Commissioning New and Repaired Machines: The Case for Reliability

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Introduction

Starting in the latter part of the 20th Century companies focused in the reduction of inventory as part of their cost reduction strategy. Such product and MRO inventories were the result of internal and external bottlenecks and equipment maintenance. The primary strategy was, and still is, Run to Failure (RTF) and reactive maintenance. The challenge is that both RTF and reactive maintenance require spares inventories that can be significant. The reduction of maintenance and MRO inventory are mutually exclusive.

What started as intelligent modifications to inventory became dramatic change as the principles of industrial and reliability engineering became sloppier. In extreme cases, maintenance or operations personnel would order double of everything and hide the extra in workshops and toolboxes or the opposite where inventory would be stripped bare. Indications of MRO gone amok include spare parts hidden by personnel through the facility or significant amounts of repair work in-progress hidden through repair vendors. For instance: motors for repair at vendors with no decision until they are needed, then processed as urgent or emergency.

The status of the inventory in a reactive type program is also driven by the last significant emergency that drew senior management attention. Even when the fault would be a low future risk, a knee-jerk reaction exists and expensive spares or components are stocked taking up space and resources. In the past decade I have seen a dozen instances of the exact following case in commercial, industrial and government facilities world-wide: a failure some 20-30 years in the past of an electric motor winding that had a significant impact and long repair time. A full set of windings or field coils is purchased and put into storage (almost always incorrectly stored). The winding fails 20-30 years later and the coils are pulled for use at the repair facility and the coils are found to be too aged or damaged for use.

Reactive and Run to Failure Strategies

The terms run to failure and reactive maintenance are often, incorrectly, used interchangeably. The concept of reactive maintenance is to run equipment until if fails and then figure out how to repair, replace or ignore it. This is the prevalent maintenance practice which has significant impact on business profitability. On the other hand, RTF is a strategy which, when performed correctly, can manage assets with a reduced impact. While not as extensive or cost effective as a PdM or CBM program, the philosophy still requires planning and thought.

With highly critical equipment, the plan may be to apply a combination of planned and condition maintenance to reduce the risk of failure. The remaining equipment is often left to fend for itself. This mistaken concept of twisting RCM and similar maintenance development tools has

resulted in significant negative impact within industry. Less and non-critical equipment was not meant to be excluded from maintenance by these strategies, just a different level of application!

In an RTF program, the concept is to perform some methods of inspection, testing, maintaining, or other method that can identify that a problem is occurring such that action can be taken. This may be planning as part of an outage or staging parts and materials for when the failure occurs. The result is improved control of the repair related costs and improved inventory practices. In an environment where maintenance is being cut, or a full program for critical equipment does not exist, such a program can assist in assuring a higher state of readiness than just allowing equipment to fail. Who has not had the experience of going to find parts for equipment during a failure only to find the parts are obsolete?

The Argument for Commissioning

A key strategy for managing condition in RTF programs and continuing to avoid reactive issues is to ensure that systems are commissioned, whether they are complete machines, parts or components that are new, used or repaired. A bad situation, such as unexpected failure upon installation, missing parts, or modifications being required can generate significant issues.

For instance, installation of an improperly repaired piece of equipment can result in modifications and/or delays during an outage that will either reduce reliability or cause problems for years to come. Modifications under pressure result in a lack of documentation as other urgencies and responsibilities come into play. Often poor decisions are made for the sake of urgency.

The best way to avoid such problems is to commission the new or repaired equipment or components. This is performed through a series of steps that do not add time to the process, but instead streamline the process and communications. In effect, commissioning is an effective part of a lean maintenance program.

The Steps for Commissioning

Commissioning is a process that starts prior to the order being placed to repair, replace, or purchase. In some cases the process is barely noted and can only require a few people; in others it can be quite extensive. The attention required depends upon the overall impact and the attention the particular system receives from management (and at which level).

The steps are broken down as follows:

1. Determine who will be involved in the process once an issue has been identified. How significant is the issue? Is it part of a program such as an RCFA? What information will be required? Is operations, maintenance, purchasing or others involved? Who makes the decisions? Who are the stakeholders?
2. Determine the requirements and specifications. Are there any special needs or history? Are there clear requirements and do specifications exist? Is there a bid requirement?

