# HOW THE BEST PRACTICES CAN HELP MAINTENANCE OF THE MACHINE OR EQUIPMENT AND OVERALL EQUIPMENT EFFECTIVENESS ( OEE ) VALUE.

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**Abstract :**

Effective Maintenance Practices play a crucial role in maximizing the performance and longevity of industrial machinery and equipment. In this Article, we explore how implementing Best practices can positively impact Overall Equipment Effectiveness (OEE).

Adopting best practices in equipment maintenance directly impacts OEE. Organizations that prioritize proactive maintenance and invest in training, processes, and technology will achieve higher equipment reliability, extended equipment lifespan, improved efficiency, reduce the risk of unexpected breakdowns, reduced costs, and improved overall performance.

OEE is commonly used as a performance metric in manufacturing industries to identify areas for optimization, track improvements over time and benchmark different equipment or production lines.

Improving OEE can bring several significant benefits to organizations in the manufacturing, Construction and mining sectors.

Key words: OEE, Best Practices, Predictive Maintenance, Root Cause Analysis, Continuous improvements

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**1. Introduction** : Effective equipment maintenance is critical for achieving high Overall Equipment Effectiveness (OEE). This abstract explores the impact of best practices on equipment maintenance and outlines strategies to enhance OEE.

**2. Objectives of the study:**

i). To identify the Best Practices for equipment maintenance.

ii). To study and evaluate the effectiveness of the Best practices for equipment maintenance.

**3**. **Understanding OEE** :

OEE is a comprehensive metric that evaluates the efficiency of production equipment. It considers three key factors:

- Availability: The percentage of time equipment is available for production.
- Performance: The rate at which equipment operates compared to its ideal speed.
- Quality: The proportion of defect-free products produced.

**4. Best Practices for Equipment Maintenance;**

4.1 Predictive Maintenance

- Definition: Predictive maintenance involves using data analytics and sensors to monitor equipment health and predict failures.
- Benefits:
  - Minimizes unplanned downtime by addressing issues before they escalate.
  - Improves availability by scheduling maintenance during planned downtime.
  - Enhances performance by optimizing equipment condition.

4.2 Proactive Repairs

- Definition: Proactive repairs involve addressing minor issues promptly to prevent major breakdowns.
- Benefits:
  - Reduces downtime by preventing unexpected failures.
  - Improves performance by maintaining equipment at optimal levels.
  - Enhances quality by preventing defects caused by faulty equipment.

4.3 Operator Training

- Definition: Well-trained operators can operate machinery efficiently and minimize errors.
- Benefits:
  - Improves performance by ensuring correct equipment operation.
  - Enhances quality by reducing operator-related defects.
  - Increases safety by preventing accidents due to operator errors.

4.4 Spare Parts Management

- Definition: Proper inventory management ensures quick access to critical spare parts.
- Benefits:
  - Minimizes downtime by having essential parts readily available.
  - Improves availability by reducing waiting time for spare parts.
  - Enhances performance by maintaining equipment with genuine parts.

4.5 Root Cause Analysis

- Definition: Investigating failures helps identify underlying issues.
- Benefits:
  - Prevents recurrence of failures by addressing root causes.
  - Improves quality by eliminating persistent defects.
  - Enhances performance by optimizing processes.

4.6 Standard Operating Procedures (SOPs)

- Definition: Clear SOPs guide maintenance tasks.
- Benefits:
  - Ensures consistency in maintenance practices.
  - Improves quality by following standardized procedures.
  - Enhances performance by minimizing errors.

4.7 Continuous Improvement

- Definition: Regularly reviewing and optimizing maintenance processes.
- Benefits:
  - Incrementally improves OEE over time.
  - Enhances performance by adapting to changing needs.
  - Fosters a culture of excellence in maintenance.

4.8 Common pitfalls of Maintenance

When it comes to maintenance, avoiding common pitfalls can save time, money, and prevent unnecessary headaches. Here are some pitfalls to steer clear of:

1. **Not involving the appropriate team members**:
   - When creating a maintenance plan, ensure buy-in from personnel responsible for managing the change. Upper management support is crucial.
   - Clear communication ensures everyone knows their responsibilities and prevents mixed messages.
2. **Failure to create (and follow) written procedures**:
   - Transitioning from reactive to proactive maintenance requires a mindset shift.
   - Having written procedures for maintaining each asset helps eliminate costly mistakes and oversights.
3. **Improper equipment selection**:
   - Choose the right assets to monitor for predictive maintenance.
   - Proper equipment selection enhances plant reliability

**5. Methodology of the study:**

Looking into the breadth and depth of research, a mixed research approach shall be deployed which will consist of both Qualitative Research as well as Quantitative Research.

