Executive TPM Introduction & Overview

1. Why Is TPM Important and Relevant?

2. How and Why TPM Works?

3. How To Implement TPM Effectively And Quickly And Achieve Bottom-line ROI?

4. Q & A
Welcome !
Executive TPM Briefing Notes

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Contact Us For A No-Obligations Top Management Briefing.
A Word About Moses....

Moses Tan is the Principal consultant of ZenPower International, an experienced TPM expert since 1996. He greatly emphasizes on implementation details and methods. With an extended 20 years of experience, Moses was previously a TPM Training Manager with a Japanese-owned semiconductor manufacturer, Silicon Systems, a wholly-owned subsidiary of TDK Corporation, Japan. TDK is an advanced TPM Practitioner and a recipient of the prestigious World-Class TPM award from the JIPM.

As TPM manager, he led in hands-on TPM Implementation and conducted TPM Training, 5S, Kai’zen employee suggestion system and other TPM-related technical skills training. His large clientele includes NEC electronics, Carsem Semiconductor, Hitachi, SCI Manufacturing, NEC Semiconductor, Siemens, Sony Display Devices, Sumitomo bakelite, Infineon, Malaysian Newsprint Industries, Yamaha Motors, Hong Leong, Hitachi-Nippon Steel, Taiko Electronics, Showa Denki, Guocera Tiles Industries and the list goes on (see next page).

He has consulted for both the discrete and process industries and consistently improved their ROI. His focus of expertise includes all the TPM Pillars – Autonomous Maintenance, Planned maintenance, Focused Improvements, Quality Maintenance, Poka Yoke, Office, Administrative and Warehouse TPM, 5S, Kai’zen Suggestion System, Why-Why Analysis and P-M Analysis with Design of Experiments. He also successfully prepared a major Client for the JIPM PM Award and has conducted numerous public and in-house seminars which were always graded extremely well. He is also the Inventor of the LEAN ScoreBoard™ which enables any Manufacturer to convert his Process/machine indices in LEAN, TPM, 6-Sigma Programs to be quantified into COSTs and vice-versa.

He occasionally contributes TPM articles to the Productivity and Services Board, Singapore. He has also received professional recognitions through awards like the 1989 National Training Awards for the Manufacturing Sector, Singapore; the 1992 & 1994 National Training Commendation Awards, Singapore; 1995 Essay Prize from the Singapore Quality Association for his published article on “TQM Implementation In Singapore MNCs”.

Moses holds a Diploma in Education (Technical); a Diploma in Electronics Engineering from the Singapore Polytechnic; a Bachelor’s in Information Technology from University of southern Queensland; and a MSc In Training (major in TQM) from the University of Leicester, UK.
OUR GROWING LIST OF TPM CLIENTS WHO HAD ENGAGED OUR PROFESSIONAL CONSULTING, IN-HOUSE AND PUBLIC TRAINING SERVICES – 1996 TO 2006

