Service Strategies

for higher reliability by lower costs

Joerg Recklies
Director Maintenance Engineering
Infineon Dresden GmbH
Maintenance Strategy

Optimized maintenance strategy = Minimized Costs + Optimized Resources + Reduced Scrap + Increased Throughput

Basic age repair/replace model

Figure 1. Total maintenance cost vs. mean time between maintenance (MTBM)
Different Strategies

- **Predictive Maintenance (PdM)**
  Uses data about the condition of equipment and facilities, FAB performance and maintenance management data to schedule the most convenient and effective point of time for a maintenance event.

- **Condition-based monitoring (CBM)**
  Uses techniques to monitor and control the condition of equipment consumables and facilities to provide quantitative data on which decision to take maintenance can be made.

- **Usage Based Preventive Maintenance (BDM)**
  Changeouts carried out at predetermined intervals of usage (e.g. RF-hour based maintenance).

- **Time Based Preventive Maintenance (TBM)**
  Parts has to be exchanged/repairsd at predetermined intervals of time (e.g. semi annual PM).

- **Breakdown Maintenance (BDM)**
  Unplanned equipment repair or replacement where equipment is repaired after a failure event (UD-events).
Maintenance Strategy Impact

**Run-to-Failure**
- SD: no impact
- UD: negative impact
- PE: positive impact
- ME: positive impact

Run-to-Failure is the best method if the failure impact is minor while the effort for preventive or predictive maintenance is big.

**Predictive**
- SD: negative impact
- UD: positive impact
- PE: positive impact
- ME: negative impact

Predictive maintenance is the best method if the failure impact and maintenance effort are substantial, the lifetimes are variable due to different processes and sensors are available.

**Preventive**
- SD: negative impact
- UD: positive impact
- PE: positive impact
- ME: negative impact

Time based preventive maintenance is the best method if the failure impact as well as the maintenance effort is substantial, the lifetimes are well known or sensors are not available.

**Risk-based**
- SD: positive impact
- UD: positive impact
- PE: positive impact
- ME: positive impact

Risk based maintenance balances the cost impacts of the maintenance intervention and the failure impacts with statistical methods. Extensive data are necessary.

**SD**: Scheduled Down time
**UD**: Unscheduled Down time
**PE**: Personnel Efficiency
**ME**: Material Efficiency
What is RCM?

- A combination of all maintenance strategies based on the critically and importance of the equipment
- Maintenance scheme based on the reliability of the various components of the system or product in question
- Implementing a proactive maintenance program using RCM can greatly reduce the cost of ownership of a product or system.
- An effective RCM program requires extensive knowledge about the reliability and maintainability of the system and all of its subsequent components
- Important factors include the MTTR (Mean Time To Repair) and failure rate (total number of failures within a given time period) of the product or system
Why should I use RCM?

- RCM can improve the efficiency of the system undergoing maintenance, and all other products or processes that interact with that system.

- An effective RCM program will optimize the maintainability of the system - allowing you to anticipate the times when the system is down for maintenance and scheduling other activities or processes accordingly.

- Effect all OEE losses
  - Speed, Downtime, Quality
Structured maintenance review program

- lead to massive reliability and productivity improvements
- the experience conducting maintenance reviews in almost all industries suggests that on average
  - 20% of maintenance tasks are ineffective or completely unnecessary
  - 25% are scheduled too frequently
  - that only 13% of the tasks are effective and require no changes
Maintenance Optimization Cycle

Review Maintenance Program
- Maintenance strategy
- Equipment problems
- Spare Parts
- Planning / Scheduling
- Costs
- Resources

Identify Important Processes, Systems and Equipment
- Safety
- Productivity
- Product Cost
- Reliability

Collect Supporting Data
- Vendor Service
- Failure History
- Personnel Interviews
- Industry Practices
- OEE Performance

Identify Equipment Importance & FMECA
- Operational Data
- Experienced Failures
- Trainings Level

Planning & Performance of Maintenance Activities
- Training
- Setup Predictive Program
- Spare Parts Optimization
- Optimize Service Support

Select, Optimize Integrate Maintenance Activities
- Adjust PM Frequency
- SMED Analysis
- Integrate Predictive Maintenance

Implement / Living Maintenance Program
- Operational Requirements
- Maintenance Feedback
- Design Changes
- Change Control
- Failure Trending

Maintenance Review Cycle
Prediction

1. unspecific information
   - check for immediate refill
   - stop planned really soon

2. specific information with values available
   - refill can be scheduled in advanced
   - alignment with one of the next gas station possible
OEE and RCM

Significant breakdowns per machine (stopped longer than 10 minutes)

Setup/adjustment time for changeovers/tool setups

Idling and minor stoppages – less than 10 minutes

Any reduction from planned/ideal cycle time (design speed)

All quality-related losses

Start-up yield – 99% or more of lot

Downtime-losses

Scheduled time

Available time

Idling/Minor stops

Speed Losses

Operating time

Startup losses

Scrap/Rework

OEE

Quality-losses

Input - amount of defects

Input

Quality rate
World class >99%

OEE

RCM- Reliability Centered Maintenance

Available time

Performance rate
World class >95%

Ideal cycle time x output

 Scheduled time

Availability rate
World class >90%
SMED Methodology

- SMED = "Single Minute Exchange of Die"
- SMED is an approach of continually challenging frequent maintenance procedures to optimize time consumption for those activities
- Maintenance procedures includes:
  - changing consumables or chemicals / adjustments or calibration / changing of spare parts / routine inspections and checks / ...

### Stages

1. Measure the total changeover time
2. Determine internal and external steps
3. Convert internal steps into external and move external steps outside of the changeover
4. Shorten the internal steps
5. Improve the external steps
6. Standardize the new changeover procedure

### Implementation

1. Prepare a „script“
   - f.e. wc – instruction with time table
   - Resource: 2h FE / 2h SE IH

2. Execute SMED – analysis at tool
   - video recording activities
   - time measurement as script
   - Resource: complete analysis time
   - 1 x maintenance shift, SE IH, FE

3. Workshop
   - Video analysis & brainstorming potential
   - Resource: 6 -8h
   - 2x maintenance shift, SE IH, FE

4. Potential list for implementation
   - Resource: 1,5h
   - Head of Department, LE IH, FE

### Benefit
Reliability vs. Costs

Optimal scenario achieves high levels of reliability while minimizing total costs from maintenance and lost productivity.

Decreasing marginal returns and increased costs may occur when trying to achieve highest levels of reliability.
Reliability Centered Maintenance is an holistic approach for an optimized maintenance strategy.

This strategy is system oriented, therefore highly recommended in an high automated environment.

It addresses the fact of reliability optimization like:

- Maintenance controls
- Continuous process improvement
- Equipment reliability, criticality, downtime analysis
- Root cause analysis
- Workforce optimization, Contract labor optimization; Maintenance training
- Cost control
- Planning and scheduling
- Change management
Thank you.

Infineon Dresden

Quality meets Innovation.

Broad Technology Base
Prime Security Standards
Fast Customer Samples
Advanced Automation
Customer Embedded
High Flexibility
Rapid Ramps
Zero Defect
Top Experts
Open Mindset
More than Moore
World Class Yields
Short Cycle Times