

How much trust do I have on my maintenance department?

The outcome of a maintenance-training curriculum.

By Antonio Reis

Many companies have difficulties with replacement of their skilled maintenance workers when they depart either because they retire or pursue other interests.

The problem is greater with respect to maintenance personnel in manufacturing. Workers that maintain equipment involved in manufacturing or supporting manufacturing processes are often required to have a broader understanding of electromechanical systems and have basic knowledge on the operations of the equipment.

At first glance, the problem appears to be related to lack of training efforts by the part of the employers. When resources are allocated and the results are less than favorable many factors are considered at fault but rarely the training curriculum and the details of maintenance-training implementation.

Many companies engaged in maintenance training programs either run within their maintenance organization or by encouraging the workers to take classes in local colleges and vocational schools. Others hire the services of specialized organizations to develop training programs. Those programs are generally aimed to achieve and satisfy what the executive management views to be the needs of the maintenance function. Often those efforts are backed with pay incentives that are realized when the worker meets determined requirements, usually passing some type of test or certification. Another sources of maintenance skills' training are the suppliers of capital equipment whom often provide training in the maintenance related to their equipment.

When looking at ways of improving the quality and effectiveness of the maintenance function in a manufacturing organization, management is looking for solutions in three basic areas; (a) equipment availability or equipment utilization, (b) product quality and (c) maintenance costs. The level of maintenance requirements in a manufacturing environment is mostly related to the complexity of the manufacturing process and the level of optimization that the said process has. In short, robust processes require less maintenance because there are less problems either inherent of the machinery or by the operator's interface.

However regardless of the robustness of the manufacturing process, maintenance personnel requires substantial training in the operation of the machinery they service. Without this knowledge, regardless of the skill level, troubleshooting becomes difficult and substantially lowers the efficiency of the maintenance function. In my opinion, this training is often not well understood because of differences in language and lack of understanding of the maintenance worker about the system and the teacher about the real problems with the equipment. This in itself can be the cause of a less than effective maintenance department.

Lets look at some of steps or paths that lead to the position of manufacturing/equipment technician (maintenance worker).

The entry-level position for equipment maintenance often does not require any testing to prove basic skills. The rationale is that such skills will be learned along with all other “manufacturing specific” requirements. An entry-level maintenance worker may be hired to rebuild/set-up a specific module in the manufacturing process. Such task may only require the use of a few hand tools and measuring devices. With that in mind the worker is hired as unskilled labor and trained for that specific task. In the event that the said worker fits the “good worker” requirements within the organization, he/she will be given the opportunity to progress towards a maintenance career. Most positions in maintenance are paid above most manufacturing job classifications and often are used by management to reward outstanding employees. This class of workers often knows the equipment well and have adequate troubleshooting abilities. In either case either worker (entry-level above and outstanding employees) has limited understanding of basic maintenance skills.

Once an “outstanding worker” moves to the maintenance department the seniority game starts and it further obstructs his/her skill development as well as of those with less seniority but with much greater understanding of the maintenance basics. In either case, the key to successful integration of these workers in the maintenance function without decline in performance must involve planned training programs.

A maintenance-training program needs to be cost effective and structured in such a way that its results can be measured. As stated above, the basic indicators of maintenance performance are; (a) equipment down time, (b) product quality, and (c) maintenance costs. However, one can't evaluate individual skill level in terms of performance of the maintenance function. It is also not wise to gauge individual skill level based on perception and bragging activities.

Is it necessary to test maintenance personnel to evaluate each worker's skill level?

In my opinion, it is neither necessary nor desirable. It is not desirable because textbook tests often do not determine one's skills or understanding in how to perform maintenance tasks. Tests are necessary for tasks like welding but companies should consider establishing a certification program for those skills rather than some in-house test. This way the company is assured that the worker has the skills and the worker has the credentials. Pay-for-skills concepts often create department divisions between academic and vocational workers with impact on the management's ability to motivate and communicate with maintenance workers.

