

## OEE 104

# Quality

- Overview
- Process variability
- Intelligent field devices
- Improved regulatory control
- Calculating quality rate

## Overview

### How can I improve the quality factor in Overall Equipment Effectiveness?

The third factor that affects profitability is product quality — the percentage of "on-spec" output produced during the first pass through the production sequence.

This course examines ways to improve quality by improving process variability.

*Hint: As you go through the topics in this course, watch for answers to these questions:*

- *What are the major sources of process variability?*
- *How can intelligent field devices help reduce variability and improve quality?*
- *How is the quality factor in OEE calculated?*

## Process variability

Although a number of factors such as raw-material quality can affect product quality, one of the greatest opportunities for improving quality is by **reducing process variability**. The more

consistently your process operates, the less profit-draining scrap and rework you'll have deal with.

Fortunately, you can reduce variability by using

- intelligent field devices
- improved regulatory control
- advanced process control.

We'll look at each of these in turn

## Intelligent field devices

Naturally, the accuracy of field devices such as sensors, transmitters, and control valves affects process variability. You can't maintain product quality if you can't accurately measure or control what's happening in the process.

But intelligent field devices — those with capabilities beyond single-variable measurement or control — offer ways to reduce process variability that go beyond general improvements in accuracy.

These additional benefits include:

- Improving device stability so the desired performance is maintained over extended periods of time and changing field conditions
- Reducing the response time to generate a representative process variable signal.
- Providing diagnostics to help detect problems before they affect product quality

## Improved regulatory control

A regulatory control system can help you produce a uniform product that consistently meets customer quality demands at the lowest cost. It does this by minimizing variance throughout the processing cycle — whether that variance is caused by changing feedstock quality, ambient conditions, equipment performance, or a host of other factors.

Without an effective regulatory control system, each successive unit operation can introduce variation that can accumulate throughout the process. The cumulative variation is reflected in final product quality and the overall cost of production.

Industry studies indicate that 20 - 40% of process controllers are operated in manual mode, missing the opportunity to reduce variability through automated control.

Studies have also shown, however, that more than 30% of the loops that are automated loops actually increase variability over manual control because of poor tuning. Many of these loops

have equipment problems, including oversized and undersized valves; excessive hysteresis, resolution, or stick-slip in the valves; and measurement problems.

The enhanced functionality and performance of intelligent field devices help minimize these problems, allowing operators to turn on "auto" control. Easy access to device data enhances loop inspection capabilities to eliminate factors affecting variability in a control loop and ensure the reliability of the field measurements. Critical control loops can now be effectively tuned to achieve the next level of additional revenue generating opportunities.

Advanced control systems control the process as each variable relates to overall productivity or effectiveness. These systems are not single-loop controls, but a multi-variable envelope representing the constraints of pressure, temperature, and other factors. Within the envelope, the process is continuously maximizing effectiveness.

Advanced control systems run continuously; responding to changes, reducing the impact of upsets, and exploiting opportunities to create more profit. They are especially valuable where production targets or the quality and availability of raw materials can all change relatively quickly, so that the operating constraints and the scope for improvement vary from day to day.

Properly tuned control loops are also vital for Advanced Process Control (APC) to function effectively. The reliability and performance of the field device is the most significant contributor to implementing and optimizing APC.

Plants that are not properly maintained and monitored can show significant performance degradation in APC initiatives. Diagnostics and maintenance data helps keep field device performance and availability at the levels necessary to maintain long-term quality benefits.

## Calculating quality rate

The quality rate used in OEE calculations is defined as:

$$\% \text{ Quality} = \frac{\text{Product produced} - (\text{scrap \& rework})}{\text{Product produced}}$$

For example, a plant produced 550,000 tons of product, but only 485,200 tons met specifications on the first pass.

$$\begin{aligned} \% \text{ Quality} &= \frac{550,000 - (550,000 - 485,200)}{550,000} \\ &= \frac{550,000 - 64,800}{550,000} \\ &= 485,200/550,000 \\ &= 88\% \end{aligned}$$