CARSEM SEMICONDUCTOR SDN BHD; CARSEM SEMICONDUCTOR MALAYSIA SDN BHD; SCI MANUFACTURING SINGAPORE PTE LTD; SINGAPORE MITSUBISHI BELTING PTE LTD; NEC SEMICONDUCTOR PTE LTD; DISPLAY DEVICE (Spore) PTE LTD; SHOWA DENKO HD; SUMITOMO BAKELITE PTE LTD SINGAPORE; SIEMENS COMPONENTS PTE LTD; MALAYSIA NEWSPRINT INDUSTRIES SDN BHD; GUOCERA TILES INDUSTRIES (Kluang) SDN BHD; YAMAHA MOTORS HONG LEONG SDN BHD; HITACHI-NIPPON STEEL PTE LTD SINGAPORE; TAIKO DENKI SDN BHD, SENAI; MALAYSIA NEWSPRINT SDN BHD; TATA MOTORS LIMITED; BHARAT HEAVY ELECTRICALS LIMITED; INDIAN OIL CORPORATION LIMITED; HMT MACHINE TOOLS LIMITED; HEG LIMITED; ITC LIMITED; MOSER BAER INDIA LTD; NTPC LIMITED; NORTH DELHI POWER LIMITED; THE TATA IRON AND STEEL COMPANY LIMITED; TRIDENT AUTO COMPONENTS PVT LTD; HALLA CLIMATE CONTROL (THAILAND) CO LTD; KIRLOSKAR FERROUS INDUSTRIES LIMITED; TIMKEN INDIA LIMITED; SULZER INDIA LIMITED; KIRLOSKAR COPELAND LIMITED; CAPTIVE POWER PLANT; ALLIED NIPPOI LIMITED; UNICHEM LABORATORIES LTD; NATIONAL ALUMINIUM COMPANY LTD; KIRLOSKAR BROTHERS LIMITED; SANDVIK ASIA LTD; TATA CHEMICALS LTD; NALCO; TATA POWER LTD; DR REDDY'S LABS, BALDA THONG-FOOK SOLUTIONS, SIAM-CEMENT; SANDVIK ASIA; UNICHEM; SAMSUNG ELECTRONICS; BHARAT HEAVY ELECTRICAL LTD; NATIONAL ALUMINIUMS COMPANY LTD; KIRLOSKAR BROTHERS LTD; MOSER BAER INDIA LTD; INDIAN OIL CORPORATION LTD; HTM MACHINE TOOLS LTD; HEG LIMITED; ITC LIMITED; NTPC LIMITED; NORTH DELHI POWER LIMITED; TATA IRON AND STEEL COMPANY LTD; TRIDENT AUTO COMPONENTS PVT LTD; KIRLOSKAR FERROUS INDUSTRIES LIMITED; SULZER INDIA LTD; KIRLOSKAR COPELAND LIMITED.

*References can be supplied upon request.
Background Of TPM

• Championed by the JIPM organization in Japan.
• Mandatory participation – Corporate Policy.
• T = Total, P = Productive, M = Maintenance.
• T = Total, P = Production, M = Management.
• T = Total, P = Perfect, M = Management.
• Evolved in Japan since 70s from Toyota for Companies who desperately want to WIN in today’s competition.
1. Why Is TPM Important and Relevant?

a. Emphasizes Equipment Excellence as backbone of Manufacturing Excellence.

b. Integrates Whole Factory’s Improvement Program into ONE.

TPM Focus On Equipment:

- Every breakdown and defect is due to a deviation from the required Basic Machine Conditions.
- Adhering To The Basic Machine Conditions keeps Manufacturing Equipment From Breaking Down or Generating Defects.
- The Basic Conditions Are: 1) Cleaning 2) Lubrication, 3) Bolt-Retightening. These are enforced with Equipment Inspection & Precision Checks by Operators, Prod Techs and Maint. Techs.
Concept of Forced Deterioration

- Equipment deterioration is natural. But neglect cause a much faster and greater amount of deterioration resulting in expensive breakdowns and defects.
- Main culprits are faulty lubrication, dust, dirt, loose parts, missing, loose or over-tightened bolts and nuts, mis-operation, faulty repairs.
- TPM aims to achieve Prevention, Early Detection and Restoration of deterioration.
TPM Unites Whole Company In Single Program

Major Pillars in TPM Implementation.

- Autonomous Maintenance
- Equipment Improvement
- Planned Maintenance
- Quality Maintenance
- 5S – Admin & Warehouse TPM
- Safety – Environment, sanitation and hygiene
- Training

**Production Operators**
- Maintenance, Equipment, Process & QA Engineers and workers, R&D

**Other Manufacturing Personnel**
- Document Control, Production Planning, Warehouse, Shipping, HR&D, Security, Finance, Purchasing, Stores, Safety, and any general offices or administrative departments.

**Administrative Personnel**
**Total Involvement Needed**: Eg: When A Production Machine Breaks down, various losses are incurred such as:

1. Time taken to report the breakdown.
2. Time taken to locate the technician.
3. Time taken to verify the breakdown.
4. Time to get tools.
5. Time to get spare parts.
6. **Actual Time to repair the machine**.
7. Time to buyoff the machine after repair.

Except for #6, the other losses are management or administrative or supervisory related losses.
The Pillars of JIPM-TPM Are:

Each Pillar represents one activity-type of TPM focus.

1. Equipment-Improvement Pillar.
2. Production Autonomous Maintenance Pillar.
3. Planned Maintenance Pillar.
4. Education & Training Pillar.
5. Initial New Equipment & Products Control Pillar (MP)
7. Warehouse & Administrative TPM Pillar.

