2 @ 15 min. = 30 min.
<b>Meal Break</b>	1 @ 30 min. = 30 min.
<b>Down Time</b>	47 minutes
<b>Ideal Run Rate</b>	60 pieces per minute
<b>Total Pieces</b>	19,271 pieces
<b>Reject Pieces</b>	423 pieces

Example

# Maintenance Performance Measures



Maintenance  
Performance

$$\begin{aligned} \text{Planned Production Time} &= [\text{Shift Length} - \text{Breaks}] \\ &= [480 - 60] = 420 \text{ minutes} \end{aligned}$$

OEE

$$\begin{aligned} \text{Operating Time} &= [\text{Planned Production Time} - \text{Down Time}] \\ &= [420 - 47] = 373 \text{ minutes} \end{aligned}$$

Example

$$\begin{aligned} \text{Good Pieces} &= [\text{Total Pieces} - \text{Reject Pieces}] \\ &= [19,271 - 423] = 18,848 \text{ pieces} \end{aligned}$$

# Maintenance Performance Measures



Maintenance Performance

<b>Availability</b>	=	<b>Operating Time / Planned Production Time</b>
	=	373 minutes / 420 minutes
	=	0.8881 (88.81%)

OEE

<b>Performance</b>	=	<b>(Total Pieces / Operating Time) / Ideal Run Rate</b>
	=	(19,271 pieces / 373 minutes) / 60 pieces per minute
	=	0.8611 (86.11%)

Example

<b>Quality</b>	=	<b>Good Pieces / Total Pieces</b>
	=	18,848 / 19,271 pieces
	=	0.9780 (97.80%)

<b>OEE</b>	=	<b>Availability x Performance x Quality</b>
	=	0.8881 x 0.8611 x 0.9780
	=	0.7479 (74.79%)