



Maintenance Strategies for Pneumatic Actuators

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Executive Summary:

This white paper addresses the most difficult challenges facing manufacturers and OEMs as they compete to reach their production targets. With their equipment running at maximum loads, how can they avoid breakdowns in pneumatic components? What are the smartest and most economical approaches available to assure optimal performance? Recent advances in sensor technology make it possible to obtain performance-related data from which more informed decisions can be made about the need to replace failing components. This paper analyzes the different maintenance strategies for pneumatic actuators and the role sensors can play in each.



Maintenance Strategies for Pneumatic Actuators

As new sensor technologies emerge to monitor the performance of pneumatic actuators, the right maintenance strategy is essential for achieving optimal performance from the equipment. There are three kinds of maintenance strategies to evaluate: corrective maintenance, preventive maintenance and condition-based maintenance. Pressure sensing technology can enhance any one of the three maintenance strategy options.

Corrective Maintenance

Corrective maintenance is the practice of diagnosing and replacing components after they have failed.

Advantages:

- Easy to implement
- Minimal startup costs

Drawbacks:

- Greater long term costs
- Unexpected downtime
- Multiple steps: one to diagnose the problem, a second to repair the equipment
- Difficulties managing repair part inventory

When to use:

A corrective maintenance strategy is effective when the cost of component failure is lower than the cost required to replace the component. To justify the application of a corrective maintenance strategy, all costs must be reviewed. These include: cost of component, value of downtime, labor hours, equipment location, availability of components, and cost of inventory.

Role of sensors:

Corrective maintenance strategies rarely include sensors. Their addition increases the initial cost of the equipment. But, there are two ways that sensors can support a corrective maintenance strategy: as a diagnostic tool and as an indicator of a failure.

The most economical way to use diagnostic sensors is by installing them after a component fails. Once the sensor discovers the error, the sensor can be removed. This approach reduces startup costs because one set of sensors can work in multiple places, such as complex pneumatic circuits where symptoms of failure can go unnoticed.

A corrective maintenance strategy can also be enhanced with “intelligent” sensors capable of remote monitoring and alarming. A sensor that sounds an alarm when the system is not working can simplify maintenance, especially for difficult-to-reach locations. Without visiting the machine, the technician will know in advance what parts are required for repair, thus reducing service time.

Preventive Maintenance

Preventive maintenance is the practice of replacing a component on a set schedule.

Advantages:

- Makes it easier to budget repairs
- Prolongs life of entire system
- Supports product quality
- Schedules maintenance

Drawbacks:

- Could replace an actuator that is still workable
- Failure can still occur without warning

When to use:

Preventive maintenance is not practical if the cost of maintaining the component is lower than the costs associated with its failure. When calculating the cost of component failure it is important to consider the effect one component has on the lives of other components in the system. Product quality can be influenced by component failures. Breakdowns in the middle of a production run could cause the loss of product, from a single unit to an entire batch.

Role of sensors:

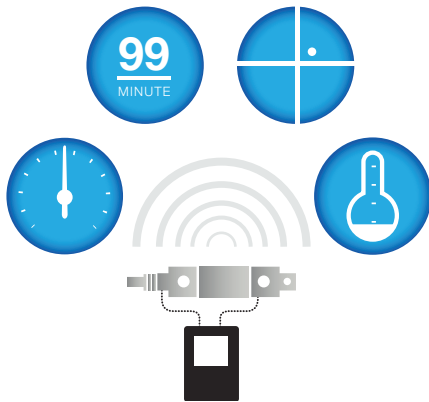
Preventive maintenance of pneumatic actuators is based on time in service or number of cycles. Because of the cyclical nature of preventive maintenance, that is, its occurrence on a set schedule, sensors play a limited role in this strategy. But new technologies allow pressure sensors to be installed near actuators where they can provide cycle count data. No longer is a magnetic rod and switch required to monitor cylinder position.



Condition-Based Maintenance / Predictive Maintenance

Condition-based maintenance is the practice of monitoring the condition of components to determine when a component should be replaced prior to failure.

Predictive maintenance is an extension of condition-based maintenance: any changes in components' conditions over time can be discovered and make possible a prediction about when the unit will break down.



Advantages:

- Reduces downtime
- Reduces inventory of repair parts
- Avoids failure during critical builds
- Maximizes life of actuator
- Schedules maintenance
- Improves product quality

Drawbacks:

- Startup costs
- Increases system complexity

When to use:

Condition-based monitoring should be employed when the cost of monitoring the component is lower than the cost of component failure. This strategy leads to significant reductions in the cost of labor and the amount of downtime because technicians can replace components before they fail but not before they need to.

Role of sensors:

Sensors are critical to the implementation of a condition-based monitoring strategy. Each actuator that is to be monitored will require installation of some instrumentation, either intermittently or permanently. The most effective approach is to permanently install a sensor solution on the equipment. This simplifies data gathering and analysis. While intermittent monitoring can be effective, it is labor intensive and may miss signs of imminent failure. For pneumatic actuators, pressure sensors are ideal for monitoring the wear of piston and rod seals. Over time, increased air leakage or changes in actuator speed can be indicators of approaching failure.

Conclusion

Choosing the right strategy for each application can be time consuming but with a little forethought there will be improvements in overall equipment efficacy (OEE). The increase in available sensors technologies has the potential to optimize any maintenance routine.

About the author

Jeremy King, CFPPS, is the IntelliSense® Product Marketing Manager with Bimba Manufacturing. Jeremy is an experienced product manager working with industrial sensors. Prior to working with sensors, Jeremy spent 11 years as a mechanical design engineer in the automotive industry.

About Bimba

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