

ZenPower International Industry TPM Consultants

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tpm/moses

TPM OVERVIEW

Manufacturing & Administrative Excellence.



Background of TPM

- **Main manufacturing excellence approach of Toyota and other excellent Japanese companies since the 70's.**
- **TPM is foundation for JIT, FA, Poka Yoke, Lean Manufacturing, Zero Defects.**
- **TPM Reference Standard - JIPM (Japan Institute of Plant Maintenance)**
- **Comes from the best of Japanese Industrial Excellence and evolved from the heat of the continuing Energy Crisis and Globalization challenges to achieve More with Less.**

TPM GOALS

1. Increase asset Utilization and Equipment OEE
2. Foster Production Equipment Ownership
3. Equipment breakdown prevention (Planned Maintenance through CM, TBM, CBM)
4. Defect Prevention (QM Process & Poka Yoke)
5. Evolving into Self Directed Work Teams (SDWTs) and Lean Manufacturing.

JIPM STANDARDS

- 1. TPM Structure & Organization**
- 2. Equipment Improvement activities**
- 3. Production Autonomous Maintenance**
- 4. Planned Maintenance**
- 5. Quality Maintenance**
- 6. Product & Equipment Initial Control**
- 7. Education & Training**
- 8. Office TPM**
- 9. Safety, Hygiene & Environment**
- 10. Quantifiable TPM Measurement**

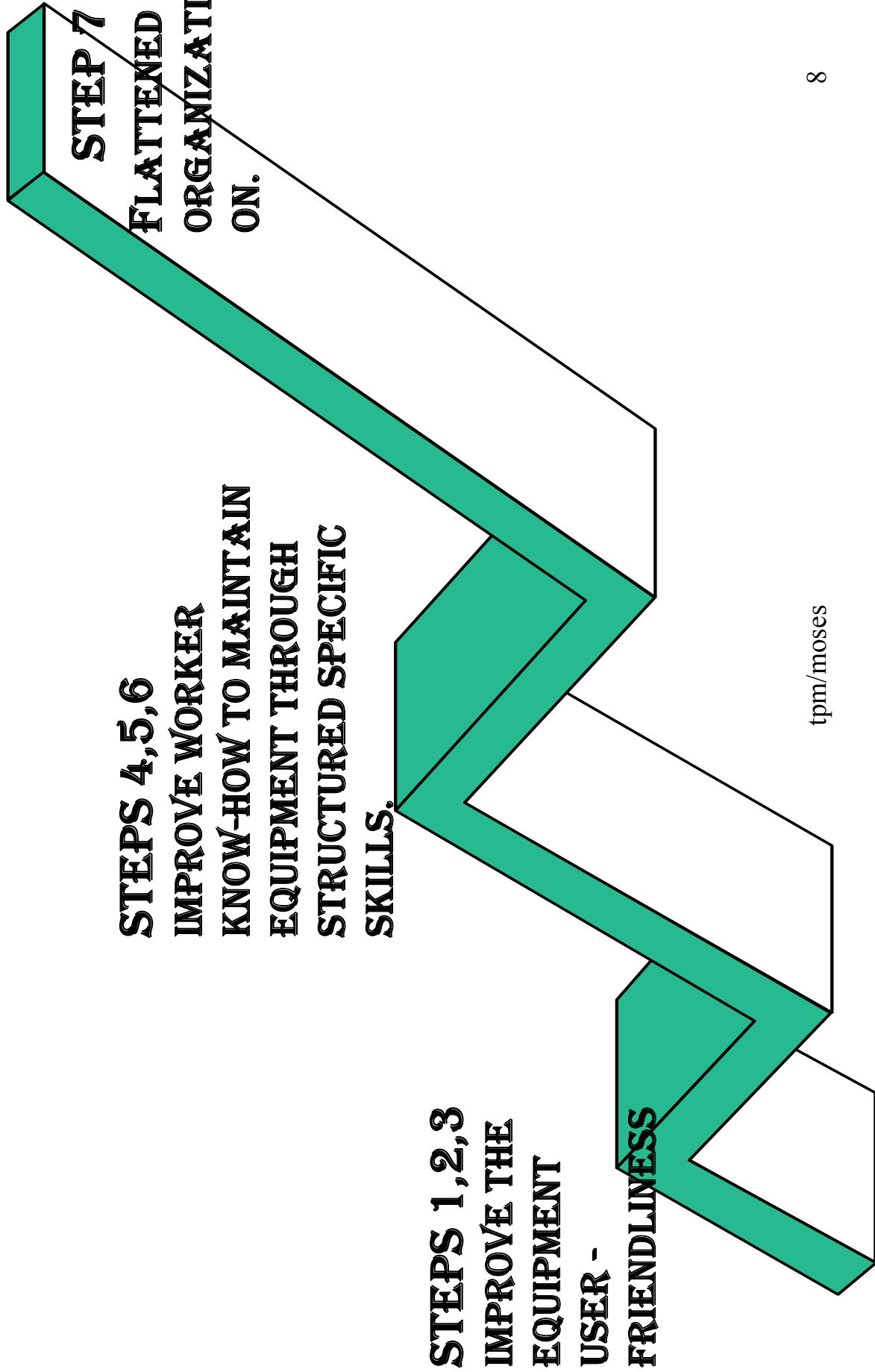
Executive Overview Of

- 1. Autonomous Maintenance**
- 2. Equipment Improvement**
- 3. Planned Maintenance**
- 4. Quality Maintenance**
- 5. Office TPM**

