

# HOW TO DECREASE EQUIPMENT FAILURES BY FOLLOWING A FEW SIMPLE TIPS

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# How you know if you are in Reactive Maintenance?

You know you have a Problem when you hear after equipment failures:

- We need to write a New PM
- Who worked on the Equipment Last
- We never have parts in the Storeroom
- We do not have time for training, to many problems
- We have a problem with Technician Morale
- We cannot afford to hire a Maintenance Planner
- Our storeroom never has the parts we need
  - We do not need a Maintenance Planner; we need our people to “step up”



# What Constitutes a Failure?

Equipment failure refers to any event in which any equipment cannot accomplish its intended purpose or task.

It may also mean that the equipment stopped working, is not performing as desired, or is not meeting target expectations.

**Two Types of Equipment Failures:**

- Total Functional Failure
- Partial Functional Failure



# Primary Causes of Equipment Failures

1. **Maintenance is Reactive (requires admitting you have a problem)**
2. **Improper Operation (Operator Error)**
3. **Failure perform Corrective and Preventive Maintenance to Specifications**
4. **Doing too much Preventive Maintenance.**
5. **Ineffective or No Predictive Maintenance Application to Critical Assets**
6. **Maintenance Planning and Scheduling is dysfunctional (Wrench-Time Low)**
7. **No Scorecard / Dashboards to ensure everyone knows their score in their specific**
8. **position Roles and Responsibilities are not clearly defined**
9. **Wrench-time is LOW**
  - **World Class Wrench-Time = 55-65%**
  - **Typical Wrench-Time = 15-25%**
  - **Worst in Class Wrench-Time = 5-10%**



# Cause #1 -Maintenance is Reactive

## Root Causes of Maintenance being in a Reactive State...

- Lack of Proactive Maintenance Knowledge or Experience
- Lack of Knowledgeable Leadership in Maintenance Best Practices (Production and Maintenance)
- The Environment in the Organization is reactive, and everyone knows it however no one knows how to move out of it
- Everyone knows Maintenance Cost is out of control, but they are not certain what to do about it.

Metric	Typical	World Class
Maintenance cost/replacement asset value Maintenance cost must include labor (including overtime), materials, contract maintenance, and capital replacements, and maintenance (replacing worn-out assets because they were never properly maintained)	3.5–9%	2.0–3.0%
Maintenance materials cost/replacement asset value Maintenance materials cost must include material in storeroom stock plus material in other locations (maintenance shop, plant floor, etc.)	1.0–3.5%	0.25–0.75%

## Cause #2 -Improper Operation (Operator Error)



### Root Causes of Operator Error...

- Lack of Leadership
- Lack of Discipline
- Lack of Training
  - No Operator Care program integration with the Maintenance PM Program
- Lack of a Scorecard that is seen and accurate

#### Operator Care Leading and Lagging KPIs



# Cause #3 – Failure to perform Corrective and Preventive Maintenance to Specifications

## Root Causes of Failure to perform Corrective and Preventive Maintenance to Specifications...

- Lack of Knowledge what is Maintenance Best Practices and how to manage as a Proactive Organization