Qualitative Research, like

1. Focused Group Survey
2. Focused Group Interview
3. Delphi method
4. 100 points or Dot voting method,

Quantitative Research, like

1. Survey Research with Purposive, Stratified, Random Sampling.
2. 100 points or Dot voting method. ( Quality Research Technique)

**6. Survey Result:**

**i). Focused Group Survey :**

a). Survey data collected from more than 18,000 equipment's users who are following some of the Best practices.

b). Random Samplings of 40 users taken from the above samples.

Best practices were grouped into **7 Techniques**, for further study or for analysis, based on the 40 samples of Customers who practiced or followed the Best Practices.

| Sl.No. | Suggested Best Practices for Equipment Maintenance |
|---|---|
| 1 | Predictive Maintenance |
| 2 | Proactive Repairs |
| 3 | Operator Training |
| 4 | Spare Parts Management |
| 5 | Root Cause Analysis |
| 6 | Standard Operating Procedures |
| 7 | Continuous improvements |

The Survey results for 7 Techniques are as follows;

| Sl.No. | Best Practices (7) followed by the Companies | Performance Ratings % | OEE ( Equipment Performance) |
|---|---|---|---|
| 1 | ABC-1 | 83 | 82% |
| 2 | ABC-2 | 45 | 43% |
| 3 | ABC-3 | 67 | 63% |
| 4 | ABC-4 | 62 | 61% |
| 5 | ABC-5 | 79 | 75% |
| 6 | ABC-6 | 38 | 33% |
| 7 | ABC-7 | 93 | 91% |
| 8 | ABC-8 | 69 | 65% |
| 9 | ABC-9 | 50 | 48% |
| 10 | ABC-10 | 67 | 66% |
| 11 | ABC-11 | 48 | 45% |
| 12 | ABC-12 | 76 | 74% |
| 13 | ABC-13 | 81 | 80% |
| 14 | ABC-14 | 100 | 95% |
| 15 | ABC-15 | 38 | 35% |
| 16 | ABC-16 | 93 | 91% |
| 17 | ABC-17 | 69 | 66% |
| 18 | ABC-18 | 74 | 72% |
| 19 | ABC-19 | 100 | 95% |

| | | | |
|---|---|---|---|
| 20 | ABC-20 | 88 | 86% |
| 21 | ABC-21 | 79 | 77% |
| 22 | ABC-22 | 71 | 69% |
| 23 | ABC-23 | 88 | 85% |
| 24 | ABC-24 | 55 | 53% |
| 25 | ABC-25 | 86 | 83% |
| 26 | ABC-26 | 43 | 41% |
| 27 | ABC-27 | 98 | 94% |
| 28 | ABC-28 | 86 | 84% |
| 29 | ABC-29 | 79 | 77% |
| 30 | ABC-30 | 36 | 34% |
| 31 | ABC-31 | 50 | 46% |
| 32 | ABC-32 | 71 | 69% |
| 33 | ABC-33 | 88 | 86% |
| 34 | ABC-34 | 98 | 94% |
| 35 | ABC-35 | 86 | 83% |
| 36 | ABC-36 | 88 | 84% |
| 37 | ABC-37 | 88 | 84% |
| 38 | ABC-38 | 60 | 58% |
| 39 | ABC-39 | 93 | 91% |
| 40 | ABC-40 | 98 | 94% |

Based on the Data's have been categorized into Excellent, Very Good, Good, Satisfactory, and Poor, based on the overall total score for each Customer.

| **Category** | **No. of Customers** | **Avg. OEE %** |
|---|---|---|
| Excellent | 8 | 96.63 |
| Very Good | 10 | 86.2 |
| Good | 7 | 75.57 |
| Satisfactory | 5 | 66.8 |
| Poor | 10 | 46.3 |

The Category of Excellent, Very Good, and Good are totalling to 25 Customers out of 40, and Satisfactory, and 10 are totalling to 15.

The companies who are falling in the category of Excellent, Very Good, and Good are totalling to 25. A focused group was formed to prioritize the Best Practices followed by the 25 companies.