QUICK LOOK AT

**Production
Autonomous
Maintenance**

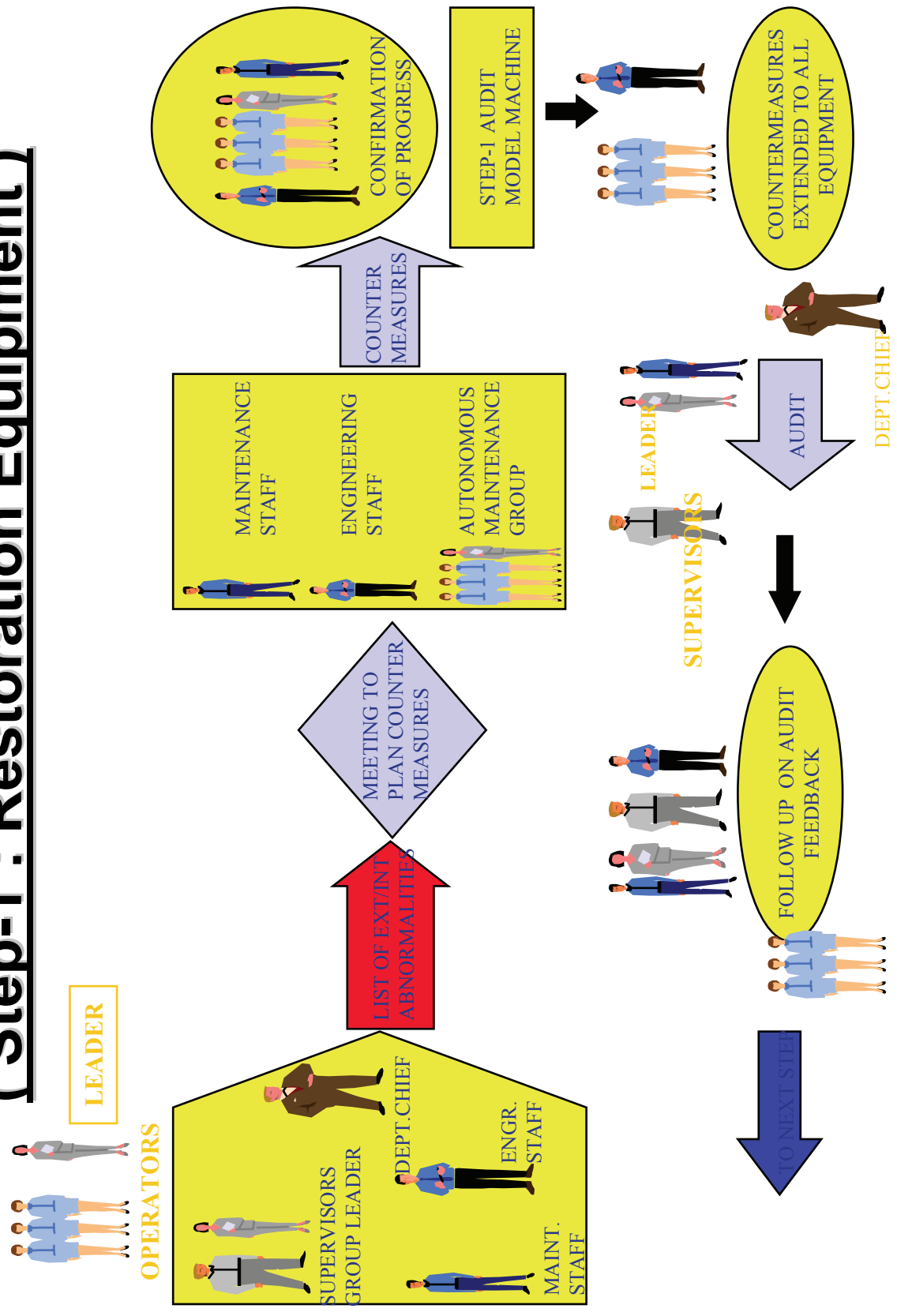
LOGIC OF AM STEPS



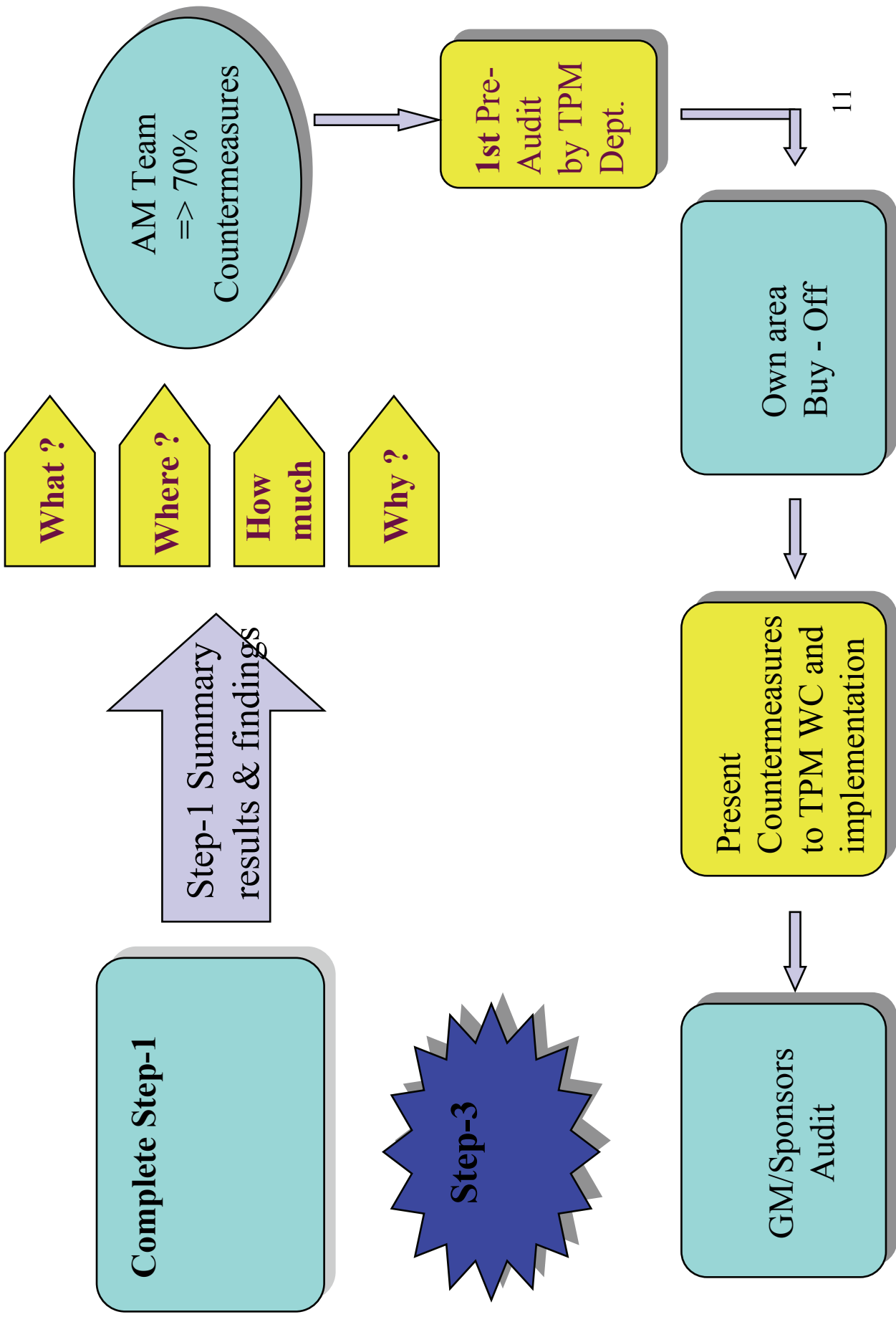
AM STANDARDS

Step #	Step Goal	Standards
Step 1	Restoration	=> 85% repair rate
Step 2	Eliminate Sources of Contamination	=> 70% successful effort
Step 3	Improve Equipment Accessibility	=> 70% successful effort
