WHAT IS OVERALL EQUIPMENT EFFECTIVENESS?

Overall Equipment Effectiveness (OEE) is one of the most common Key Performance Indicators (KPI) used to measure the performance of your manufacturing process. It’s comprised of the following three components: Availability, Performance, and Quality. By multiplying each component together, a single OEE number is calculated.

WHY USE OVERALL EQUIPMENT EFFECTIVENESS?

Although OEE encompasses many components, it provides one number on a scale from 0 to 100% to determine how your process is running. OEE is quick and easy to understand by all levels of personnel. It can quickly identify weaknesses in your process.

CALCULATING OVERALL EQUIPMENT EFFECTIVENESS

\[
OEE = \text{Availability} \times \text{Performance} \times \text{Quality}
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**Availability** is a measure of the ratio of running time to available time.

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\text{Availability} = \frac{\text{Running Time}}{\text{Available Time}}
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**Performance** is a measure of how long it should take to produce a given quantity of products vs how long it “actually” took.

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\text{Performance} = \frac{\text{(Total Pieces} / \text{Running Time})}{\text{Ideal Time}}
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**Quality** is a measure of your good parts to total parts produced.

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\text{Quality} = \frac{\text{Good Pieces}}{\text{Total Pieces}}
\]
EXAMPLE OVERALL EQUIPMENT EFFECTIVENESS CALCULATION

Let’s break it down into real numbers. Remember, 
OEE = Availability x Performance x Quality.

AVAILABILITY = RUNNING TIME / AVAILABLE TIME

AVAILABLE TIME

In our example, available time is the maximum shift time minus break time. Assume there is an eight hour shift with one half hour break and two fifteen minute breaks.

This equates to 480 minutes – 60 break minutes, or 420 minutes.

RUNNING TIME

The maximum Running Time could be the same as the Available Time, but this is rarely the case. Let’s subtract 20 minutes of downtime.

This leaves us with 400 minutes of Running Time. Divide the Running Time by the total Available Time to receive the Availability.

• Availability = Running Time / Available Time
• Availability = 400 minutes / 420 minutes
• Availability = 95.24%

PERFORMANCE =
(TOTAL PIECES / RUNNING TIME) / IDEAL TIME

Calculating Performance requires knowing the total pieces produced by the equipment. In this case, let’s assume 250 pieces. Divide the Total Pieces produced by the Total Running time. Next we have to divide the result by the Ideal Time, which will be 1 Piece Per Minute.

• Performance = (Total Pieces / Running Time) / Ideal Time
• Performance = (250 pieces / 400 minutes) / 1 Pieces Per Minute
• Performance = 62.5%
QUALITY = GOOD PIECES / TOTAL PIECES

We previously mentioned the Total Pieces (250 pieces) produced, and we’ll use them again to calculate Quality. In a perfect world, we will never have waste, but let’s assume 10 wasted pieces. To calculate the Good Pieces, subtract the Wasted Pieces from the Total.

Good Pieces = 250 Total Pieces – 10 Wasted Pieces

Good Pieces = 240 Pieces

- Quality = Good Pieces / Total Pieces
- Quality = 240 pieces / 250 pieces
- Quality = 96%

FINAL OVERALL EQUIPMENT EFFICIENCY CALCULATION

OEE = Availability x Performance x Quality

- OEE = 95.24% x 62.5% x 96%
- OEE = 0.9524 x 0.625 x 0.96 = .5714
- OEE = 57.14%

It’s easy to see that based on one single number (OEE), you can quickly determine that something has gone wrong in your process. By diving a little deeper, you can begin to see what’s happened.

The example process was down for a total of 20 minutes and there were 240 Good Pieces produced out of a total of 250. The process was running much slower than expected, decreasing efficiency.

The Overall Equipment Efficiency score provides insight on where to investigate these inefficiencies. Maybe the machine operator had inadvertently slowed down the machine.

BENEFITS OF USING OEE

The benefits of using OEE can help any company in achieving World Class recognition.

OEE helps to

1. Decrease machine downtime & increase machine uptime
2. Increase labor efficiencies
3. Increase productivity
4. Increase quality of product & reduce the amount of waste

PROBLEMS ASSOCIATED WITH
MANUAL COLLECTION

OEE is a very powerful tool, but it’s only as good as the data that is collected. Many plants still collect much of this data manually. Many times the data is hand collected by the operators and entered into an old database. This process opens itself up to many mistakes, typos, wasted time and it relies on the honesty of the data collector.

BENEFITS OF AUTOMATED SYSTEM

An automated system would not only eliminate the time needed to collect and enter the data, but would also provide accurate data and calculations. Data can be obtained from either a DCS or PLC control system, collected by an OPC server, and integrated with a custom database with reporting capabilities; the options are endless.

Imagine sitting in your office and being able to monitor the performance of your facilities anywhere in the world. Although OEE can be calculated by hand and recorded, the benefits of an automated system can reduce clerical errors, improve time accuracy, and provide real time metrics throughout the day.

CLOSING

In today’s economy, it’s become more important to get more out of your equipment than ever. OEE is your pathway forward. It utilizes a standardized mythology that has worked for many of the top performing companies and it’s simple: How can you improve your process without knowing where your problems exist?

OEE is not soft science; it provides real data that many leaders use in their daily meetings. It identifies weaknesses in your process, of which many are very inexpensive to fix. Innovative Controls has a proven track record that has empowered many companies to establish a good baseline of their manufacturing process by installing an automated OEE System.
Nabil Salman graduated from Mercer University, with a degree in Electrical Engineering. Nabil has extensive controls experience in both discrete automation and process manufacturing.

He has worked in many industries such as Specialty Chemicals, Food and Beverage, Medical, and Water/Waste Water.

Specialties Include:
Rockwell Automation Control Systems
Automated OEE Systems
Virtualization Applications
Legacy Migrations

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