Best Maintenance Repair Practices

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Numerous surveys conducted with industry in the United States have found that 70% of equipment failures are self-induced and are largely impacted by maintenance personnel not following "*Best Maintenance Repair Practices*".

More than 30-50% of these self-induced failures are caused by maintenance personnel not knowing the basics of maintenance and an another 20-30% could be caused by maintenance personnel who are skilled but choose not to follow "Best Maintenance Repair Practices".

Human Error Rate

Description	Probability
General rate for errors involving very high stress levels	**30%**
Complicated non-routine task, with stress	30%
Supervisor does not recognize the operator's error	10%
Non-routine operation, with other duties at the same time	10%
Operator fails to act correctly in the first 30 minutes of stressful emergency situations	10%
Errors in simple arithmetic with self-checking	3%
General error rate for oral communication	3%
Failure to return the manually operated test valve to the correct configuration after maintenance	1%
Operator fails to act correctly after the first few hours in a high stress scenario	1%
General error of omission	1%
General error rate for an act performed incorrectly	0.3%
Error in simple routine operation	0.1%
Selection of the wrong switch (dissimilar in shape)	0.1%
Selection of a key-operated switch rather that a non-key-operated switch (EOC)	0.01%
Human performance limit: single operator	0.01%
Human performance limit: team of operators performing a well-designed task	**0.001%**

This problem has been further validated through the skill's assessment process with the State of Georgia. This assessment program evaluated the basic maintenance fundamentals through a written, identification and performance format of thousands of maintenance personnel. A large number of maintenance personnel, from many different types of industries, were assessed with the results indicating over 90% lacked the basic fundamentals of mechanical maintenance. This article will focus on "Best Maintenance Repair Practices" necessary to make equipment more reliable and companies more profitable through reduced maintenance cost and increased capacity.

The cost savings can be beyond the understanding or comprehension of management. Many managers are in the denial state which means they do not think the repair practices directly impact an organization's bottom line profitability. Companies have demonstrated that by reducing the self-induced failures can increase production capacity by as much as 20%. Many managers except less than the standard for maintenance repair because they either do not understand the problem or choose to ignore this issue. A good manager must be willing to stand up and say we have a problem, and we must find a solution.

You may be asking what the "Best Maintenance Repair Practices" are. Here are a few which maintenance personnel must know:

Best Repair Practices

Maintenance Task	Standard	Required Best Practices	Consequences for not Following Best Practices	Probability of Future Failures / # of Self-Induced failures vs following Best Practices
Lubricate Bearing	**Lubrication interval – time based / 10% variance**	**1. Clean fittings 2. Clean end of grease gun 3. Lubricate with proper amount and right type of lubricant. 4. Lubricate within variance of frequency**	**➢ Early bearing failure reduced life by 20-80%.**	**100% / 20 to 1**
Coupling Alignment	**Align motor couplings utilizing dial indicator or laser alignment procedures. (Laser is preferred for speed and accuracy) Straight edge method is unacceptable.**	**1. Check runout on shafts and couplings. 2. Check for soft foot. 3. Align angular. 4. Align horizontal. 5. Align equipment specifications not coupling specifications.**	**➢ Premature coupling failure. ➢ Premature bearing and seal failure in motor and driven unit. ➢ Excessive energy loss.**	**100% / 7 to 1**
V-Belts	**Measure the tension of v-belts through tension and deflection utilizing a belt tension gage.**	**1. Identify the proper tension and deflection for the belt. 2. Set tension to specifications**	**➢ Premature belt failure through rapid belt wear or total belt failure. ➢ Premature bearing failure of driven and driver unit. ➢ Belt creeping or slipping causing speed variation without excessive noise. ➢ Motor shaft breakage.**	**100% / 20 to 1**
Hydraulic Components	**Hydraulic fluid must be conditioned to component specifications.**	**1. Hydraulic fluid must be input into the hydraulic reservoir utilizing a filter pumping system only. 2. Filters must be rated to meet the needs of the component reliability and not equipment manufacturer's specification. 3. Filters must be changed on a timed basis on based on filter condition. 4. Oil samples must be taken on a set frequency and all**	**➢ Sticking hydraulic valves. ➢ Premature or unknown hydraulic pump life. ➢ Sustaining hydraulic competency by maintenance personnel. ➢ Length of equipment breakdowns causes lost production.**	**100% / 30-1**

		particles should be trended in order to understand the condition and wear of the hydraulic unit.		