Step 4	Initial Maintenance Standards	> 50% sudden b/d reduction
Step 5	General Inspection Skills	> 90% sudden b/d reduction
Step 6	Autonomous Inspection	> 95% sudden b/d reduction
Step 7	Organise and manage workplace	TBD by management

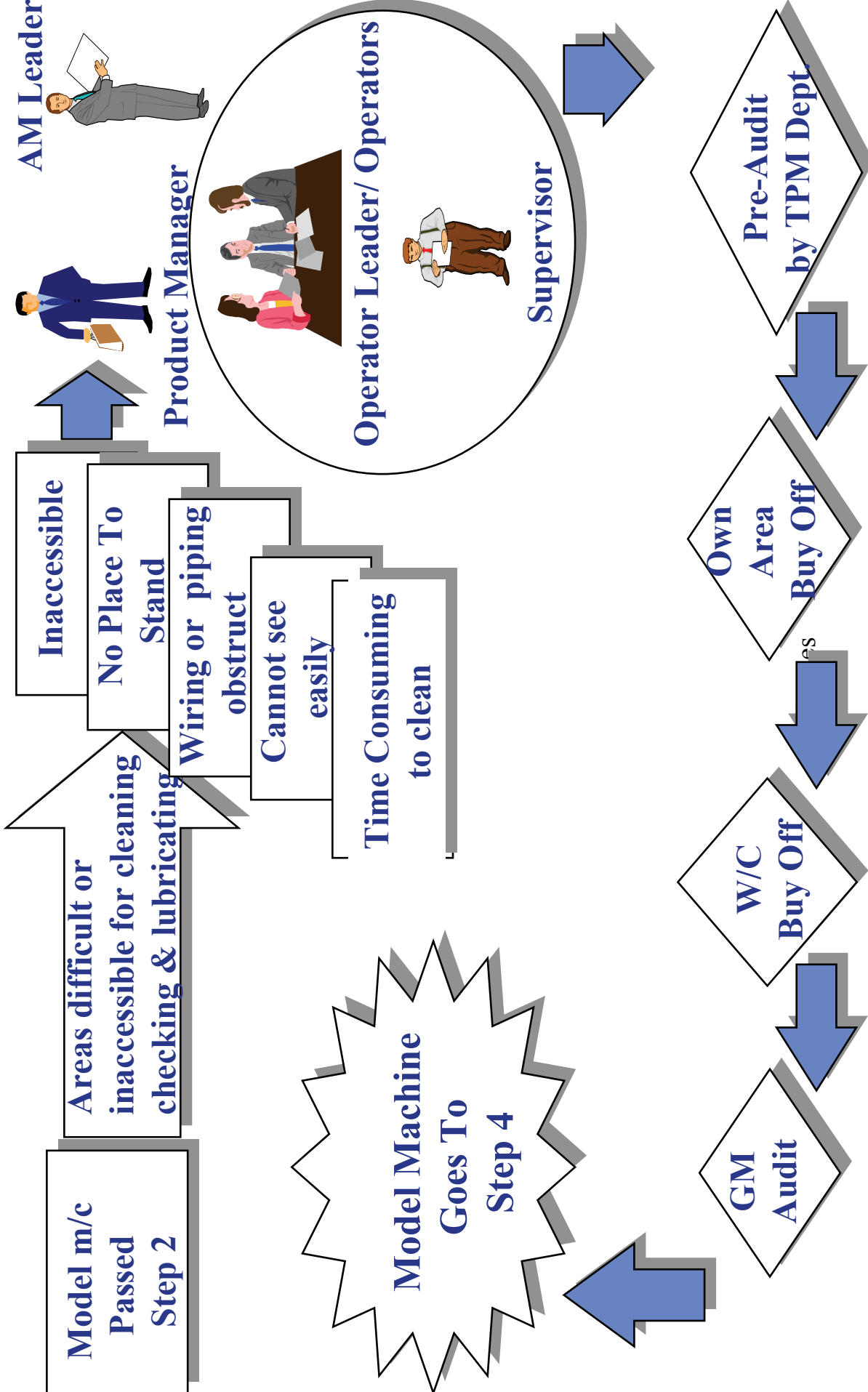
(Step-1 : Restoration Equipment)



