



# OEE Insight Series – Introduction

## Who are we?

At Industrial Network Systems we’re dedicated to helping manufacturing companies increase their productivity and profits.

INS was started 21 years ago solely to supply customers with scalable factory automation solutions that deliver increased productivity and ROI from manufacturing and throughout the enterprise. Over time our focus has evolved to providing solutions that collect, distribute, control and provide visualization of information from any plant floor system.

Our MI Group (Manufacturing Intelligence) is the consultative side of our business. We are experts at bringing together large amounts of manufacturing data from multiple sources and using analytical and visualization tools, deliver the right data; to the right people; at the right time.

Our team has amassed decades of experience working for major manufacturing companies, first as internal technical resource and now as technical consultants within the MI Group. Helping companies locate, analyze, store and then visualize the necessary data to track their OEE is our specialty.

Manufacturers we have done work for include:





## Overall Equipment Effectiveness Explained

In an ideal environment, all equipment would operate all the time at full capacity producing good quality product. In real life, however, this situation is almost non-existent. Put simply overall equipment effectiveness (OEE) is a measure of what you actually made over what you could have made in theory over that timeframe. The difference between the ideal and actual situation is due to losses. These losses can be categorized into various metrics that provide you with excellent data to enable you to target that specific area and help you **Improve**.

The three main categories of OEE are Availability, Performance and Quality. By measuring the performance in each of these categories and multiplying the result will give you the OEE figure. These three categories are subdivided into what is known as the 'Six Losses'.

## OEE Calculation

### OEE Category Calculation

OEE Category	Calculation
Availability	Operating time / Planned production time
Performance	Net operating time / Operating time
Quality	Fully productive time / Net operating time

**OEE = Availability X Performance X Quality**

## Six Loss and Counter Measures

One of the major goals in TPM or OEE improvement programs is to reduce or eliminate the Six Losses. It allows us to accurately pinpoint the area of focus that will improve the efficiency of the equipment. The table on the following page explains the Six Losses and how they can be addressed:



Six loss category	OEE measure	Reason for Loss	Countermeasures
Planned downtime or external unplanned event	Availability	<ul style="list-style-type: none"> <li>Changeovers</li> <li>Asset care</li> <li>Planned Maintenance</li> <li>Material shortages</li> <li>Labour shortages</li> </ul>	<ul style="list-style-type: none"> <li>SMED – quick changeover techniques</li> <li>Benchmarking</li> <li>Planned downtime log and matrix</li> </ul>
Breakdowns	Availability	<ul style="list-style-type: none"> <li>Equipment failure &gt;5mins</li> <li>Major component failure</li> <li>Unplanned maintenance</li> </ul>	<ul style="list-style-type: none"> <li>Asset care or preventative maintenance</li> <li>Lubrication</li> <li>Root cause analysis</li> <li>Electrical thermographs or vibration analysis</li> </ul>
Minor stops	Performance	<ul style="list-style-type: none"> <li>Equipment failure &lt;5mins</li> <li>Fallen product</li> <li>Obstruction</li> <li>blockages</li> </ul>	<ul style="list-style-type: none"> <li>Targeted reduction of MTBF</li> <li>High speed cameras</li> <li>Tick sheets for further analysis</li> <li>OEM audit and servicing</li> </ul>
Speed loss	Performance	<ul style="list-style-type: none"> <li>Running lower than rated speed</li> <li>Untrained operator not able to run at nominal speed</li> <li>Machine idling</li> </ul>	<ul style="list-style-type: none"> <li>Optimising line control</li> <li>Training and awareness of line balance theory</li> </ul>
Production rejects	Quality	<ul style="list-style-type: none"> <li>Product out of specification</li> <li>Damaged product</li> <li>scrap</li> </ul>	<ul style="list-style-type: none"> <li>Error proofing</li> <li>Six Sigma</li> <li>Targeted analysis of reject area to analyse cause</li> </ul>
Rejects on start up	Quality	<ul style="list-style-type: none"> <li>Product out of specification at start of run</li> <li>Scrap created before nominal running after changeover</li> <li>Damaged product after planned maintenance activity</li> </ul>	<ul style="list-style-type: none"> <li>Precision settings</li> <li>Ensure machine availability on start up</li> <li>Complete all checks before start up</li> </ul>

**Six loss category OEE measure Reason for Loss Countermeasures**

Six loss category	Calculation
Planned downtime or external unplanned event	Planned downtime / Total production time
Breakdowns (>5mins)	Major fault time / Total production time
Minor stops (<5mins)	Minor fault time / Total production time
Speed loss	(Output / Ave speedxTotal production time) – (Output / Rated speedxTotal production time)
Production rejects	Rejects in production / Actual speedxTotal production time
Rejects on start up	Rejects on start up / Actual speedxTotal production time



### OEE and Six Loss Analysis Calculation Example

In a 480 minute (8 hour) shift

On a machine rated at 100 products output per minute

Maximum output = 480 minutes x 100 units = 48000 units

- Shift info: Output (Good Production) = 32000 units
- Speed = 98 units per minute
- Planned downtime = 82 minutes
- Bottleneck loss due to B/down = 30 minutes
- Rejects (in process) = 1255 in 8 hr shift

Output (OEE) = 32000 / 48000 = 66.7%

480mins x 66.67% = 320 minutes, therefore Total Loss = 160 minutes

#### Six Loss Calculations:

##### Speed loss

Max theoretical units possible at actual speed = 98 x 480 = 47040

(32000/47040) – (32000/48000) =

68.03% - 66.67% = 1.36%

480 x 1.36%

= 6.53 minutes / 480 = (1.36%)

##### Planned downtime

= 82 minutes / 480 = (17.08%)

##### Breakdown

= 30 minutes / 480 = (6.25%)

##### Rejects

1255 / 98 (actual running speed)

= 12.81 minutes / 480 = (2.67%)

##### Minor stops

480-320-6.53-82-30-12.81

= 28.66 minutes / 480 = (5.97%)

**Total loss = 160 minutes = (33.33%)**

#### OEE Calculations (Time in minutes):

##### Availability Loss

Production time = 480

- Planned downtime =82

- Breakdowns =30

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Total =112

##### Performance Loss

Time less availability loss = 368

- Speed loss =6.53

- Minor stops (<5mins) =28.66

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Total =35.19

##### Quality Loss

Time less performance loss = 333

- Rejects on start up =0

- Rejects in process =12.81

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Total =12.81

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Availability (368/480) = 77%

Performance (333/368) = 90%

Quality (320/333) = 96%

**OEE = 0.77x0.9x0.96 = 66.7%**