**Table: 100 Points or Dot Voting Method.**

| Sl.No | List of Customers under Excellent, Very Good & Good Category | Total Votes per Stakeholder | Votes for ; | | | | | | | Total Voted |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Proactive Repairs | Continuous improvements | Use of Genuine Parts | Operator Training | Predictive Maintenance | Root Cause Analysis | Standard Operating Procedures | |
| 1 | ABC-1 | 100 | 10 | 10 | 15 | 20 | 20 | 15 | 10 | 100 |
| 2 | ABC-5 | 100 | 5 | 10 | 20 | 25 | 20 | 10 | 10 | 100 |
| 3 | ABC-7 | 100 | 5 | 5 | 15 | 20 | 20 | 15 | 20 | 100 |
| 4 | ABC-12 | 100 | 10 | 10 | 20 | 15 | 20 | 10 | 15 | 100 |
| 5 | ABC-13 | 100 | 7 | 8 | 20 | 25 | 20 | 15 | 5 | 100 |
| 6 | ABC-14 | 100 | 10 | 10 | 18 | 22 | 20 | 10 | 10 | 100 |
| 7 | ABC-16 | 100 | 5 | 15 | 20 | 25 | 20 | 8 | 7 | 100 |
| 8 | ABC-18 | 100 | 8 | 10 | 15 | 20 | 20 | 15 | 12 | 100 |
| 9 | ABC-19 | 100 | 5 | 8 | 20 | 20 | 20 | 18 | 9 | 100 |
| 10 | ABC-20 | 100 | 10 | 10 | 15 | 15 | 15 | 15 | 20 | 100 |
| 11 | ABC-21 | 100 | 8 | 14 | 18 | 20 | 20 | 10 | 10 | 100 |
| 12 | ABC-22 | 100 | 5 | 8 | 20 | 17 | 17 | 18 | 15 | 100 |
| 13 | ABC-23 | 100 | 9 | 12 | 18 | 25 | 20 | 9 | 7 | 100 |
| 14 | ABC-25 | 100 | 6 | 12 | 17 | 23 | 22 | 10 | 10 | 100 |
| 15 | ABC-27 | 100 | 5 | 10 | 15 | 25 | 25 | 10 | 10 | 100 |
| 16 | ABC-28 | 100 | 5 | 10 | 20 | 20 | 20 | 20 | 5 | 100 |
| 17 | ABC-29 | 100 | 8 | 12 | 18 | 22 | 22 | 9 | 9 | 100 |
| 18 | ABC-32 | 100 | 5 | 15 | 20 | 20 | 20 | 10 | 10 | 100 |
| 19 | ABC-33 | 100 | 5 | 15 | 20 | 20 | 20 | 10 | 10 | 100 |
| 20 | ABC-34 | 100 | 6 | 13 | 20 | 25 | 20 | 9 | 7 | 100 |
| 21 | ABC-35 | 100 | 4 | 8 | 25 | 30 | 20 | 5 | 8 | 100 |
| 22 | ABC-36 | 100 | 5 | 5 | 25 | 30 | 20 | 8 | 7 | 100 |
| 23 | ABC-37 | 100 | 8 | 8 | 22 | 28 | 18 | 8 | 8 | 100 |
| 24 | ABC-39 | 100 | 7 | 11 | 18 | 32 | 18 | 7 | 7 | 100 |
| 25 | ABC-40 | 100 | 5 | 10 | 20 | 25 | 20 | 10 | 10 | 100 |
| | **Total Votes** | | **166** | **259** | **474** | **569** | **497** | **284** | **251** | **2500** |
| | **% of Votes** | | **7%** | **10%** | **19%** | **23%** | **20%** | **11%** | **10%** | **100%** |
| | **Derived Ranking / Priorities** | | 7 | **5** | **3** | **1** | **2** | **4** | 6 | |

The followings are the **Best Concepts** which are obtained **Top 5 Ranking** through 100 Points Voting ;

| Sl.No. | Best Practices |
|---|---|
| 1 | **Operator Training** |
| 2 | **Predictive Maintenance** |
| 3 | **Spare Parts Mgt.** |
| 4 | **Root Cause Analysis** |
| 5 | **Continuous improvements** |

7. **Case Study Result :** Company ABCD Equipment Manufacturer and Operator Manufacturing implemented best practices, resulting in:

- 20% reduction in unplanned downtime.
- 15% increase in equipment availability.
- 10% improvement in product quality.

8. **CONCLUSION :**

**Conclusion:** Adopting best practices in equipment maintenance directly impacts OEE. Organizations that prioritize proactive maintenance and invest in training, processes, and technology will achieve higher efficiency, reduced costs, and improved overall performance

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