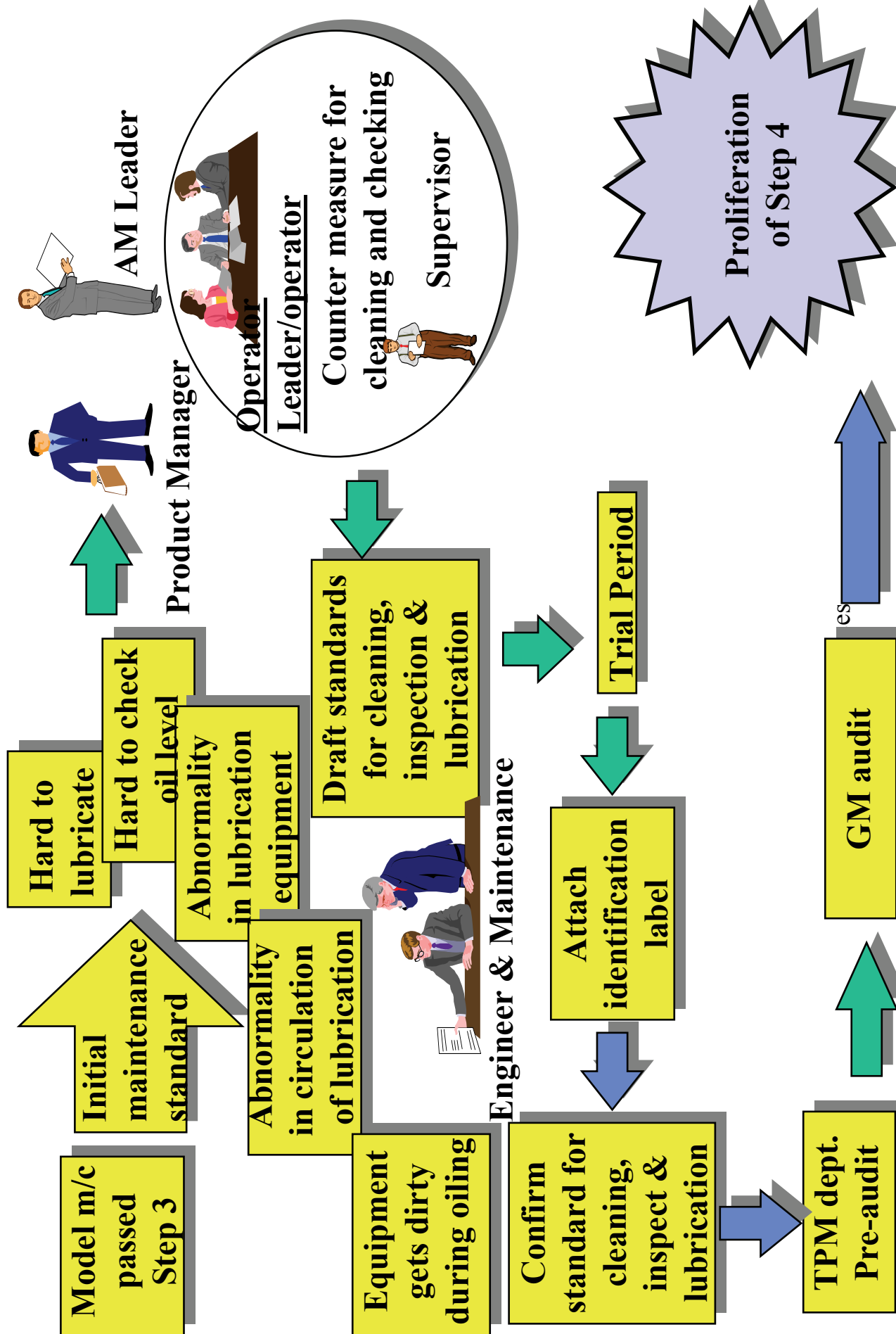
(Step-2 : Eliminate Contamination & Stains on Area & Parts)



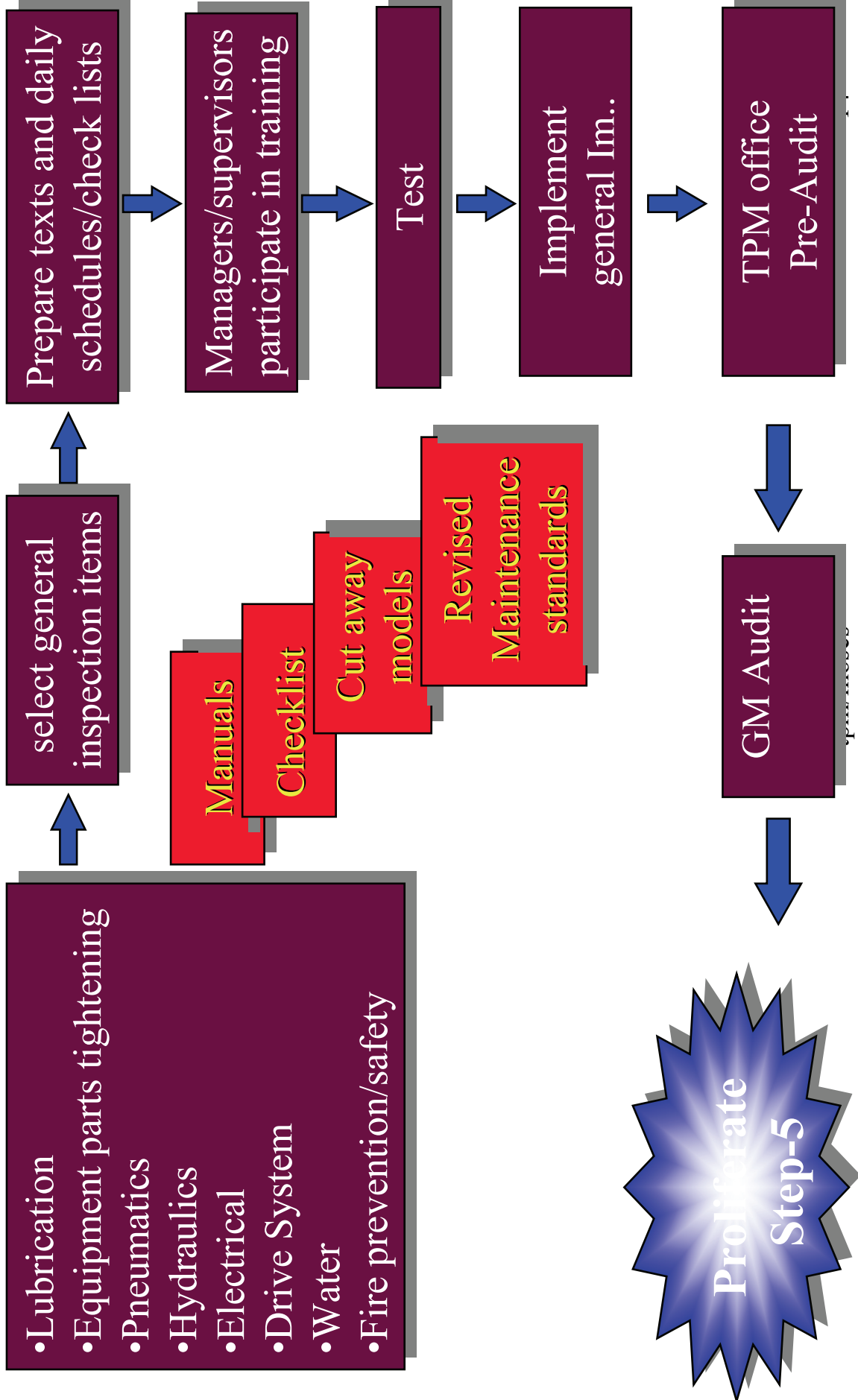
(STEP 3 : IMPROVE EQUIPMENT ACCESSIBILITY).