Two other important activities deserve to be emphasized here:

9. Target setting and Measurement
10. TPM Section/Department.

Source: JIPM
2. How & Why TPM Works?

a. Overall Design Logic Of TPM.

b. 7 Steps and 4 Stages Of Autonomous Maintenance.

c. The Initial Stage Of TPM Sustainability.

d. Developing Advanced Stages of TPM.
   • Focused Equipment Improvement
   • Quality Maintenance & Poka Yoke
   • Chronic Defects
   • Self Managing Work Teams
Overall Design Logic / Relationship Between TPM Pillars

CORE Pillars Are

- Autonomous Maintenance
- Planned Maintenance
Design of Autonomous Maintenance.
(Approach to changing worker mindset, Improve Worker-Skills & workplace culture)

Sustainable Foundational Phase is at AM Step 4

Step 0  Step 1  Step 2  Step 3  Step 4  Step 5  Step 6  Step 7

Motivation  Improve the Equipment  Improve the Operators  Improve Organization. Culture.

Advanced AM Steps 5, 6, 7 heavily rely on Planned Maintenance, EI, QM, Solving Chronic Problems.
We Take A Very Quick Look At **CORE PILLAR** - Autonomous Maintenance.

- They Are Structured.
- They Are Sequentially Implemented
- They Are Led By Production Supervisors But Technically Supported By Maintenance Group.
## 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>=&gt; 85%</td>
</tr>
<tr>
<td>Step 2</td>
<td>Eliminate Sources of Contamination</td>
<td>=&gt; 70% successful effort</td>
</tr>
<tr>
<td>Step 3</td>
<td>Improve Equipment Accessibility</td>
<td>=&gt; 70% successful effort</td>
</tr>
<tr>
<td>Step 4</td>
<td>Initial Maintenance Standards</td>
<td>&gt;50% sudden b/d reduction</td>
</tr>
<tr>
<td>Step 5</td>
<td>General Inspection Skills</td>
<td>&gt; 90% sudden b/d reduction</td>
</tr>
<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>

TPM Exec Briefing  
Presented By ZenPower Int'l @ www.tpmquality.com
(Step-1: Restoration Equipment)

- LEADER
- OPERATORS
- SUPERVISORS
- GROUP LEADER
- DEPT.CHIEF
- MAINT. STAFF
- ENGR. STAFF

- LIST OF EXT/INT ABNORMALITIES
- MEETING TO PLAN COUNTERMEASURES
- CONFIRMATION OF PROGRESS
- SUPERVISORS
- GROUP LEADER
- DEPT.CHIEF

- MAINTENANCE STAFF
- ENGINEERING STAFF
- AUTONOMOUS MAINTENANCE GROUP

- FOLLOW UP ON AUDIT FEEDBACK
- COUNTERMEASURES EXTENDED TO ALL EQUIPMENT

TPM Exec Briefing
Presented By ZenPower Int'l @ www.tpmquality.com
(Step-2: Eliminate Contamination & Stains on Area & Parts)

Complete Step-1

Step-1 Summary results & findings

AM Team => 70% Countermeasures

What?
Where?
How much?
Why?

Step-3

1st Pre-Audit by TPM Dept.

GM/Sponsors Audit

Present Countermeasures to TPM WC and implementation

Own area Buy - Off
(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

Model Machine Goes To Step 4

Inaccessible

AM Leader

Product Manager

Operator Leader/Operators

Supervisor

Pre-Audit by TPM Dept.

Own Area Buy Off

W/C Buy Off

TPM Audit

GM Audit
(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
- Confirm standard for cleaning, inspect & lubrication
- Attach identification label
- Trial Period
- TPM dept. Pre-audit
- GM audit
- AM Leader
- Operator Leader/operator
  - Counter measure for cleaning and checking
  - Supervisor
- Proliferation of Step 4
AM Step 4 Initial Maintenance Standards

Information Collected From:
- AM Steps 1-3
- Lubrication Study Program
- Bolt-tightening Study Program
- Why-Why Analysis of Equipment Sporadic Breakdowns

- Equipment Cleaning Standards
- Equipment Lubrication Standards
- Equipment Inspection Standards
A Strategic Implementation Plan Sees AM Steps 0-4 As A Single Stage.