- Lack of Resources

✓ Money

The Right People  
Leadership from top to  
bottom Lack of TRAINING  
DOLLARS

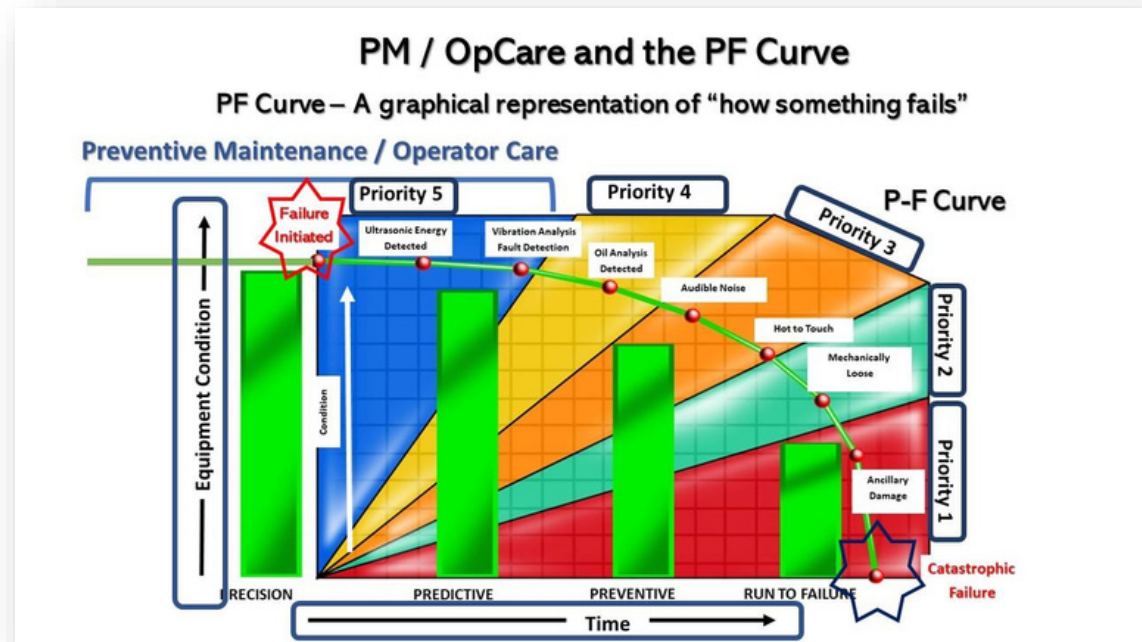
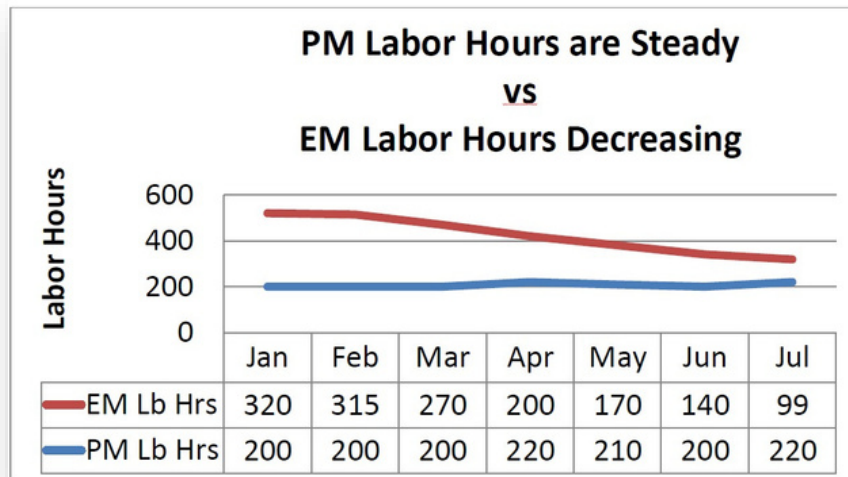
PM Procedure Example

