ZenPower International Presentation.

TPM Implementation Blue-Print

www.tpmquality.com

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Introduction.

Who We Are:

ZenPower International was established in 1995 with its registered office in Singapore.

Our Vision.

To be the preferred regional provider of training, consultancy and sales services known for its integrity and excellence in business Quality, Reliability and Delivery.
Focus:

Understanding and Using Autonomous Maintenance and OEE concept for Continuous Improvement in manufacturing
## TPM-AM Standards

<table>
<thead>
<tr>
<th>Step #</th>
<th>Step Goal</th>
<th>Standards</th>
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</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Restoration</td>
<td>=&gt; 85% repair rate</td>
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<tr>
<td>Step 2</td>
<td>Eliminate Sources of Contamination</td>
<td>=&gt; 70% successful effort</td>
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<tr>
<td>Step 3</td>
<td>Improve Equipment Accessibility</td>
<td>=&gt; 70% successful effort</td>
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<tr>
<td>Step 4</td>
<td>Initial Maintenance Standards</td>
<td>&gt; 50% sudden b/d reduction</td>
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<tr>
<td>Step 5</td>
<td>General Inspection Skills</td>
<td>&gt; 90% sudden b/d reduction</td>
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<tr>
<td>Step 6</td>
<td>Autonomous Inspection</td>
<td>&gt; 95% sudden b/d reduction</td>
</tr>
<tr>
<td>Step 7</td>
<td>Organise and manage workplace</td>
<td>TBD by management</td>
</tr>
</tbody>
</table>
Langkah-1 : Mengembalikan Peralatan Seperti Asal
(Step-1 : Restoration Equipment)
Langkah-2 : Menghapuskan Punca-Punca Kekotoran (Step-2 : Eliminate Contamination & Stains on Area & Parts)

AM Team = 70%

Countermeasures

Complete Step-1

1st Pre-Audit by TPM Dept.

Own area Buy - Off

Step-1 Summary results & findings


Present Countermeasures to TPM WC and implementation

GM/Sponsors Audit

Step-3

Countermeasure
LANGKAH-3 : MEMUDAHKAN KERJA-KERJA PEMBERSIHAN, PEMERIKSAAN DAN PELINCIRAN
( STEP 3 : IMPROVE EQUIPMENT ACCESSIBILITY ).

AM Leader
Model m/c
Passed Step 2

Areas difficult or inaccessible for cleaning checking & lubricating

Inaccessible
No Place To Stand
Wiring or piping obstruct
Cannot see easily

Time Consuming to clean

Product Manager

Operator Leader/ Operators
Supervisor

Model Machine Goes To Step 4

GM Audit
W/C Buy Off
Own Area Buy Off
Pre-Audit by TPM Dept.
Langkah-4 : Piawaiian Penyelenggaraan Awal
(Step 4 : Initial Maintenance Standards)

Model m/c passed Step 3
Initial maintenance standard
Abnormality in lubrication equipment
Abnormality in circulation of lubrication
Equipment gets dirty during oiling

Engineer & Maintenance

Hard to lubricate
Hard to check oil level
Draft standards for cleaning, inspection & lubrication
Attach identification label

Trial Period

TPM dept. Pre-audit
GM audit

AM Leader
Product Manager
Operator Leader/operator
Supervisor

Counter measure for cleaning and checking

Proliferation of Step 4

GM audit
Langkah-5 : Skil Pemeriksaan Am
( Step 5 : General Inspection skills )

- Lubrication
- Equipment parts tightening
- Pneumatics
- Hydraulics
- Electrical
- Drive System
- Water
- Fire prevention/safety

Select general inspection items

Managers/supervisors participate in training

Test

Implement general Im..

GM Audit

TPM office Pre-Audit

Prepate texts and daily schedules/check lists

Revised Maintenance standards

Cut away models

Checklist

Manuals

Proliferate Step-5
(Step 5: General Process Inspection)

- Process Flow
  - Process knowledge.
  - Adjustment skills
  - Abnormalities in Process.
  - Process flowchart.