- Resource Allocation.
- Implementation Strategies & focus.
- Delay Advanced Planned Maint., EI, QM till Foundation is laid.
(Step 5: General Inspection skills)

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

select general inspection items

- Manuals
- 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
(Step-6: Autonomous Inspection)

Maintenance | Inspection standards, breakdown analysis

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

Finalise standards for cleaning and lubrication

Operators who understand their equipment (able to maintain inspection standards)
Step-7: Organise and Manage Workplace

Organise and set standards for:

- EQUIPMENT PRECISION
- INSPECTION ITEMS
- TOOLS AND MATERIALS
- FLOW AND STORAGE
- STANDARDS FOR INDIVIDUAL WORK RESPONSIBILITIES
After TPM Foundation AM Step 4
Then Other Advanced Pillars

Build Advanced TPM Activities Towards Zero Defects & Zero Breakdowns
We Take A Very BRIEF Look At CORE PILLAR - Planned Maintenance.

• They Are Structured.
• They Accumulates ALL Maintenance Knowledge relating to prevention of breakdowns and defects for both Autonomous Maintenance & Maintenance Department.
• They receive inputs from All Pillars and Problem Solving Teams.
### Preventive Maintenance Standards

| System level Assy | Assy overall function | Assy symptoms (functional + WIP quality) | *Breakdown parts of System level assembly | Repair Class - Minor / Major | TBM change, calibrate | Cleaning | Lubrication | *Inspection | Machine: Press |
|-------------------|-----------------------|------------------------------------------|-------------------------------------------|-------------------------------|----------------------|----------|-------------|-------------|----------------|----------------|
| Drive System      |                       |                                          |                                           |                               |                      |          |             |             |                |                |
| 1) Gravity powder assembly | To feed powder into charger grid | 1.1 hopper box powder not full (F) | 1.1.1 Mesh, elephant trunk and powder distributor blocked by powder lumps. | Minor | Calibrate every setup |          |             |             |                |                |
| 2) Charger assembly | To feed powder into the mould cavity and | 2.1 Green tiles below compactness delta range (Q) | 2.1.1 Setting of Charger and table plate not level. | Minor | Calibrate every setup |          |             |             |                |                |

**WHY-WHY Analysis Case 1:** Cylinder operation is jerky.

<table>
<thead>
<tr>
<th><strong>Question</strong> (Hint: Ask questions to point out Man’s error)</th>
<th><strong>Answer</strong></th>
<th><strong>Actions</strong> (Restorative &amp; Preventive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Why is cylinder operation jerky?</td>
<td>The oil strainer is clogged.</td>
<td>Clean the strainer.</td>
</tr>
<tr>
<td>2. Why is the oil strainer clogged?</td>
<td>The oil is dirty.</td>
<td>Drain oil, clean and replace.</td>
</tr>
<tr>
<td>3. Why is the oil dirty?</td>
<td>Dirt has entered the tank.</td>
<td>Prevent surrounding dirt from scattering.</td>
</tr>
<tr>
<td>4. Why did dirt get into the tank?</td>
<td>Upper plate of tank has a hole.</td>
<td>Plug the hole</td>
</tr>
<tr>
<td>5. Why is the hole there?</td>
<td>It was a repair error by Maintenance.</td>
<td>Standardize future repairs.</td>
</tr>
</tbody>
</table>

Every problem solved such as by Why-Why Analysis is “captured” or “standardized” permanently.
## PREVENTIVE MAINTENANCE RESPONSIBILITY MASTER LIST

