Robert M. Williamson, Strategic Work Systems, Inc. Overall equipment effectiveness (OEE) 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. OEE is the primary measure used in TPM to identify and quantify the major equipment-related losses and a metric for rating equipment effectiveness.

OEE has become widely used in many plants with or without the elements of TPM to quantify equipment effectiveness losses. This usage has also caused some confusion, and has led to many misuses of the OEE percentage calculation.

The early Toyota Production System focused on eliminating waste to reduce cost. OEE was initially developed to identify the major losses in equipment performance and reliability. TPM then became a company-wide approach to eliminating them. Here is a list of the original major losses:

Availability losses: Planned shutdown—no production scheduled, planned maintenance; downtime—breakdowns and failures, changeover (product, size), tooling or part changes, startup or adjustment

Performance efficiency losses: Minor stops (jams, circuit breaker trips, etc.) and reduced speed, cycle time, or capacity

Quality losses: Defects/rework, scrap, and yield (changeover, startup losses)

OEE, as a metric, is a calculated rating of equipment effectiveness represented by Availability x Performance Efficiency x Quality Rate, each expressed in percent.

Let the confusion begin

This is where all the confusion begins. OEE percentages became a metric to compare current equipment performance to world-class performance, typically pegged at 85 percent.

Once used as a benchmarking score for world-class, OEE then came to be used for comparing one piece of equipment to another, regardless of function or operating environment. OEE has been extended to specify overall plant effectiveness (OPE) by using an aggregate score for all equipment in the plant.

These metrics have become widely used to compare levels of maintenance effectiveness and equipment performance to world-class levels, and even a club to punish those whose OEE slips.

All of these uses are inaccurate, unfair comparisons, and a gross misuse of the original purposes of OEE.

OEE data: OEE was originally designed and developed to characterize and communicate the major equipment-related losses.

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 OEE data then could measure and communicate the effectiveness of the focused improvement efforts and the countermeasures put in place to eliminate the major loss, or problem.

OEE percentage rating: The OEE percentage calculation 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 OEE rating.

OEE as a calculated rating is not entirely accurate. It assumes the basic factors of availability, efficiency, and quality losses are equally important. It is a rare situation when a 1 percent downtime loss has the same business or financial impact as a 1 percent efficiency loss or a 1 percent quality loss.

OEE is not a maintenance measure

OEE is not a measure of maintenance effectiveness—it is a measure of the factors that determine equipment effectiveness. Maintenance alone can address very few of the major losses captured for OEE. This is why OEE is used in total productive maintenance where the entire organization, including operations and engineering, focuses on eliminating the major losses.

OEE data very quickly leads to root cause identification and elimination. OEE data answers the question—did we eliminate the root cause of poor equipment performance? OEE data is the means to an end: improving overall equipment effectiveness.

However, calculating OEE ratings removes our efforts further from eliminating the major losses to comparing OEE scores.

Be careful—OEE is a measure of equipment effectiveness, not maintenance effectiveness. Don’t be misled by OEE. **MT**