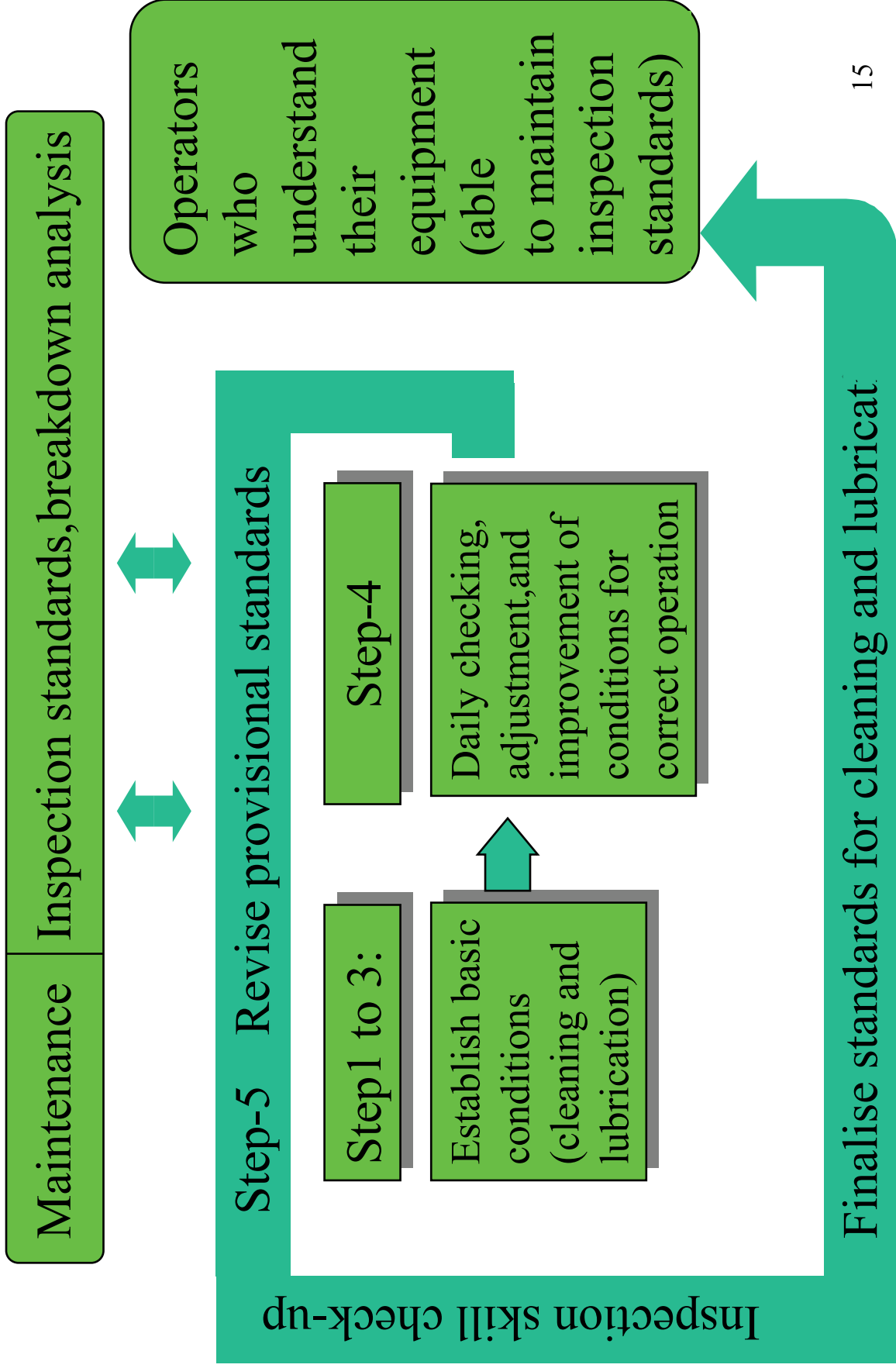
(Step 4 : Initial Maintenance Standards)



(Step 5 : General Inspection skills)



(Step-6 : Autonomous Inspection)



Step-7 : Organise and Manage Workplace

Organise and set standards for :