<table>
<thead>
<tr>
<th>S/N</th>
<th>Sub-Assembly</th>
<th>Cleaning Item</th>
<th>Operator</th>
<th>Maint.</th>
<th>DM/PM/Prod.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conveyor cover</td>
<td>Top cover</td>
<td>O</td>
<td>Prod</td>
<td></td>
<td>1 Day</td>
</tr>
<tr>
<td>2</td>
<td>XY Table</td>
<td>Top Surface</td>
<td>O</td>
<td>Prod</td>
<td></td>
<td>1 Week</td>
</tr>
<tr>
<td>3</td>
<td>Device Table</td>
<td>Top Surface</td>
<td>O</td>
<td>Prod</td>
<td></td>
<td>1 Week</td>
</tr>
<tr>
<td>4</td>
<td>M/C Top cover</td>
<td>Top cover</td>
<td>O</td>
<td>Prod</td>
<td></td>
<td>2 Week</td>
</tr>
<tr>
<td>5</td>
<td>Servo Control Box</td>
<td>Door Panel and Air Filter</td>
<td>O</td>
<td>Prod</td>
<td></td>
<td>1 Month</td>
</tr>
<tr>
<td>6</td>
<td>In and Out Conveyor</td>
<td>Railing and Belts</td>
<td>O</td>
<td>Prod</td>
<td></td>
<td>1 Month</td>
</tr>
<tr>
<td>7</td>
<td>Prism Surface</td>
<td>Glass surface</td>
<td>O</td>
<td>PM</td>
<td></td>
<td>3 Month</td>
</tr>
<tr>
<td>8</td>
<td>Nozzle Filter</td>
<td>Filter Element</td>
<td>O</td>
<td>PM</td>
<td></td>
<td>3 Month</td>
</tr>
<tr>
<td>9</td>
<td>Nozzle</td>
<td>Nozzle Tip and Reflecting Sticker</td>
<td>O</td>
<td>PM</td>
<td></td>
<td>3 Month</td>
</tr>
<tr>
<td>10</td>
<td>Filter Regulator</td>
<td>Filter Element</td>
<td>O</td>
<td>PM</td>
<td></td>
<td>3 Month</td>
</tr>
<tr>
<td>11</td>
<td>Nozzle Clutch</td>
<td>Clutch Surface</td>
<td>O</td>
<td>PM</td>
<td></td>
<td>3 Month</td>
</tr>
<tr>
<td>12</td>
<td>Cam Box</td>
<td>All Cam Bearing and Turret</td>
<td>O</td>
<td>PM</td>
<td></td>
<td>3 Month</td>
</tr>
</tbody>
</table>

Use same format to demark Lub / Inspect / Precision Check / ….
We Take A Very **BRIEF** Look At Equipment Focused Improvement
(Linked Back to PL. Maintenance)

- From OEE Loss-Chart Analysis, all 16 losses known can be measured.
- Each type of Loss such as MTBA, MTBF, Defects, Speed losses and Logistics Losses need different methodologies.
Loss Structure Of Manufacturing Activities (16 Major Losses)

**Manpower Efficiency**

<table>
<thead>
<tr>
<th>No.</th>
<th>Loss Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equipment failure loss</td>
</tr>
<tr>
<td>2</td>
<td>Set-up loss</td>
</tr>
<tr>
<td>3</td>
<td>Startup loss</td>
</tr>
<tr>
<td>4</td>
<td>Minor stoppages &amp; idling loss</td>
</tr>
<tr>
<td>5</td>
<td>Speed loss</td>
</tr>
<tr>
<td>6</td>
<td>Defects and rework loss</td>
</tr>
<tr>
<td>7</td>
<td>Down time loss</td>
</tr>
<tr>
<td>8</td>
<td>Production manhour loss</td>
</tr>
<tr>
<td>9</td>
<td>Line organisation manhour loss</td>
</tr>
<tr>
<td>10</td>
<td>Defects in manhour loss</td>
</tr>
<tr>
<td>11</td>
<td>Measurement and adjustment loss</td>
</tr>
<tr>
<td>12</td>
<td>Skills &amp; morale loss</td>
</tr>
<tr>
<td>13</td>
<td>Setup loss</td>
</tr>
<tr>
<td>14</td>
<td>Operating motions loss</td>
</tr>
<tr>
<td>15</td>
<td>Management loss</td>
</tr>
<tr>
<td>16</td>
<td>Operating failures loss</td>
</tr>
</tbody>
</table>

**Equipment Efficiency**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equipment failure loss</td>
</tr>
<tr>
<td>2</td>
<td>Set-up loss</td>
</tr>
<tr>
<td>3</td>
<td>Cutting blade and jig change loss</td>
</tr>
<tr>
<td>4</td>
<td>Start-up loss</td>
</tr>
<tr>
<td>5</td>
<td>Minor stoppages &amp; idling loss</td>
</tr>
<tr>
<td>6</td>
<td>Speed loss</td>
</tr>
<tr>
<td>7</td>
<td>Defects and rework loss</td>
</tr>
<tr>
<td>8</td>
<td>Shutdown loss</td>
</tr>
<tr>
<td>9</td>
<td>Line organisation loss</td>
</tr>
<tr>
<td>10</td>
<td>Defects in manhour loss</td>
</tr>
<tr>
<td>11</td>
<td>Measurement and adjustment loss</td>
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<td>12</td>
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<td>14</td>
<td>Operating motions loss</td>
</tr>
<tr>
<td>15</td>
<td>Management loss</td>
</tr>
<tr>
<td>16</td>
<td>Operating failures loss</td>
</tr>
</tbody>
</table>

