### The IMPORTANCE of MAINTENANCE

 $(Changing\ from\ a\ \textit{FAIL}\ and\ \textit{FIX}\ Approach\ to\ a\ \textit{PREDICT}\ and\ \textit{PREVENT}\ Approach)$ 

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The importance of an effective maintenance program cannot be overlooked because it plays such an important role in the effectiveness of Lean manufacturing. As in personal health care insurance, maintenance may be considered the heath care of our manufacturing machines and equipment. It is required to effectively reduce waste and run an efficient, continuous manufacturing operation, business, or service operation. The cost of regular maintenance is very small when it is compared to the cost of a major breakdown at which time there is no production.

## **Purpose of Maintenance**

The main purpose of regular maintenance is to ensure that all equipment required for production is operating at 100% efficiency at all times. Through short daily inspections, cleaning, lubricating, and making minor adjustments, minor problems can be detected and corrected before they become a major problem that can shut down a production line. A good maintenance program requires company-wide participation and support by everyone ranging from the top executive to the shop floor personnel.

#### **Breakdowns**

A machine's breakdown **true cost** is sometimes difficult to measure. A recent survey showed that the cost for a machine breakdown is more than just the maintenance labor and materials to make the repair. A recent survey showed the actual cost for a breakdown between four to fifteen times the maintenance costs. When the breakdown causes production to stop, the costs are very high because no parts are being produced.

For years, maintenance has been treated as a dirty, boring and often overlooked job. It is very important to get the best productivity from a company's equipment but it is not recognized as a part of the operation that produces revenue. The simple question is often, "Why do we need to maintain things regularly?" The answer is, "To keep things as reliable as possible." But the real question is, "How much change or wear has occurred since the last round of maintenance?" Generally the answer is, "I do not know."

#### **General Maintenance**

The challenge for reliability is dealing with data from the past. Failure is modeled, analyzed and, to some extent, predicted. Unfortunately, the prediction does not take into account users or working environment-related restrictions, and often the results are not those useful.

Machine conditions are monitored at the machine level, one machine at a time. It is a "*Fail and Fix* approach." Troubleshooting is the primary purpose.

### **Autonomous Maintenance**

The purpose of autonomous maintenance is to develop operators to be able to take care of small maintenance jobs on the equipment they use so skilled maintenance people can concentrate on value-added activity and technical repairs.

### The Maintenance World of Tomorrow

With modern computing and information technologies, more products and machines are equipped with sensors on critical parts of machines to warn of potential failures long before they may fail so they can be corrected before they stop production.

# **Intelligent Maintenance Systems**

Intelligent maintenance systems (IMS) *Predict and Forecast* equipment performance so "near-zero breakdown" status is possible. Near-zero downtime focuses on machine performance techniques to minimize failures. Data comes from two sources: sensors (mounted on the machines) and the entire enterprise system (including quality data, past history and trending). By looking at data from these sources (current and historical), it can predict future performance.

### **Alarm Bells**

Today, machine field services depend on sensor-driven management systems that provide alerts, alarms and indicators. The moment the alarm sounds, it is already too late to prevent the failure. Most factory downtime is caused by these unexpected situations. There is no alert provided that looks at normal wear over time. If it were possible to monitor the normal wear, then it would be possible to forecast upcoming situations and perform maintenance tasks before breakdown occurs.

The long-term view on intelligent maintenance is that we can use any means - including embedded (software) and remote technologies - to monitor equipment performance. Then, if wear starts to occur, there is enough time to service the item before failure. A machine can self-assess its health and trigger its own service request as needed. If this model works, then we will have a product that can manage its own service performance and its own warranty-based contracts. It also can alert us on ways to keep it running in a high-performance manner.

## **Focusing on the Bottom Line**

Today, with industry so focused on the bottom line, the cost of downtime has a big impact on profitability. If equipment starts to wear, it is possible to start producing parts with unacceptable quality and not know it for a long time. Eventually, machine wear will seriously affect not only productivity but also product quality.

World-class companies already have taken a game-changing approach, implementing a new service business model to change maintenance systems into smart service and asset management solutions. They reduce downtime and provide the ability to look ahead at the quality of products before they ship by closely watching equipment performance and machine wear. Rather than reactive maintenance - "Fail and Fix" - companies can indeed move to "Predict and Prevent" maintenance.