3. Contact vendors and ensure requirements and specifications are communicated and agreed. Are the requirements and specifications feasible and cost effective? Are there expected delivery dates? Is there a delivery issue? Modifications? Other issues? Communications must be clear in both directions, and in writing, where possible. Terms and conditions must be understood. Any test/inspection requirements must be communicated.
4. Perform or receive any in-process inspections during the repair process. Receive or use digital photos where possible.
5. Receiving inspections must be performed. Are there any shelf life issues? Can problems be detected upon receipt? What testing, inspections, or technologies can be applied? At this point, either witness vendor testing or perform your own. Inspections may include storage inspections and process before acceptance.
6. In-place final testing. This may include operational testing, installation acceptance and other processes. For instance, if a vendor installs a motor and pump, a visual inspection, alignment and vibration report, and electrical testing may be required.

These steps can be extremely important. For instance, in 2009 we received insulation systems from suppliers that were past their shelf lives. Our commissioning process includes knowing the shelf life of such components, available on such items as manufacturer tear sheets. The items were returned. In another case, special insulation material was ordered and after many delays, material arrived that did not match what was ordered. The vendor had provided the wrong part number based upon samples they received and the new material was ordered based upon the incorrect information. As communications involved digital photos and email, the vendor received back the material and provided the correct material.

In another case, rectangular wire was received from a manufacturer. Samples were tested and determined to be defective. By working directly with the vendor on a solution, we jointly identified process issues that helped their production and our delivery times and quality of received product. As this problem was noticeable across a number of vendors, the solutions developed provided the vendor with a competitive advantage. In other cases, at a manufacturing facility, inspections of received bearings identified that a particular vendor was supplying bearings that had been returned to them after having been installed and run on other equipment.

At a manufacturing facility, several electric motors were sent for repair. They had been tested as part of the new CBM program that the vendors in the following examples were unaware of. The first set of Motors sent to one repair vendor were sent out for cleaning and baking and a repair specification was provided and communicated. During the initial inspection process, the repair facility reported that the windings failed the surge test. As the testing performed would have identified the failure, copies of the inspection reports were requested. It was noted that the 480 volt motors were tested at 3700 volts with a fast rise time while the windings were still contaminated. The provided and industry specifications all state limits on high voltage testing and also state that high voltage testing may only be performed when windings are clean and dry. The result was that the vendor was required to repair the motors at their own expense. The motor owners would have split the cost of the repair due to the age of the insulation systems. However, it was readily apparent that they attempted to mislead as to the reason for the high voltage applied.

Another set of motors was sent to a second repair facility. Upon their return it was noted that insulation readings were far lower than when they were sent out. It was expected, as the facility agreed and paid for a dip and bake, that the results would be significantly higher. The motors were returned and it was discovered that the dip and bake had not been performed, but that the windings were glyptoled. As the pained could not be removed, the repair shop was required to rewind both motors at their expense.

Two lessons of experience:

- When a vendor knows that commissioning will be performed, there are fewer instances of delivery and inspection issues. It is important to recognize this fact as programs are sometimes abandoned when it is noted that there are not quite as many catches. This actually means that the program is being effective and not that it is not necessary.
- Often, when incorrect modifications are made or a situation occurs, an extended warranty is offered. This is a low risk to the vendor as most forget about the extended warranty or there is some reason why it cannot be honored when presented. When possible have the defect corrected immediately.

Conclusion

Concepts of maintenance programs including reactive and run to failure will significantly impact the availability of a facility, especially with pressure to reduce inventory. It is important to understand the significance of the application of a proper maintenance philosophy over the poor application of such philosophies today. In all cases, it is important to understand the application of a commissioning program for parts and equipment to control issues of through the corrective action process, including planning.

The impact of a communicated commissioning program can be significant, when used as part of the maintenance philosophy. Even when instances of non-conforming product or equipment is reduced it is a sign of the success of the program, not its level of usefulness.

About the Author

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