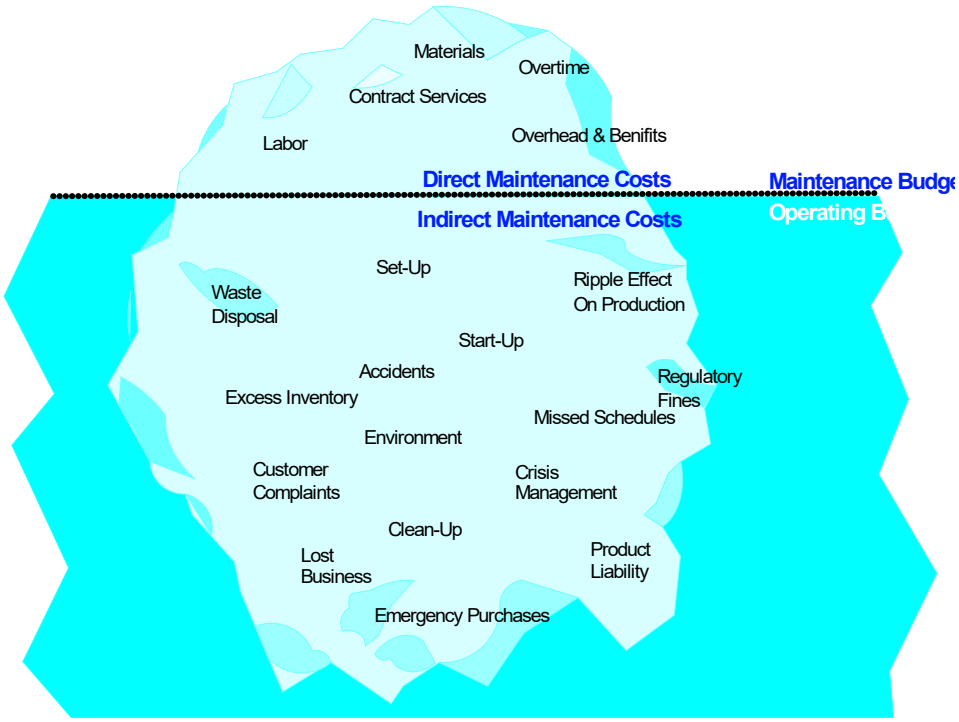
As you may have reviewed the "Best Maintenance Repair Practices" you may be asking yourself do we follow these practices in our own organization. You may be shocked by what you find. What you may find is that the problems have been in your organization for a long time. To fix the problem, you must understand that the culture in an organization is the problem. Everyone is a maintenance expert, but the results do not validate this statement. To change this culture, we must identify why an organization does not follow these best practices in the repair of their equipment. I will list a few reasons these practices are not followed.

1. **Maintenance is totally reactive and do not follow the definition of maintenance, which is to protect, preserve, prevent from decline. (Plant culture)**
2. **Maintenance personnel do not have the skills required.**
3. **The maintenance workforce has a lack of discipline to follow "Best Maintenance Repair Practices".**
4. **Management is not supportive and do not understand the consequences of not following these best practices. (they think they understand but understanding must involve how much money is loss to the bottom line)**

In order to solve this problem of not following "Best Maintenance Repair Practices" a course of action should be taken:

1st: Identify if a problem exists. (i.e.. Measure repetitive equipment failures, review capacity losses to production and causes of these losses, measure the financial losses due to repair issues "review the Nyman Iceberg")