**EQUIPMENT PRECISION
INSPECTION ITEMS**

**STANDARDS FOR
INDIVIDUAL WORK
RESPONSIBILITIES**

**TOOLS AND MATERIALS
FLOW AND STORAGE**

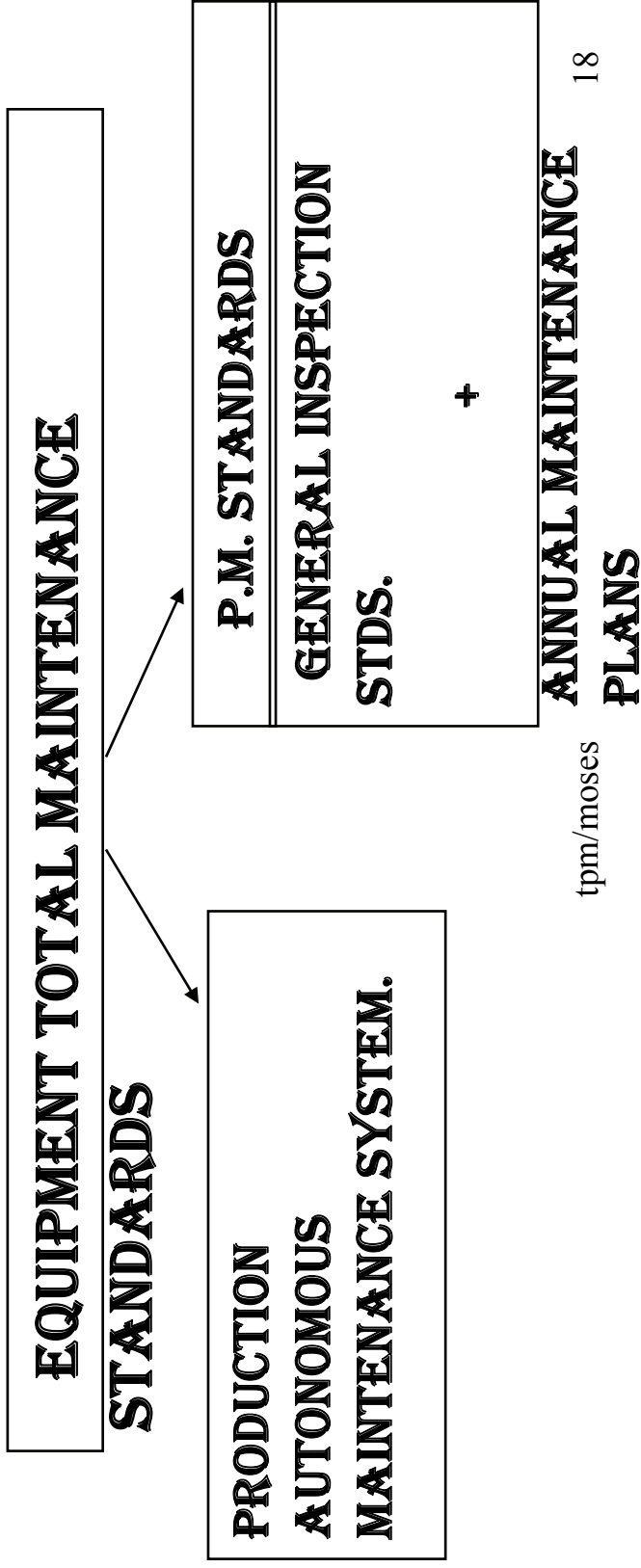
QUICK LOOK AT

Planned Maintenance Pillar

GOAL OF PLANNED

MAINTENANCE EQUIPMENT BREAKDOWNS”

by implementing systems of
“parts replacement before failure” through
TBM and CBM.



PLANNED MAINTENANCE ACTIVITIES:

- 0 SUPPORT AUTONOMOUS MAINTENANCE ACTIVITIES BY
TECHNICAL SUPPORT, BREAKDOWN ANALYSIS AND
DEMARCATION BETWEEN PRODUCTION & P.M. SYSTEMS.**
- 0 P-M ANALYSIS FOR CHRONIC BREAKDOWNS.**
- 0 TIME BASED MAINTENANCE ITEMS**
- 0 CONDITION BASED MAINTENANCE ITEMS.**
- 0 SPARES MGMTM & MAINTENANCE DAY PRACTICE.**

QUICK LOOK AT

Equipment Improvement Pillar

ROLE OF PLANT EI TEAM

Achieve systematic breakthroughs in equipments' 6 BIG LOSSES and establish Standards for Basic Machine Conditions.

The Basic Machine Conditions are:

- 1. Cleaning Standards.**
- 2. Lubrication Standards.**
- 3. Bolt-tightening Standards.**

EQUIPMENT & BIG LOSSES

(FOCUS IS AT THE BOTTLENECK PROCESSES.)

- 1. BREAKDOWN LOSSES**
- 2. SPEED LOSSES.**
- 3. SETUP LOSSES.**
- 4. DEFECT LOSSES.**
- 5. START-UP OR YIELD LOSSES**
- 6. MINOR STOPPAGES LOSSES**