Select General Process items

- Manuals
- Checklists
- Cleaning standards
- Process Inspections schedules

Prepare texts and daily schedules/check lists

Managers/supervisors participate in training

Test

Implement general Im..

TPM office Pre-Audit

GM Audit

Proliferate Step-5
Langkah-6 : Pemeriksaan Autonomi
(Step-6 : Autonomous Inspection)

Maintenance | Inspection standards, breakdown analysis

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Step-1 to 3:
Establish basic conditions (cleaning and lubrication)

Step-4
Daily checking, adjustment, and improvement of conditions for correct operation

Step-5
Revise provisional standards

Finalise standards for cleaning and lubrication

Operators who understand their equipment (able to maintain inspection standards)
Organise and set standards for:

- Equipment Precision
- Inspection Items
- Tools and Materials
- Standards for Individual Work Responsibilities
- Flow and Storage
OEE

= Availability * Performance Rate * Quality Rate

= Maximum 100%

Under Actual Manufacturing conditions, some losses are inevitable. Hence the Best Practices have adopted 85% as a realistic **monthly** target.
Equipment OEE Losses

Equipment Total Available time in 8 hr shift = 480 mins.

Equip. Loading time = 460 mins

Equip. Planned D/T = 20 mins

Equip. Operating time

Equip. UnPlanned D/T = 60 mins

Equip. Speed Performance Losses.

Equip. Nett Operating time

Virtual/Immeasurable time.

Equip. Quality Losses

Equip. Valuable Operating time
Calculating Availability in OEE.
Equipment OEE Losses

Equipment Total Available time in 8 hr shift = 480 mins.

A

Equip Loading time = 460 mins

B

 Equip Planned D/T = 20 mins

 Equip UnPlanned D/T = 60 mins

C

 Equip Operating time

 Equip Speed Performance Losses.

 Equip Nett Operating time

 Equip Quality Losses

 Equip Valuable Operating. time

Real Measurable time

Virtual/Immeasurable time.
Availability & Utilization

- Losses due to unplanned downtime only.
- The unplanned events are Machine Breakdown and Setups.
- Small fluctuations.

- Losses due to the same reasons plus
- Planned downtime mainly due to ‘no schedule’ during poor business conditions or holidays, PM shuts
Calculating

Performance Rate

in OEE.
Equipment OEE Losses

Equipment Total Available time in 8 hr shift = 480 mins.

1. Equip Breakdown losses.
2. Equip Setup losses (>10min)
4. Reduced Speed losses.
5. Defect losses
6. Yield/startup losses

Equipment Planned D/T = 20 mins
Equipment Unplanned D/T = 60 mins

Equipment Speed Performance Losses

Equipment Quality Losses

Equipment Valuable Operating time

Virtual/Immeasurable time

Real Measurable time
USEFULNESS OF OEE

• Provides a long-term baseline of equipment condition for improvement measurement.

• When an OEE analysis chart is plotted, the exact reasons in terms of the 6 Big Losses are clearly understood.

• Suitable tools can be used to address specific selected Losses.
IDENTIFY THE MAJOR LOSSES THROUGH THE OEE ANALYSIS

Before

OEE-Analysis Format

1-Month Summarized Data in Minutes

1. Total available time = 44640 min
2. No schedule time = 26870 min
3. Planned downtime = 3655 min
   3a. PM time = 0 min
   3b. Meeting time = 0 min
   3c. Housekeeping / TPM = 3655 min
4. Loading time = 1 - 2 - 3 = 14115 min = 846900 sec
5. Unplanned downtime = 2941 min
   5a. Machine breakdown = 2168 min
   5b. Engineering time = 0 min
   5c. QC / QA time = 193 min
   5d. P. Parts shortage = 580 min
   5e. No material (Lot waiting) = 0 min
   5f. Facility stoppages = 0 min
   5g. Break time / No operator = 0 min
   5h. Rework / Retest = 0 min
6. Production time = 4 - 5 = 11174 min
7. Total quantity processed (Actual O/P) = 33877 frame
8. TCT (theoretical cycle time) = 109.86 sec
   8a. Theoretical possible O/P = 4/8 = 61671 frame
9. MCT (machine cycle time) = 128.32 sec
   9a. Currently possible O/P = 4/9 = 52799 frame