Nyman's Maintenance Cost Iceberg



2nd: Identify the source of the problem: (this could be combination of issues)

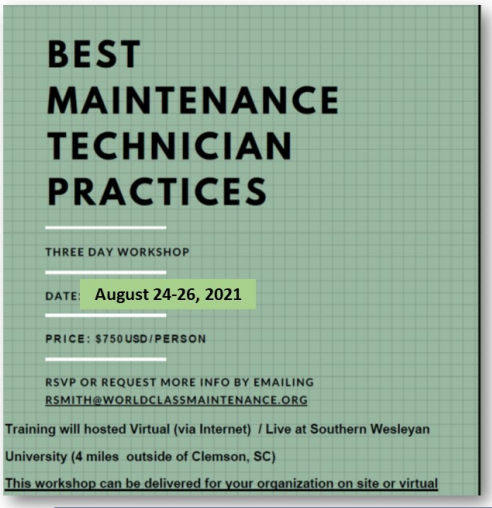
- **Maintenance Skill Level – Perform Skills Assessment (written and performance based) to meet "Best Maintenance Repair Practices" for your specific maintenance organization.**
- **Maintenance Culture – Provide training to all maintenance and management in this change in maintenance strategy and how it will impact their lives. (ie. Increase in profit for the plant, less overtime because of less equipment breakdowns, etc.) Measure the change and show this to everyone.**
- **Maintenance strategy – Develop a plan to introduce a proactive maintenance model with Preventive and Planned Maintenance at the front of priority. This will provide more time to perform maintenance utilizing the "Best Maintenance Repair Practices".**

3rd: Implement the changes needed to move toward following " Best Maintenance Repair Practices" and measure the financial gains.

Be warned the financial rewards could be great but we must understand why it is hard to achieve. I have listed some of the reasons why we fail implementing a program of change such as the one we have discussed.

1. **Management not committed.**
2. **Lack of discipline**
3. **Lack of management commitment and accountability**
4. **Momentum is slowed or changes.**
5. **Lack of skilled workforce**
6. **No gap analysis with an action plan to guide this effort.**
7. **Conflict between emergencies and performing maintenance following <u>"Best Maintenance Repair Practices"</u>. (This does not mean all repairs must be repaired properly the first time but it does mean the repair will be corrected on the next outage of the equipment)**

To conclude, over 90% of companies in the United States do not follow "Best Maintenance Repair Practices". The 10% that do follow these practices reap the rewards of well run , capacity driven organization that can compete in today's and tomorrow's market place. Remember that the "Best Maintenance Repair Practices" are a prerequisite to the future success of an organization in today's economy.



Course Objectives

- To enhance communication between Maintenance / Reliability /Production / Plant Leadership and Maintenance Technicians
- To provide the vision of Proactive and Maintenance to all Maintenance Technicians
- To increase knowledge and skills for Maintenance Technician through education and knowledge sharing
- To define Roles and Responsibilities between technicians and management
- To reduced turnover of Maintenance technicians because of lack of understanding between management and hourly technicians

Course Outline

- Benefits of the CMRT Exam and Certification
- Review of Certified Maintenance & Reliability Technician – CMRT - Candidate Guide for Certification and Recertification
- Definition of Maintenance of Reliability Best Practices
- SMRP Body of Knowledge and the Relationship to
- Definition of Maintenance and Reliability "Best Repair" Practices
- Causes of Equipment Failures
  - Inconsistent Execution of Work
  - Lack of effective Processes
  - Lack of Knowledge
  - Lack of Repeatability
  - Lack of proper aligned Leading and Lagging KPIs
- Preventive Maintenance / Prediction Maintenance
- Maintenance Planning and Scheduling

…. And so much more

"Virtual via Zoom (Internet) and Live at Southern Wesleyan University – 4 miles from Clemson, SC