TPM Implementation Blue-Print
www.tpmquality.com

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ZenPower International

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>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Restoration</td>
<td>➞ 85% repair rate</td>
</tr>
<tr>
<td>Step 2</td>
<td>Eliminate Sources of Contamination</td>
<td>➞ 70% successful effort</td>
</tr>
<tr>
<td>Step 3</td>
<td>Improve Equipment Accessibility</td>
<td>➞ 70% successful effort</td>
</tr>
<tr>
<td>Step 4</td>
<td>Initial Maintenance Standards</td>
<td>➞ 50% sudden b/d reduction</td>
</tr>
<tr>
<td>Step 5</td>
<td>General Inspection Skills</td>
<td>➞ 90% sudden b/d reduction</td>
</tr>
<tr>
<td>Step 6</td>
<td>Autonomous Inspection</td>
<td>➞ 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)

**Complete Step-1**

**Step-1 Summary results & findings**

**AM Team => 70% Countermeasures**

**Step-3**

**1st Pre-Audit by TPM Dept.**

- **GM/Sponsors Audit**
- **Present Countermeasures to TPM WC and implementation**
- **Own area Buy - Off**
Langkah-3 : Memudahkan Kerja-Kerja Pembersihan, Pemeriksaan Dan Pelinciran (Step 3: Improve Equipment Accessibility).

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

Operator Leader/Operators
Supervisor

Model Machine Goes To Step 4

AM Leader

GM Audit
W/C Buy Off
Own Area Buy Off
Pre-Audit by TPM Dept.

Pre-Audit by TPM Dept.
Langkah-4 : Piawaian Penyelenggaraan Awal
(Step 4 : Initial Maintenance Standards)

Model m/c passed Step 3

Initial maintenance standard

Hard to lubricate

Hard to check oil level

Abnormality in lubrication equipment

Abnormality in circulation of lubrication

Equipment gets dirty during oiling

Draft standards for cleaning, inspection & lubrication

Counter measure for cleaning and checking

Operator Leader/operator

Supervisor

Confirm standard for cleaning, inspect & lubrication

Attach identification label

Trial Period

TPM dept. Pre-audit

GM audit

AM Leader

Pre-audit

Proliferation of Step 4

Product Manager

Engineer & Maintenance

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

Manuels

Checklist

Cut away models

Revised Maintenance standards

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

Select General Process items

Prepare texts and daily schedules/check lists

Managers/supervisors participate in training

Test

Implement general Im..

TPM office Pre-Audit

GM Audit

Process Inspections schedules

Cleaning standards

Checklists

Manuals

Proliferate Step-5

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

| Maintenance | Inspection standards, breakdown analysis |

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**Step 5** Revise provisional standards

- **Step 1 to 3:** Establish basic conditions (cleaning and lubrication)
- **Step 4:** Daily checking, adjustment, and improvement of conditions for correct operation

Operators who understand their equipment (able to maintain inspection standards)

Finalise standards for cleaning and lubrication.
Organise and set standards for:

- EQUIPMENT PRECISION INSPECTION ITEMS
- TOOLS AND MATERIALS FLOW AND STORAGE
- STANDARDS FOR INDIVIDUAL WORK RESPONSIBILITIES

Langkah-7 : Mengatur Dan Menguruskan Tempat Kerja
Step-7 : Organise and Manage Workplace
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 UnPlanned D/T = 60 mins
- Equip Operating time
- Equip Speed Performance Losses
- Equip Nett Operating time
- Equip Quality Losses
- Equip Valuable Operating time
- Virtual/Immeasurable time
Calculating Availability in OEE.
Equipment OEE Losses

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

A

Equipment Planned D/T = 20 mins

B

Equip Loading time = 460 mins

Eqip UnPlanned D/T = 60 mins

C

Equipment Operating time

Equipment Speed Performance Losses

Equipment Nett Operating time

Equipment Quality Losses

Equipment 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

1. Equip Speed Performance Losses.
2. Equip Quality Losses
3. Equip Valuable Operating. time

Virtual/Immeasurable 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

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

**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** = 44,640 min
2. **No schedule time** = 26,870 min
3. **Planned downtime** = 3,655 min
   - **PM time** = 0 min
   - **Meeting time** = 0 min
   - **Housekeeping / TPM** = 3,655 min
4. **Loading time = 1 - 2 - 3** = 14,115 min
   - **Total =** 846,900 sec
5. **Unplanned downtime** = 2,941 min
6. **Production time = 4 - 5** = 11,174 min

**Other remarks:**

- **Availability rate** = 79.16 %
- **Performance rate** = 81.63 % (etd)
- **Quality rate** = 99.80 %

**OEE** = 64.48 % (estimated)

**Remarks:** TSSOP 14 / 16 ld = 50 unit / frame.

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**OEE-Analysis Format**

**Output Scale:** Y-1 : 5k X-1 : 2.5k

**Improvement done can be observed through the OEE analysis.**

**After**
Various Examples Of Improving OEE.
# Speed Improvement

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Improvement</th>
<th>Delta (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TCT</td>
<td>Before: 109.86, After: 106.79</td>
<td>2.79%</td>
</tr>
<tr>
<td>2</td>
<td>MCT</td>
<td>Before: 128.32, After: 112.64</td>
<td>12.22%</td>
</tr>
<tr>
<td>3</td>
<td>UPH</td>
<td>2579, 2905</td>
<td>12.64%</td>
</tr>
<tr>
<td>4</td>
<td>OEE</td>
<td>54.82%, 64.48%</td>
<td>* 9.66%</td>
</tr>
</tbody>
</table>

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 1/1</th>
<th>Contributing Condition</th>
<th>Investigation Result</th>
<th>4 M Correlation, Investigation Result</th>
<th>4M Correlation, Second Item (3rd, 4th, 5th and 6th Items)</th>
<th>Investigation Result</th>
<th>Investigation Result</th>
<th>Countermeasure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physical view (Logical reasoning)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Restoration, Replace -</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Standardization and link to TPM Maintenance System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Improvement, Remodeling</td>
<td></td>
</tr>
</tbody>
</table>