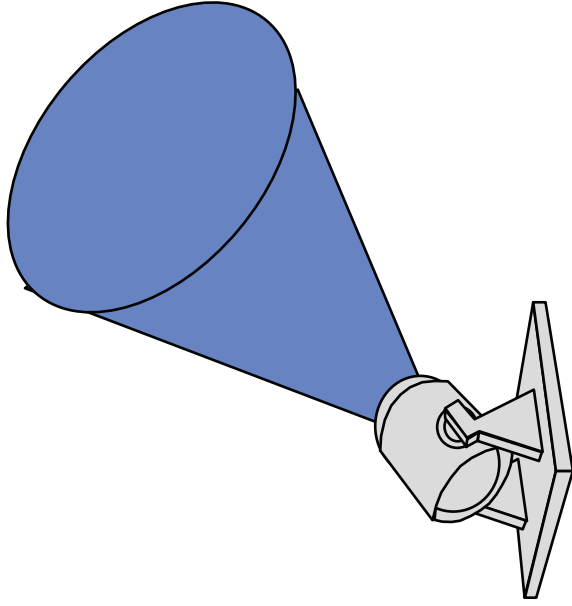


LOSSES Maint LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1. Breakdown losses	<ul style="list-style-type: none"> • Have chronic B/Ds • B/d Repair time PM time. • >20% deviation of service life range. • Root-cause s of breakdown not clear. 	<ul style="list-style-type: none"> • Only spontaneous breakdowns. • B/d Repair time = PM time. • Within parts service life span. • Root-causes of B/Ds are clear and addressed. 	<ul style="list-style-type: none"> • Time-based component maint. system. • D/T repair time < PM time • B/d downtime < 1% • Service life of components => upper range of specs. 	<ul style="list-style-type: none"> • Condition-based maint system • Maint staff do only PM. • AM do D/T repairs < at 0.1% of DT level. • Clear improvement in MTBF
2. Setup Losses	<ul style="list-style-type: none"> • Incomplete setup documentation. • Setup times variation >30%. 	<ul style="list-style-type: none"> • Complete set-up documentation • On-line and off-line setups are defined. • Setup Time variation < 15% • Data on frequency, location of minor stoppages. 	<ul style="list-style-type: none"> • Successful efforts to convert on-line to off-line setups • All adjustments are fully clarified and standardized. 	<ul style="list-style-type: none"> • Optimal set-ups under 10 mins. • 1st time set-up produce good parts. No need to adjust any further.
3. Minor Stoppages	<ul style="list-style-type: none"> • No awareness/data. 	<ul style="list-style-type: none"> • Root-causes are clear • Settings documented by package / machine type. • < 5% variation between same type machines 	<ul style="list-style-type: none"> • REDUCED 1/20TH OF CURRENT minor stoppages are clear and countermeasures in place. 	<ul style="list-style-type: none"> • Zero minor stoppages.
4. Speed Losses	<ul style="list-style-type: none"> • Equipment specs not clear. • No settings documented by different packages/ machine models & types. 	<ul style="list-style-type: none"> • Chronic defects are quantified by type, frequency and volume. • Root causes for problems are identified and understood. 	<ul style="list-style-type: none"> • Countermeasures for root-causes of speed losses implemented. • Revised settings with notes on quality and accuracy impact. • < 2% speed loss. 	<ul style="list-style-type: none"> • Operates at designed speed or above. • Zero Speed losses
5. Defect & Startup Losses	<ul style="list-style-type: none"> • Nothing done about chronic losses. • No results from previous actions 	<ul style="list-style-type: none"> • Countermeasures implemented effective for early in-process detection of defects. • Q-components identified and effects on quality are clear. 	<ul style="list-style-type: none"> • M-Q relationship established. • Regular audit of Q-components • Loss due to quality defects is < 0.1% 	

OVERALL EQUIPMENT EFFICIENCY

OEE => 85% target

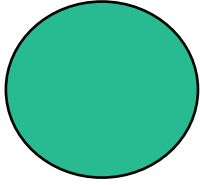
NOTE: OEE IS NOT THE SAME AS UTILIZATION. UTILIZATION MEASURES THE UP-TIME OF THE EQUIPMENT. OEE MEASURES THE 'ABILITY' OF THE EQUIPMENT TO PRODUCE. LIKE THE HORSE-POWER RATING OF AN ENGINE, OEE DESCRIBES THE EQUIPMENT'S HEALTH.



Sporadic & Chronic Problems

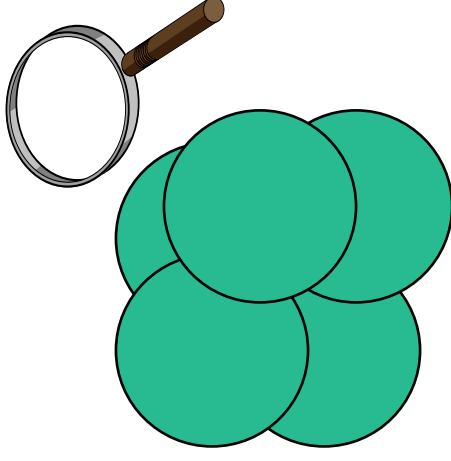
Why-Why

Analysis.



FOR PROBLEMS WITH CLEAR AND ASSIGNABLE CAUSES.

P-M Analysis.



FOR PROBLEMS WITH CLEAR CAUSES & NO EFFECTIVE COUNTER-MEASURES

Why-Why Analysis & P-M Analysis

- Used with other data analysis or data collection tools.
- Emphasize on logical reasoning to fully understand the whole chain of cause-effects so as to devise holistic multiple solutions.
- All defects, breakdowns, accidents and work – problems are result of an error by Man which is the Root Cause.
- Problems are traced to all the 4Ms
- Solution Sustained by linked to the TPM systems.

QUICK LOOK AT

Quality Maintenance Pillar

QUALITY MAINTENANCE:

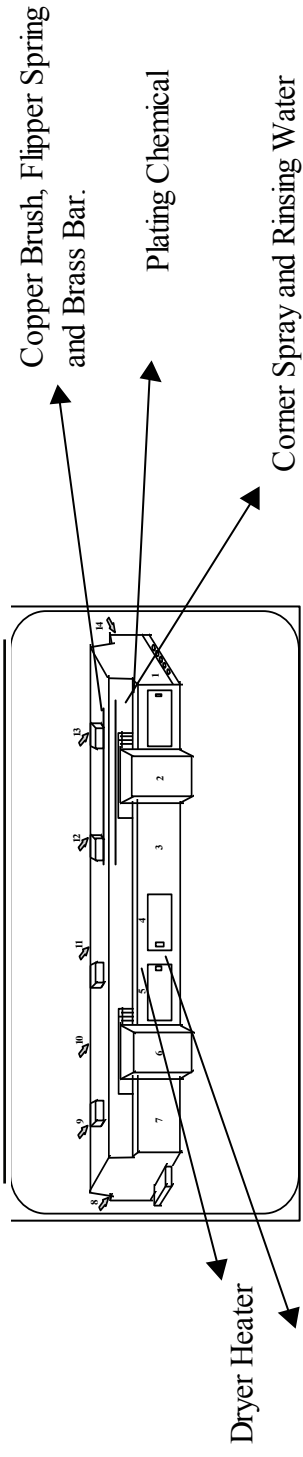
IS ACTIVITIES TO SET EQUIPMENT CONDITIONS, BASED ON THE BASIC CONCEPT OF MAINTAINING PERFECT EQUIPMENT TO MAINTAIN PERFECT QUALITY OF PROCESSED GOODS. THE MACHINE CONDITIONS (Q-COMPONENTS) ARE CHECKED AND MEASURED IN TIME-SERIES TO VERIFY THAT MEASURED VALUES ARE WITHIN STANDARD VALUES TO PREVENT DEFECTS. THE TRANSITION OF MEASURED VALUES IS WATCHED TO PREDICT POSSIBILITIES OF DEFECTS OCCURRING AND TO

TAKE COUNTERMEASURES BEFOREHAND

ROLE OF PLANT TPM-QM

Achieve “ZERO DEFECT” by identifying all the upstream factors of Equipment causes of defects and implementing fool-proofing techniques to eliminate man and materials-caused defects.