Equipment Block ID: Line 101		Step		Description	Craft	# of Crafts	Clock Hours	Craft Hours	Craft Index	Comments / Findings:       Craft's Feedback on Procedures:   Craft's Signature:  Date:  Page 3 of 3
Equipment Hierarchy: E8400XX Super Process Line		1	Inspect Hydraulic System Running	• Does the Pressure Fluctuate more than 5psi? <b>Yes/No</b> • Number of Hydraulic Leaks	Mech	2	5	1.0		
Project Description: Perform PM on Super Process Line		2	<b>Caution: Failure to Check inside reservoir will result in premature valve failure</b>		Mech	2	25	5		
Job Description: Perform PM on Hydraulic System		2	Clean inside Reservoir with Lin Free Edge		Mech	2	1.0	2.0		
Frequency: Monthly		3	Replace Hydraulic Filters (2)		Mech	1	0.3	0.3		
Estimated Craft Hours: 2 hrs @ 1.0 hrs   Estimated elapsed time: 1.0		4	Tighten Fasteners on Filter Patches to L		Mech	1	5	5		
Originator: Dave Shene   Origination Date: 03/12/2012 Owner: Plant Maintenance   Version #: 1.0		5	Inspect 3 Hydraulic Hoses for wear or leaks	• Hose 1.1 Yes/No • Hose 1.2 Yes/No • Hose 1.3 Yes/No • Hose 1.4 Yes/No	Mech	2	1	2		
Approved: DS   Version #: 1.0		6	Inspect Hydraulic Cylinder for Leaks	• Inspect Rod Seal for Leaks (Circle One) - No Leaks - Weeping Oil - Oil Sprays • Inspect Rod Yoke for break in thread seal on threads - Yes/No	Mech	1	0.3	0.3		
Warnings: <b>Failure to follow instructions could result in death or serious injury.</b> Caution: <b>Failure to follow procedure could result in early equipment failure.</b>		7	Inspect all work after production is up to rate	• Do not leave equipment until production is up to rate	Mech	2	5	1.0		
Personal Protective Equipment Required: gloves, face shield, hearing protection		TOTAL Hours:					4.35	7.0		
Consumables Needed: Degreaser, Lin Free Tools, Thread Seal		Condition (As Found):								
Special Tools Required: 1. Torque Wrench		Condition (As Left):								
Mobile/Special Equipment: None		Required Departmental Coordination: Production Line shutdown / Hydraulic Cylinder Extended / One Operator to Assist Maintenance Other Procedures Referenced: Job Preparation / Lockout Procedure #XXXX								

# Cause #4 –Doing too much Preventive Maintenance

## Root Causes why you are doing too much Preventive Maintenance...

- No training in Preventive Maintenance, all knowledge has been passed down over the years
- Not knowing how to perform Preventive Maintenance as a “Controlled Experiment”
- Equipment not in a “Maintainable Condition”
- Measuring the wrong thing
- No one understands the PF Curve

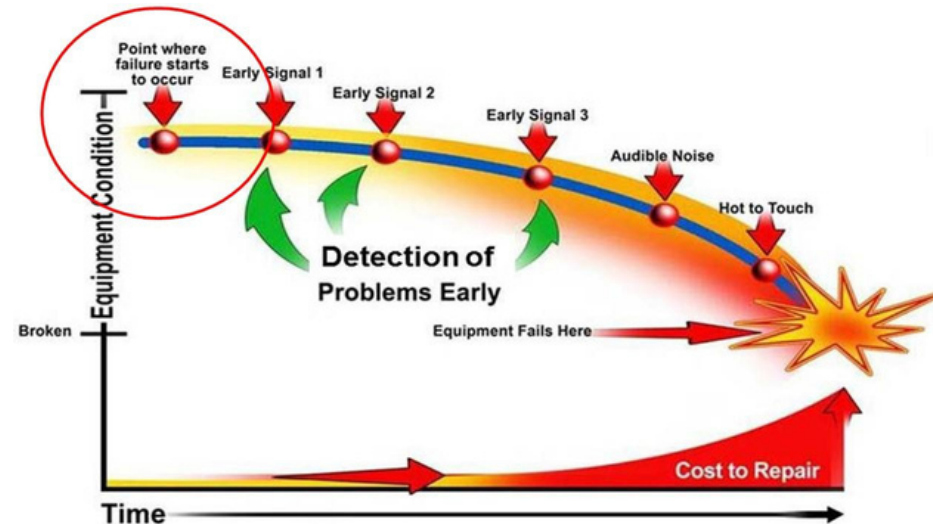




# Cause #5: Ineffective or No Predictive Maintenance Application

## Root Cause of Ineffective or No Predictive Maintenance:

- No one understands how to detect Failure Modes early
- Predictive Maintenance only used to satisfy the insurance company without regard to the enough money being loss on a daily basis
- No one has heard of the PF Curve



# Cause #6: Maintenance Planning and Scheduling is dysfunctional (Wrench-Time Low)

## Root Cause of Dysfunctional Maintenance Planning and Scheduling

- Maintenance Leadership has never been trained in Maintenance Planning and Scheduling
- No one knows how bad the organization wrench time is
- Maintenance Planners are trained however not allowed to Plan and Schedule the “Right Way”
- Maintenance is Reactive – Maintenance Planner is chasing parts