This is not to be interpreted that there isn't a need to evaluate the skill level of the maintenance workers. However evaluation of a maintenance worker based on test results rarely reflect the individual contribution of the worker to the maintenance function. In short what skill worth more? installing a bearing or changing a fuse? How far can a worker advance in a specific maintenance field by reading and taking tests?

The skill level and progression of a maintenance worker depends mostly on the maintenance curriculum.

Documentation, whatever in the form of notes, manuals, technical documents etc, is the core of the maintenance function. Understanding of those documents is vital to the effectiveness of the maintenance tasks, quality of the work and promotion of a safe environment. If a maintenance worker is not able to read and understand the manuals, work orders, etc, in my opinion, that worker is a liability to the manufacturing process instead of an asset. To a less extent but also important is the need to read schematics and blueprints. In-house "on-the-job training" is as good as the current state of the maintenance function for the period of the training. At times the people doing the training have deficiencies in their knowledge and skills. Most important, they may not have a good understanding on the important skills and knowledge needed at the plant and emphasize skills that are more glamorous but less needed.

In-house training needs to be aided with other learning materials that will enhance learning from the ground up. Self-study training manuals, videotapes and computer programmed instruction are good learning tools. When including vocational schools, one needs to evaluate in detail if the materials exposed in school are in line and sufficient to satisfy the needs of the maintenance function. The same applies to training programs developed by dedicated companies that often claim greatness.

Emphasizing the absolute need of Cooperation, Teamwork and Ability to Communicate across the diverse maintenance crafts resolves many of the issues related to understanding of terminology.

Now what?

The curriculum must provide for hands-on training. A maintenance worker should not attempt to remove a broken stud from a piece of equipment before he/she has developed the confidence and skill to perform the task without damaging the assembly. That is true for a large number of tasks that are often done out of goodwill and the best of intentions but result in alterations of process variables, equipment characteristics and at times substantially reduce the equipment's life cycle. Here is a small list of some tasks that should be practiced somewhere else before done in manufacturing equipment:

- Bearings removal/replacement (Bearing heating/cooling)
- Alignment operations (Drive systems alignment)
- Removal of broken studs screws or bolts. (Component repair)
- Overhead welding (Pipe welding)
- Brazing operations (Cast brazing)
- Cutting of a bearing race on a shaft (Oxy-acetylene cutting of a bearing inner race on a large diameter shaft)
- Scarf of welds (Removal of welded components)
- Balancing operations (Blower fan installations)
- High Voltage work (Switch gear maintenance)
- Rigging operations (Lifting and moving of heavy components)
- Hazmat operations (Any maintenance tasks while using breathing apparatus).
- Machining operations on equipment components (thread chasing).

- Hydraulic hose assembly (Crimping of fittings on high pressure hoses)

As an example, assume a simple procedure of heating a bearing and install it in the journal of a roll. Assume that during the installation of a bearing, for whatever reason, the bearing is not properly seated while hot.

What to do now? I have been a spectator on an extreme instance.

The worker got a hammer and drive punch and attempted to properly seat the bearing. After all it was just a little off. With a few of unlucky strikes, the punch marred the shaft. After a while of good pounding effort the worker decided to extract the bearing. Since the shaft was marred the bearing did not slide as usually with the bearing puller. After some time the bearing was destroyed and the torch was brought to the floor. The scarf operation was somewhat successful but there is a small mark on the shaft.

The job exceeded the repair time allocated, it impacted the production schedule, and management lost confidence in the maintenance function and will be reluctant to stop the process for maintenance until it breaks down. Had the worker used the puller to remove the bearing instead the hammer, the situation would be very different.

Alignment of the training/learning process with the tasks performed on the equipment is essential to optimize the skills of maintenance workers and the performance of the maintenance function. Manufacturing companies should require that maintenance workers practice and get proficient on specific tasks such as: conveyor lacing, bearings installations, pipe thread cutting etc. before those tasks are performed on manufacturing equipment. Specially, the worker must be familiar with the results and procedures needed if the task does not go as planned.

Next we will discuss what craft cross training really means.

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