The 6 Big Equipment Losses are (1) Equipment failure or Breakdown Loss (2) Setup Loss (3) Startup Loss (4) Minor stoppages and Idling Loss (5) Speed Loss and (6) Defect & Rework Loss. The other two (7) Shutdown or Preventive Maintenance Loss and (8) Cutting Blade and jig change loss may also be considered if significant.
Output (tct) = 900
Output (mct) = 600
Yield Loss
Rejects = 12 pcs
Unplanned D/T losses.
MTBA & Idling Losses
We Take A Very BRIEF Look At Quality Maintenance (Poka Yoke) (Linked Back To PI. Maintenance)

• Two Major Reasoning Tools: Why-Why Analysis and P-M Analysis (with DoE or Taguchi Methods)

• All Breakdowns & Defects have 4Ms Causes BUT always started by a Man-Mistake which is the true Root Cause.

• Poka Yoke Design starts with Process Defects to find Man Mistakes for Mistake Proofing countermeasures.
The Standardized P-M Analysis Worksheet

<table>
<thead>
<tr>
<th>PM Analysis Chart</th>
<th>Checked by</th>
<th>Prepared by</th>
<th>Phenomenon</th>
<th>Physical view (Logical reasoning)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No./-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contributing Condition</th>
<th>Investigation Result</th>
<th>4 M Correlation</th>
<th>Investigation Result</th>
<th>4M Correlation</th>
<th>Investigation/Measuring Method</th>
<th>Investigation Result</th>
<th>IF NG, why NG?</th>
<th>Countermeasure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The 8-steps sequence are indicated by the numbers.

Counter measures should be designed to also address the Mistake (Man-cause) using Why-Why Analysis.

7 Standardization into Production System.

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Presented By ZenPower Int'l @ www.tpmquality.com
P-M ANALYSIS WORKSHOP

2-DAY WORKSHOP + *1-DAY PROJECT-BASED

* Optional, recommended for Project teams

METHODOLOGY BASED ON JIPM-MODEL
(An Advanced Toyota Production System Problem-Solving Tool)
Poka-Yoke DESIGN
advanced *3-day workshop
(*3+1 For In-House Training)

Poka Yoke Design is able to prevent Man’s inadvertent (un-intended) mistakes in any Process based on the concept that all defects are Man-caused.
3. How To Do TPM Effectively, Quickly & Get Bottom-line ROI?

a. A 3½ -Day Management and Leaders’ TPM Implementation Workshop. (Separate Asia & Europe)

b. Followed by ½ Day TPM Implementation Planning.

c. Use Proven FAST-Track TPM Methodology reaches AM Step 4 in under 1 ½ years. Results guaranteed.

Six Reasons To Choose Fast-Track© TPM Implementation

1. **Complete foundational AM Step 4** in 9 to 20 months with Expert Hand-Holding for your TPM facilitators and Pillar Leaders.

2. **Achieved sustainability at this Step 5.**

3. **Significant % reduction** in sporadic and chronic Quality defects.

4. **Measurable Capacity** improvement.

5. **Significant Savings** In Implementation Costs, Efforts, Resources.


* Provided Client co-operates fully with the Fast-Track Program requirements.
## A 12-Month Fast-Track TPM Milestone

© ZenPower International’s Fast-Track TPM Utilizing about *24 Consultant-days for AM 0,1,2,3,4.*