### Proactive Maintenance Planning and Scheduling Guiding Principles

- Maintenance Planners focus on Future Work only, today's issues are handled by Maintenance Supervisor or Lead Person
- All work “Scheduled” which require parts / material are kitted in a secure area
- All Planned and Scheduled work is tracked through status codes, see “Status Codes” below:
  - RTS – Ready to Schedule (parts kitted and staged/secure)
  - AP – Awaiting Parts
  - AWP – Awaiting Production
- All Work Scheduled one week in advance, typically scheduling meeting is held on Thursday for the following week with Production, Maintenance, and others as required (ie. Contractors, Safety)
- Leading and Lagging KPIs are used to manage the Planning, Scheduling, and Work Execution Process.

# Cause #7: No Scorecard / Dashboards to ensure everyone knows their score in their specific position

## Root Cause of NO Maintenance Scorecards / Dashboards

- **Leaders do not have time to identify how to create a Maintenance Score / Dashboard**
- **No one knows how to create one**
- **Maintenance is data rich, but no one knows how to assimilate the data to help everyone know their score in their position**

**“ You cannot manage what you do not measure”  
- Peter Drucker**

# Cause #8: Roles and Responsibilities have not been defined

## Root Cause of Un-Clear Roles and Responsibilities

- Reactive Plant Culture
- No one has roles and responsibilities defined by position for any process

Lean Maintenance "Roles and Responsibilities"								
Task ↓ Position →	Plant Mgr.	Prod Mgr.	Maint Mgr.	Stores Mgr.	Maint Tech	Maint Super	Maint Planner	CMMS Admin
CMMS Management	I	I	C	C	I	C	R	A
Lean Leading and Lagging KPI Management	I	I	A	C	I	C	R	R
Preventive Maintenance	I	I	A	I	R	C	C	C
PM Evaluation/Optimization	I	C	A	C	R	R	R	R
Maint. Planning/Scheduling	I	R	A	I	I	R	R	I
Work Execution	I	I	A	I	R	C		I
Maintenance Rework	I	I	A	C	R	C	C	C
Production Rework	I	A	I					
Failure Reporting, Analysis, Corrective Action Process	A	R	R	C	I	C	C	C

Responsibility	"the Doer" (could be more than one)
Accountable	"the Buck stops here" (One person only)
Consulted	"two-way communication" (in the Loop)
Informed	"one-way communication" (kept in the picture)

# Simple Tips Resulting in a Reduction in Equipment Failures

1. Define what constitutes a partial functional and total function failure

2. Hire someone to provide simple RCA training for Plant Production, Maintenance Leadership, Maintenance Technicians, and Operators

3. Write Work Orders for all Failures and ensure the following is identified:

- Asset Number, Problem or Work Required
- Parts Used, Labor type, Hours, and Number of techs
- Root Cause of the Failure
  - (LS) Lack of specifications
  - (OE) Operator error
  - (NT) Not enough time to repair to specifications
  - (NP) No Repeatable Procedure
  - Etc.
- Condition as Found
- Condition as Left
- Recommended Changes to Procedures

WO # 12033      Asset # 12332 - Line 1

Job Description: \_\_\_\_\_

Frequency: Monthly

Estimated Production Downtime: 0

Owner: Maintenance Dept      Version #: 1

Approval: RAS      Version #: 1.0

Personal Protective Equipment Required: Gloves, hearing protection

Part # (Stores ID)	Part Description	Quantity	Quantity Description
C-1395	Synthetic Lube	1	Each

Consumables Needed: \_\_\_\_\_

Special Tools Required: \_\_\_\_\_

Mobile/Special Equipment: \_\_\_\_\_

Production Lead will be notified before execution of Lubrication

ID	Description	Craft Type	# of Crafts	Craft Hours	Initial Steps
1	Ask Operator if any issues with asset	M	1	.1	KL
2	Inspect for fluid leaks & inform ops	M	1	.1	KL
3	Clean grease fitting with lint free rag	M	1	.1	KL
4	Apply grease to grease fitting	M	1	.1	KL
5	Notify Production work is complete	M	1	.1	KL
6	Complete Work Order	M	1	.1	KL
Total Hours			1	1	KL