Other remarks:
10. Availability rate = 79.16 %
    Performance rate = 69.39 %
    Quality rate = 99.80 %
11. OEE = 54.82 %

Remarks: TSSOP 14 / 16 ld = 50 unit / frame.
1-Month Summarized Data in Minutes

1. Total available time = 44640 min
2. No schedule time = 26870 min
3. Planned downtime = 3655 min
   3a. PM time = 0 min
   3b. Meeting time = 0 min
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   5e. No material (Lot waiting) = 0 min
   5f. Facility stoppages = 0 min
   5g. Break time / No operator = 0 min
   5h. Rework / Retest = 0 min
   5i. Conv. / Setup = 0 min
6. Production time = 4 - 5 = 11174 min
7. Total quantity processed (Actual O/P) = (estimated) frame
8. TCT (theoretical cycle time) = 106.79 sec
   8a. Theoretical possible O/P = 4/8 = 63444 frame
9. MCT (machine cycle time) = 112.64 sec
   9a. Currently possible O/P = 4/9 = 60149 frame

Other remarks:
10. Availability rate = 79.16 %
    Performance rate = 81.63 % (etd)
    Quality rate = 99.80 %
11. OEE = 64.48 %
      (estimated)

Remarks: TSSOP 14 / 16 ld = 50 unit / frame.
Various Examples Of Improving OEE.
## Speed Improvement

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Improvement</th>
<th>Delta (%)</th>
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<tbody>
<tr>
<td>1</td>
<td>TCT</td>
<td>Before: 109.86</td>
<td>After: 106.79</td>
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<tr>
<td>2</td>
<td>MCT</td>
<td>Before: 128.32</td>
<td>After: 112.64</td>
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<tr>
<td>3</td>
<td>UPH</td>
<td>Before: 2579</td>
<td>After: 2905</td>
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<tr>
<td>4</td>
<td>OEE</td>
<td>Before: 54.82%</td>
<td>After: 64.48%</td>
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Note: Item 1, 2 & 3 are calculated by IE department
* item 4 is base on no loss from lot-waiting
Example Of Improving Performance Rate through Improving the Equipment MTBA Losses.
Summary of “Static” Restoration Activities (1st Part]

• Six standards “static” conditions were checked and identified areas need to be restored.
  ✗ Indexer clamp’s parallelism was out.
  ✗ The index clamper and back rail gap were out of the required spec.
  ✗ Output index clamper position not parallel when a lead-frame is clamped.
  ✗ One hot plate screw was missing.
‘Before’ and ‘After’ Restoration

MTBA

* MTBA based only on Alignment Error stoppages.

1st goal: 3 Hr. 12 Min.

2nd goal: 22 Hr. 40 Min.
Equipment
Quality Rate
Losses.
### P-M Analysis Chart

<table>
<thead>
<tr>
<th>No</th>
<th>Contributing Condition</th>
<th>4M Correlation, First Item</th>
<th>4M Correlation, Second Item</th>
<th>Investigation/Measuring Method</th>
<th>Investigation Result</th>
<th>Temporary Decision Criterion</th>
<th>Measurement Value</th>
<th>Decision</th>
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**Physical view (Logical reasoning)**

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- **Physical view (Logical reasoning)**
- **Physical view (Logical reasoning)**

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**The 8-Steps in the P-M Analysis Format!**

- **Standardization and link to TPM Maintenance System**

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*The 8-Steps in the P-M Analysis Format! is a method for analyzing and improving processes.*

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*Standardization and link to TPM Maintenance System is a key aspect of maintaining and improving industrial equipment and processes.*