

OEE – the Quality measure.

My previous articles have focussed primarily on how to improve the 'Availability' and 'Performance' elements that form part of the OEE calculation ($A \times P \times Q = OEE$); today, we examine 'Quality'. It may be an urban myth, but Henry Ford is supposed to have said "Quality means doing it right when no one is looking." An interesting thought, but can we really expect to achieve perfect quality in a modern operation without regular sample checking? Probably not.

Historically, many manufacturing processes have tended to overlook 'Quality' as a 'constant', or simply a KPI for the QC department, rather than an opportunity for manufacturing process improvement. This mind-set has changed significantly in the past few years with the price of raw materials reaching an all-time high, a real drive towards RFT manufacturing, and increasingly demanding customer-driven audits.

Today, quality inspections range from automatic inspection on CNC machines through final inspection of every product, to checks on an agreed number of examples. (Some operations even rely on the customer making the quality checks but this is a risky and often expensive strategy!)

With so many shop-floor systems available, the question is whether quality checks and record keeping should be paper based, part of a large ERP system, or a stand-alone application? There are business cases for all of these options, but logically, building quality checks into OEE measurement makes perfect sense, as 'Quality' is a vital part of the calculation.

Quality is directly linked to the assets that make the product, and the number of products made, which are both essential elements in OEE. Moreover, the following information is already available in any comprehensive OEE System:

- Asset structure
- Product definitions
- Number of rejects
- Reject reasons and locations.

We are also likely to have employee definitions of 'rejects', a touch screen interface, and two-way communications already in place, so to measure and check quality using another system is simply duplication of effort.

Some companies still use paper based inspection methods; perhaps an A3 sheet with the checks to perform down the left hand side with the rest of the page split into 15 segments. Quality Operators then perform the inspection tasks at 15-minute intervals, and enter a pass or fail value in each of the segments. Completed sheets are then filed, usually with some data entered into a spreadsheet for analysis, and only ever looked at again during a crisis related to batch traceability.

Checks	Range	Tolerance	06:10	06:15	06:30	06:45
Weight	100g	+ 2 / - 0	101	100	102	102
Width	40mm	+ 1 / - 1	40	39	40	40
Length	100mm	+ 1 / - 1	100	101	97	101
Air mist OK	n/a	Y/N	Y	Y	Y	Y

Automate this process, and not only does it take the pain (and margin for error) out of data entry, but it also means that the data collected can be used to inform the manufacturing Improvement Agenda.

There are two basic requirements to automate the process: an administrator to manage the check creation and an operator console to capture the results.

Lets start with what we want to inspect. For a specific asset and product combination, five elements need to be defined.

1: What is the measure?

It could be moisture content, weight, length, colour, temperature, visual comparison, or calibration test.

2: What is the range for pass or fail?

If legislation dictates the weight must be 100 grams, the pass options could be 100, 101, 102, 103, whilst 99 and 104 grams are both fails.

3: What response do we expect?

It may be a value, text, yes or no, signature or pin number sign off

4: What do we do when a fail is registered?

Send an automated alert, send an advisory message, or stop the plant?

5: What is the frequency?

It could be by time, shift, product or ad hoc.

Of course, the 'quality' check does not have to be directly related to assessing the quality of the product; it could, for instance, require the operator to check and top-up an oil mist bottle every shift. In this case we just need to know the task has been completed within the required frequency. (It's now clear to see the logic of including quality inspections in the OEE management framework.)

Next we select a range of products or asset combinations, and group the quality checks that are likely to be similar across the plant; so the set-up process can be fairly quick. Once the quality inspections are defined they can be scheduled to automatically remind the Quality Operators when the checks are due. We can then show when the checks are due, and react to any 'missed' inspections.

With a touch screen it's quick and easy to enter the data, and the results can be made visible across the plant: 'ideal' and 'fail' values can be clearly displayed so that the operator can just touch the value of the measured sample.

Weight	10:30	10:45	11:00	11:15	11:30	11:45
Below 99g						
99g						
100g			●		●	
101g	●					
102g		●		●		
103g						
104g						●
Above 104g						

Once the task creation and results are captured we need a few reports to measure adherence:

- Did we meet the target frequencies?
- Statistically how well are we doing?
- Are we giving too much away?

With the values filed digitally, batch traceability is comprehensive. We have a record of the plant conditions when the results were captured, and we know which operator was logged on at the time. Because the quality element is recorded by the OEE System, we also know when production started and when it ended, how many products were made and the number of rejects. Crucially, we can also review every stoppage event or problem that occurred so we may be able to see which problem caused the quality issue in the first place.

The key advantage of building quality checks into the OEE System, is the ability to generate fully automatic alerts, so as soon as a critical fail is recorded we can send a text message and email to an individual or group, informing them that the values have fallen well below set parameters. This ensures that the quality issue can be rectified as soon as possible. It also means that there is no place to hide; the alerts can also be recorded so that we have a robust audit trail.

Of course quality measurement and recording can exist outside the OEE framework, but it makes sense to bring the two together as it results in time, resource, and financial savings. We can use the existing hardware framework of touch screens for both activities, reducing our infrastructure outlay and

improving return on investment. We can also remove much of the paper and provide instant reports, without duplicating the data analysis process. Much of the quality data is already captured in the system; the asset structure, product definitions, company calendars and employee definitions are already present. We can even use the existing employee security structure and pin codes for sign-off.

One final point, the operations team has access to stoppage and quality alerts in the same system. They can review production problems and successes and match them to quality results. Good production runs should deliver good quality statistics; the opposite may also be true. When urgent traceability is required; all the run parameters, people and products are accessible in a single place, which is especially useful during a customer audit.



John Ruskin famously said that 'Quality is never an accident; it is always the result of intelligent effort'. The key word for me here is 'intelligent'. Maintaining perfect quality doesn't have to be arduous – with intelligent systems in place many factories could relieve the pressure on their manufacturing and operations teams, especially during audits.

Convinced? Ditch some of the endless paper trail, and try it; when the measurement systems are highly visible, and easily traceable, operations teams may agree with Ford that "Quality means doing it right when no one is looking."

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