Condition (As Found): (Required)  
Leaks coming from #1 Gearbox

Condition (As Left): (Required)  
Clean up oil, notified production leader to keep area clean of oil

Comment(s): (Optional)  
None

Craft's Feedback on Procedures: (Optional)  
All Good

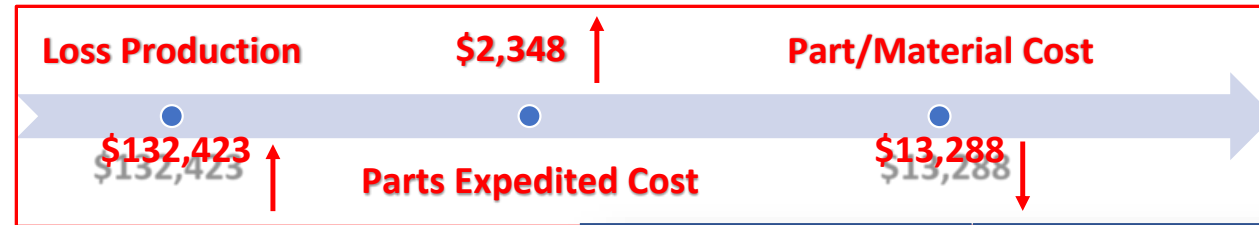
Craft's Signature(s): (Required)  
*Jim Jimbo*


Date:  
10/11/2019

# Simple Tips to Resulting in a Reduction in Equipment Failures

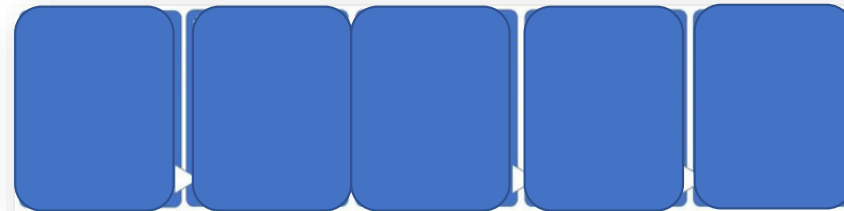
## 4. Track and Manage Failures

- Cost of the Failures
  - Loss Production (\$)
  - Parts Expedited Cost
  - Parts/Material Cost
  - Etc.
- Create a A3 Failure Board to share failures with everyone



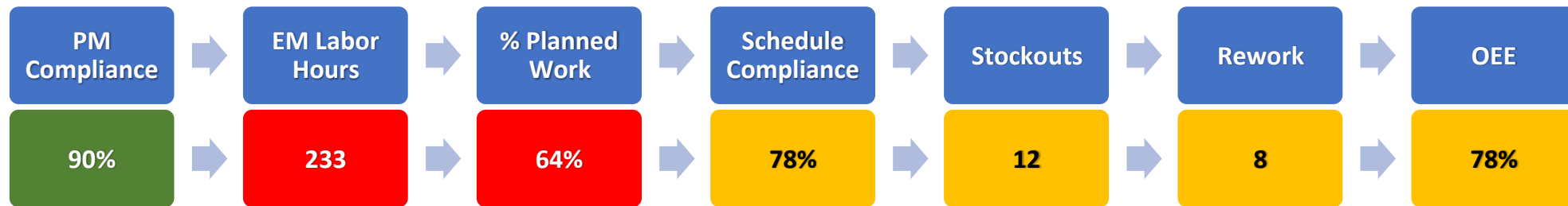
<p><b>Problem:</b></p> <p>Line 3 - Gearbox Failure (Asset Criticality - High)</p> <ul style="list-style-type: none"> <li>• Production Losses - 330 Unit</li> <li>• 4 Hours downtime (\$7450)</li> </ul> 	<p><b>Resolution:</b></p> <ol style="list-style-type: none"> <li>1. Replaced Gearbox to specifications</li> <li>2. Sent gearbox out for rebuild and forensics "ID Root Cause", why it failed, replaced parts returned for view by all Maintenance Techs</li> <li>3. Review all PM frequencies on gearbox</li> <li>4. Review past oil sample results</li> <li>5. Cost of Gearbox Replacement, Labor \$200, Gearbox \$800</li> </ol>
<p><b>Root Cause:</b></p> <p>The Facts -</p> <ol style="list-style-type: none"> <li>1. Known gearbox noise</li> <li>2. Reported on daily check list for 2 weeks</li> <li>3. Production needed to run, could not take downtime to replace gearbox</li> </ol>	<p><b>Measurement /Sustainment:</b></p> <ol style="list-style-type: none"> <li>1. PM Compliance +/- 10% of time frequency on critical assets</li> <li>2. Oil Sample Time from Sample taken;                     <ul style="list-style-type: none"> <li>• To Results Received and Review Measured</li> <li>• If resample - require 3 days to resample</li> <li>• If out of specs found, CM WO written, Replacement Planned and Scheduled</li> </ul> </li> </ol>

