

## Don't Be Misled by O.E.E.

Overall equipment effectiveness (O.E.E.) has been used as one of the more important “maintenance metrics” since Total Productive Maintenance (TPM) came to the U.S. in the late 1980s. O.E.E. is the primary measure used in TPM to identify and quantify the major equipment-related losses and a metric for rating “equipment effectiveness.” O.E.E. has become widely used in many plants with or without the elements of TPM in place since the early years of TPM to quantify equipment effectiveness losses. This usage has also caused some confusion and has led to many misuses of the O.E.E. percentage calculation.

The early Toyota Production System focused on “*eliminating waste to reduce cost.*” O.E.E. was initially developed to identify the “major losses” in equipment performance and reliability. TPM then became a “company-wide approach to eliminating the major equipment losses.” O.E.E. addressed whether the equipment was doing the right things. Here is a list of 11 major losses:

- **Availability losses**
  - Planned shutdown losses
    - No production scheduled (1)
    - Planned maintenance (2)
  - Downtime losses
    - Breakdowns & failures (3)
    - Changeover (product, size) (4)
    - Tooling or part changes (5)
    - Startup or adjustment (6)
- **Performance efficiency losses**
  - Minor stops (jams, circuit breaker trips, etc.) (7)
  - Reduced speed, cycle time, or capacity (8)
- **Quality losses**
  - Defects/rework (9)
  - Scrap (10)
  - Yield/transition (from changeover, startup/adjustment) (11)

O.E.E. as a metric, a calculated rating of equipment effectiveness, is as follows:

**Availability % (x) Performance Efficiency % (x) Rate of Quality % (=) O.E.E. %**

O.E.E. grew out of the “Japanese Quality Revolution” in the 1950s, 1960s, and beyond. The Deming cycle (plan – do – check – act), based on the “scientific method,” required the collection of data to define and characterize the nature of the problem to be solved.

### Let the Confusion Begin...

This is where all the confusion begins. O.E.E. percentages became a metric to compare current equipment performance to world-class performance. The measure of 85% equipment effectiveness became known as “*world-class O.E.E.*” Once used as a benchmarking score for “world-class”, O.E.E. became used as a way to compare one piece of equipment to another, even though the equipment performed different functions in a different process, or even in a different plant. Once

this basic calculation became more widespread, O.E.E. started being used to specify “Overall Plant Effectiveness” (O.P.E.) by using an aggregate score for all equipment in the plant. O.E.E. and then O.P.E. have become widely used to compare current levels of maintenance effectiveness and equipment performance to “world-class” levels, and even a “club” to punish those whose O.E.E. slips. **All of these uses are inaccurate, unfair comparisons, and they are a gross misuse of the original purposes of O.E.E.**

### **O.E.E. Data**

O.E.E. was designed and developed to characterize and communicate the major equipment-related losses as stated in the first part of this article. By capturing equipment performance and reliability data and classifying it as a specific “availability, efficiency, or quality loss,” Pareto charts could be developed to communicate the “major losses” **for focused improvement**. This O.E.E. data could then measure and communicate the effectiveness of the focused improvement efforts, the countermeasures put in place to eliminate the major loss, or problem, and to tap the “hidden capacity.”

### **O.E.E. Percentage Rating**

The O.E.E. percentage calculation (O.E.E. rating) served no purpose other than a very high-level indicator of performance improvement or degradation. Today, entirely too much emphasis is placed on trending and analyzing the “calculated O.E.E. rating.” The original intent is lost in many cases.

O.E.E. is a process for characterizing and communicating the major equipment-related losses. If it is only used as a “calculated rating,” it **cannot** be used by reliability professionals, operators or mechanics to quickly determine and eliminate the root causes of poor performance – as it should be used.

**O.E.E. as a calculated rating is not entirely accurate.** The basic factors of “availability, efficiency, and quality losses” **assume** that each of these losses is **equally** important. This is not universally true. It is a rare situation in manufacturing that a 1% downtime loss has the same business or financial impact as a 1% efficiency loss or a 1% quality loss. The O.E.E. calculation assumes equal weight of each factor – a dangerous assumption in return-on-investment calculations.

O.E.E. should not be used to compare machine-to-machine or process-to-process unless they are identical. O.E.E. should not be used to compare plant to plant or to specify “world-class” performance and reliability. There is no credible “world-class” O.E.E. percentage threshold – only a misconception.

### **O.E.E. is Not a Maintenance Measure**

O.E.E. is **not** a measure of “maintenance effectiveness.” It is a measure of the factors that determine “equipment effectiveness.” For example, of the 11 major losses listed above, “maintenance” is typically in direct control of only two: planned maintenance and breakdowns & failures. And quite often, these two major losses are also impacted by the operations roles. Maintenance alone cannot address all of the major losses captured for O.E.E. This is why O.E.E. is used in Total Productive Maintenance where **the entire organization focuses on eliminating the major losses**.

## **Summary**

O.E.E. data collection, analysis, reporting, and trending provide the fundamental underlying basis for improving equipment effectiveness by eliminating the major equipment-related losses. O.E.E. data very quickly leads to root-cause identification and elimination. O.E.E. data then answers the question, “Did we eliminate the root cause of poor equipment performance?” O.E.E. data is the means to an end: improving overall equipment effectiveness.

Calculating O.E.E. removes our efforts further from eliminating the major losses to comparing O.E.E. scores and the related punishment and praises as O.E.E. falls or improves. O.E.E. scores are neither a means to an end or an end. Be careful: It is a measure of “equipment effectiveness” not maintenance effectiveness. Don’t be misled by O.E.E.

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