<table>
<thead>
<tr>
<th>Step</th>
<th>Task Description</th>
<th>Consultant Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select Implementation Area and identify Model Machines. (1/2)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Appoint Fast-Track TPM Project Team and identify the baselines for measuring before/after results (11/2 Consultant-day)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Do Fast-Track AM Step-1 on Model M/C (1 Consultant-day)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Do Fast-Track AM Step-2 on 1st Model M/C with proto-types of countermeasures (1 Consultant-day)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Do Fast-Track AM Step-3 on 1st Model M/C with prototypes of countermeasures. Rationalize with Item (4). (1 Consultant-day)</td>
<td>1</td>
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<tr>
<td>6</td>
<td>Meeting with Fast-Track Project Team to finalize actual implementation of countermeasures (1 Consultant-day)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Repeat 3-6 with other Model M/Cs. (4 Consultant-days)</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Setup Fast-Track AM-4 Initial Maintenance Stds for 5 Model M/cs with the Fast-Track Project Team and SMEs. (5 Consultant-days)</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Conduct 1-Month Trial on Model M/Cs. Monitor indices and results (1 Consultant-day)</td>
<td>1</td>
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<tr>
<td>11</td>
<td>Fine-tune and finalize the Initial Maintenance Standards. (1 Consultant-day)</td>
<td>1</td>
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<tr>
<td>12</td>
<td>Proliferate countermeasures to all machines in 2 months (2 Consultant days)</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Training of all operators, supervisors and technicians. (2 Consultant-days)</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>Post-launching follow-up (3 Consultant days)</td>
<td>3</td>
</tr>
</tbody>
</table>

Utilizing about *24 Consultant-days for AM 0,1,2,3,4.*
Typical Expected ROI

On Installation Of AM Step 4
Initial Production System
Production System through TPM

- Process Overview.
- Business results achieved through TPM Implementation.
Raw Material Batching
- Body mix
Milling
- Body Slip
Spray Drying
- Granules
Pressing
- Green tiles
Drying
- Dry tiles
Glazing, Decoration
- Unfired tiles
Firing
- Fired tiles
Sorting & Packing
- Finished goods
Examples Of Common Defects of Ceramic Tiles
COMPLAINT ON SIZE VARIATION

45x45cm floor tiles laid with the recommended 4mm gaps but still show poor uniformity in size. Tile X was found to be 2.5mm bigger than the rest of the tiles. Therefore, this tile was packed into the carton by mistake.
MORE EXAMPLES OF WATER SEEPAGE

In this picture, the gel-like substance has penetrate the tile body through a spot hole on the glaze.
TPM BUSINESS RESULT
COSTING

98/99 | 99/00 | 00/01 | '01/02 | '02/03 | '03/04 | '04/05 | '05/06
---|---|---|---|---|---|---|---
106 | 107 | 100 | 91 | 87 | 86 | 90 | 87

(EXPECTED)

(13%)
TPM Exec Briefing

Pres: ZenPower Int'l

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No Type of Glaze

GLAZE

98/99 99/00 00/01 '01/02 '02/03 '03/04 '04/05 '05/06

0 15 30 45 60 75

22 23 41 53 60 65

195%

TPM STEP 0

TPM STEP 1

TPM STEP 2

TPM STEP 3

TPM STEP 4
COLOUR GLAZE

No of Colour Glaze

98/99 99/00 00/01 '01/02 '02/03 '03/04 '04/05 '05/06

(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)

154%

TPM Exec Briefing

www.tpmquality.com
TPM Exec Briefing

PRODUCTIVITY (m²/MAN/YEAR)

- Production '000 m²/man/year

- Expected productivity 2005/06: 18.50 m²/MAN/YEAR

TPM Steps:
- Step 0: 12.30 m²/MAN/YEAR (1999/00)
- Step 1: 13.60 m²/MAN/YEAR (2000/01)
- Step 2: 15.80 m²/MAN/YEAR (2001/02)
- Step 3: 16.90 m²/MAN/YEAR (2002/03)
- Step 4: 17.20 m²/MAN/YEAR (2003/04)
- Step 5: 18.00 m²/MAN/YEAR (2004/05)
- Expected: 18.50 m²/MAN/YEAR (2005/06)

Total Increase: 36%
WORKERS TURNOVER (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Turnover (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>98/99</td>
<td>5.20</td>
</tr>
<tr>
<td>99/00</td>
<td>4.20</td>
</tr>
<tr>
<td>00/01</td>
<td>2.80</td>
</tr>
<tr>
<td>'01/02</td>
<td>2.20</td>
</tr>
<tr>
<td>'02/03</td>
<td>2.00</td>
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<tr>
<td>'03/04</td>
<td>1.80</td>
</tr>
<tr>
<td>'04/05</td>
<td>1.50</td>
</tr>
<tr>
<td>'05/06</td>
<td>1.50 (EXPECTED)</td>
</tr>
</tbody>
</table>

TPM Exec Briefing

(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)

1.3%