Clean Equipment Won't Sell TPM to Management

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"Look, my equipment's clean," is an expression heard all too often in companies where total productive maintenance (TPM) is implemented but seemingly shows few benefits. The individual in charge of the TPM program has concentrated on operator involvement in the Japanese "5S" concept of workplace organization. Those "5S" principles are:

1. Properly arranged (Seiri)
2. Ordered (Seiton)
3. Clean (Seiso)
4. Cleaned up (Seiketsu)
5. Disciplined (Shitsuke)

As a result, the plant equipment in the area of the plant where TPM is being implemented looks better than anyone can remember. The equipment is clean, and everything is organized and in place.

Management is Sure to Ask

On the day that upper management and TPM supporters tour the area, they are impressed with the changes. Sometime during the tour, however, one of the managers is likely to say, "This looks great, but we have spent a lot of money to clean the equipment and train the employees in TPM principles and how to inspect their equipment. So, what is the impact this is making on our profit picture? After all, we can't stay in business with just clean equipment!"

Now panic sets in for the TPM coordinator. There is no clear answer to the question. The "soft" benefits--better morale and better working conditions, for example--and the other points that have been made on the tour are now fading in the minds of the managers. Someone has asked the show-me-the-money question.

Today, in many companies, TPM has been sub-optimized simply because no one had the vision to build a business case or a cost/benefit analysis when the program was implemented. In fact, many companies began TPM activities on the wrong equipment in their plants simply because the financial impact was not understood.

Critical Equipment and its Efficiency

Where should initial TPM efforts in a plant focus? In order to maximize the return on investment that a company makes in TPM, it must focus on the critical equipment in the plant. Critical equipment is equipment that if it would operate and produce the way it was originally designed would make a significant differ-

ence to the plant's operation. For example, it could be an equipment item that is a production bottleneck. Or it could be a piece of equipment that requires a high level of maintenance resources to keep it running.

Once the critical equipment is identified, it is important to benchmark its performance. This benchmark is called the overall equipment effectiveness or OEE. The OEE is calculated by the following formula:

OEE = Availability X Performance efficiency X Quality rate

Availability is the time the equipment is scheduled to run divided by the time the equipment is available to run, expressed as a percentage. The goal should be at least 90%. (To calculate availability, do not use only maintenance shutdowns, use all downtime.)

Some companies don't like to use the total time available to run, since the equipment might be capable of running on a 7 X 24 schedule, and they are only running it on a 5 X 24 schedule. However, availability should indicate when there is excess capacity in the equipment, in case it is needed. Knowing about excess capacity might keep a company from purchasing additional equipment and, thereby, needlessly increasing its investment in assets. Doing the latter negatively impacts corporate financial indicators such as return on net assets. It is best to understand the true availability of the equipment, rather than hiding it behind spurious calculations.

Some companies will choose to use the scheduled run time divided by the actual run time, realizing that the equipment has unused capacity. This allows personnel to concentrate on maximizing the equipment performance during the scheduled time, always realizing that there is additional capacity if it is ever needed.

Performance efficiency is the rate the equipment is operating divided by the design rate of operation, expressed as a percentage. The goal here should be at least 95%. There are two common mistakes associated with this calculation. First, some companies will re-engineer the equipment or otherwise raise performance standards and not reflect this by changing the design rate of operation. This gives them a performance efficiency of more than 100%, which is misleading and subsequently could hide other areas of weakness in the OEE.

The second mistake consists of not really understanding the design specifications of the equipment. This often is a problem with older equipment. No one remembers what the design performance specifications originally were. So, the equipment performance is accepted as the level at which someone remembers what it "used to do." Typically, this level is far below its design performance level and, again, the OEE calculation is affected. The lack of data hides the true potential of the equipment.

Quality rate is the product produced minus the off-spec product divided by the product produced. This percentage should be above 99%.

The most common mistake in calculating quality rate centers around defining what constitutes a defect. A defective item is one that is not first-pass quality. In other words, any item requiring rework, re-filtering, re-packaging, or re-formatting is not first-pass quality.

Knowing Efficiency is Not Enough

A sample calculation of equipment efficiency might look like this:

Availability = 85%,
Performance efficiency = 90%,
Quality rate = 95%.

Thus, OEE = .85 X .90 X .95 = 72.6%

If the goal is 85% (.90 X .95 X .99), then 72.6 may not seem so bad. However, this is where more than an OEE calculation is required. Even if the management walk-through described earlier occurred after the OEE calculation, and the question, "What impact is this making on our profit picture?" was asked, an acceptable answer could not be given. Simply saying that the OEE has gone from 72% to 85% will not satisfy financial managers.

The meaningful answer is derived by *dollarizing* the OEE. This means that the production output for a 72% OEE must be compared to the production output for an 85% OEE, in real dollars. For example, suppose production output for 72% OEE is 15,600 pieces/week (use any production measure). Suppose also that production output for 85% OEE is 23,400 pieces/week. The difference is 7,800 pieces/week. At, say, a market value of $12.00/piece, increased throughput is $93,600 ($12 X 7,800). At 50 weeks/year, that's an annual increase in throughput of $4.68 million (50 X $93,600).

Now, when the question, "What impact is this making on our profit picture?" is asked, the answer is clear and in terms financial people will understand. In fact, if additional funding was required for additional tools, training, or personnel, the return on that investment would be easy for anyone to calculate.

TPM is more than just another program that companies can implement. It is an operating philosophy that must be tied to the company's profit picture. Unless TPM efforts are connected to the bottom line, there is little chance of its success in a company. While certain activities are a part of TPM--the 5 Ss, for example--unless TPM coordinators take a financial approach that highlights TPM's benefits, long term viability of the initiative will be doubtful.

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