## 5. Create a Dashboard to measure a reduction or increase in failures by area or asset or overall



# Final Thoughts

1. Keep the Maintenance Storeroom Locked and Secure 24/7
2. Ensure 90% plus of Maintenance Work is Planned and Scheduled
3. Ensure 100% of Scheduled work has repeatable Procedures
4. State “Equipment Failures” are unacceptable and must be eliminated unless RTF (Run-To-Failure) is the Maintenance Strategy for a specific asset or assets
5. Train Maintenance Leadership in Maintenance Best Practices
6. Train all Maintenance Planners (plus one technician) in formal Maintenance Planning and Scheduling Best Practices
7. Provide Formal Training to “2” Maintenance Technicians in “Root Cause Analysis”
8. Create a New Position –“Maintenance Engineering Technician” (this technician only focused on Failure Mitigation and Elimination
9. Post a Scoreboard to Provide all Levels of Plant Personnel to the status of the Maintenance Process



# Questions

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## MAINTENANCE PLANNING AND SCHEDULING

THREE DAY WORKSHOP WITH RICKY SMITH, CMRP, CMRT, CRL

DATE: JANUARY 19-21, 9:00AM - 4:00PM EST

VIRTUAL: EACH PERSON WILL JOIN A ZOOM LINK TO JOIN EACH DAY

IN-PERSON: SOUTHERN WESLEYAN UNIVERSITY, CLEMSON, SC



### QUESTIONS CONCERNING THIS TRAINING

How can I attend? 2 Options.

**OPTION 1:** "Zoom" is just an internet tool that allows anyone to meet, learn, or teach a workshop, all you will have to do is have the internet and click on the link sent to you the morning of each day.

*"Zoom allows everyone to interact with the instructor, work with others virtually in "hands on" exercises."*

**OPTION 2:** Live at Southern Wesleyan University in Central, SC (4 miles from Clemson, SC).

*All attendees will socially distance in a very large training facility.*





# #1 Software for Maintenance & Reliability Teams

UpKeep is a service-first company that builds software designed to make maintenance easier for technicians and managers everywhere. Reduce downtime up to 18% by switching over to a preventative maintenance solution!

[www.upkeep.com](http://www.upkeep.com)

## Our Products



### Mobile-first maintenance management and collaboration across all location, assets, and teams

"With nearly 340 different machines in our work environment, it's an impossible task to manually assign and track PM's. *With UpKeep we can schedule regular maintenance without overlapping tasks with other critical jobs.*"

★★★★★ Paul D, Health and Safety Coordinator



### An end-to-end solution for remote condition-based monitoring

Connected and secure IoT sensors for real-time remote condition asset monitoring



**DATAHUB**  
UpKeep

### Integrated & Centralized Data Ecosystem for World Class Asset Operations

The only purpose built Asset Data Platform. Asset Focused ELT Solution for advanced analytics and integrated, real-time asset data.



### The Maintenance Community Coalition was founded on the belief that working together will benefit everyone within our community

Committed to helping each other thrive in our individual professional journeys by sharing resources and expertise, granting scholarships, hosting events, and unlocking knowledge – always at no cost.