- 1. Identify all the Q-components**
- 2. Implement fool-proofing techniques to prevent man and materials-caused defects.**
- 3. Eliminate all Chronic defects.**



Dryer Blower

Part of Machine	Plating Chemical	Flipper	B. Bar / C. Brush	Dryer Heater
Measurement	Chemical Content	Tension	Contact Pressure	Hot Air Temperature
Std. Value	MSA: 37.5% +/- 5% TIN: 37.5 g/l +/- 5 g/l Additive: 2 g/l +/- 0.5 g/l	Upper <= 250 g Nominal = 120g Lower => 60g	Upper = 6 kg/cm Nominal = 5.5 kg/cm Lower = 5 kg/cm	Upper = 130 deg. C Nominal = 125 deg C Lower => 120 deg C
Interval	Daily	Weekly	Forthnightly	Daily
Quality Defect	Thickness Fail	Thickness Fail	Thickness Fail	Thickness Fail
Quality of M/c Part				
Circularity				
Content	EXAMPLE OF AN M-Q (MACHINE-QUALITY) MATRIX			
Deterioration				
Smoothness				
Q-Tag number & Revision	Q-tag # 60-001 RevA	tpm/moses Q-tag # 60-002 RevA	Q-tag # 60-003 RevA	Q-tag # 60-004 RevA

ABOUT OFFICE TPM

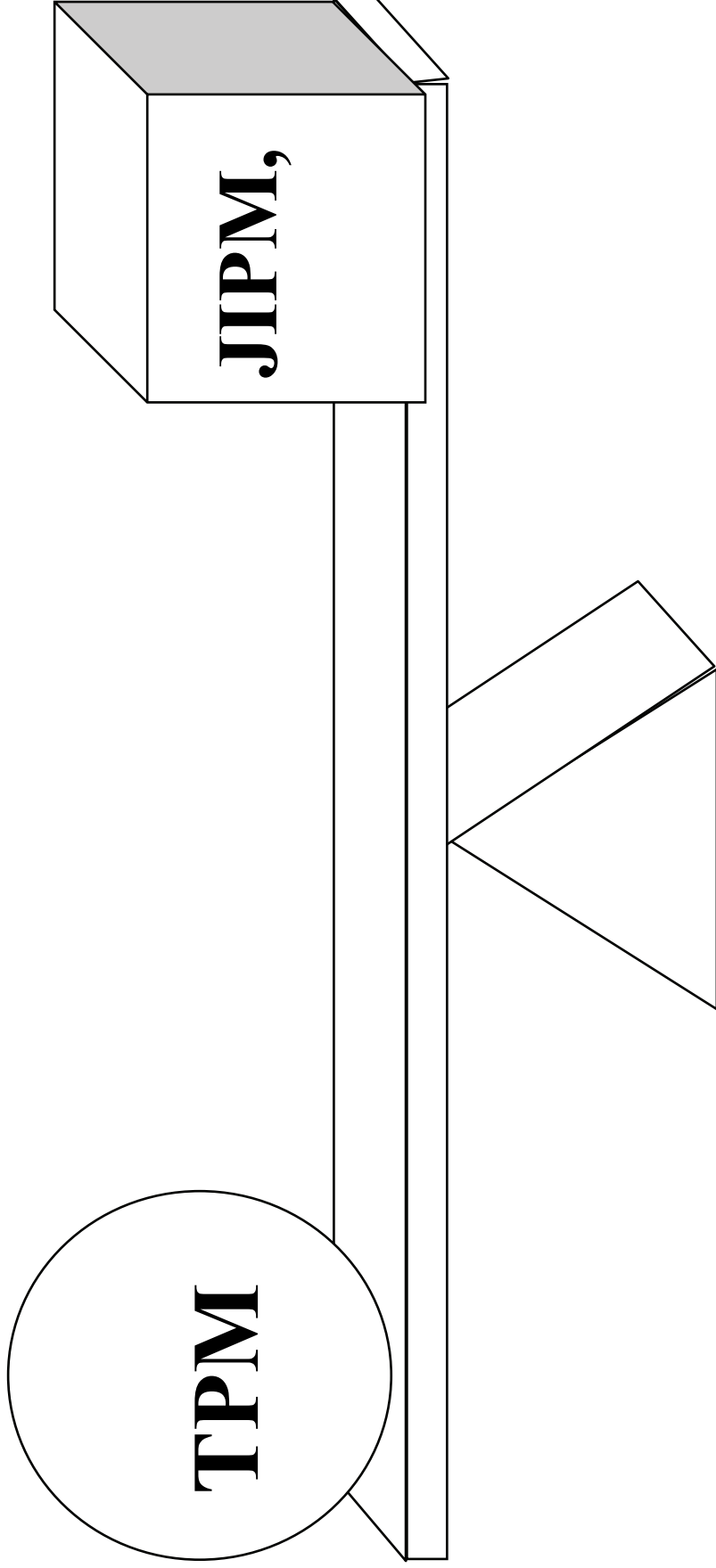
- **Is a structured 5S program using Why-Why Analysis as a problem-solving tool.**
- **Has similar Autonomous Maintenance 5 Steps**
- **Improves “CRITICAL FUNCTIONS” of Ware-house, Storage Place, administrative areas’ through work-flow studies.**
- **Areas contributing to OEE losses are selected for Kai’zen activities.**

The 5S step-by-step program.

<p>1 - Cleaning & Restoration.</p>	<p>THOROUGHLY RESTORE & CLEAN. MOTIVATION THROUGH PARTICIPATION.</p>
<p>2 - Eliminate Stains, Mixed, Contamination.</p>	<p>STUDY ROOT CAUSES OF DIRT, MIXING, LOSS, DAMAGE AND TAKE ACTIONS. ACHIEVE 1 MINUTE ACCESSIBILITY TIME FOR DOCUMENTS + PARTS. IMPLEMENT STOCK-MANAGEMENT-</p>
<p>3 - Improve Accessibility.</p>	<p>AT A GLANCE ACHIEVE A PROBLEM-FREE WORK FLOW IN STOCK INVENTORY, DATA AVAILABILITY.</p>
<p>4 – Standardization & Control of Work.</p>	<p>SELF MANAGING WORK TEAMS.</p>
<p>5 - Self Management</p>	

TOGETHER.....

Towards World-Class Manufacturing Excellence



TPM MASTERPLAN 2001 - 2003

DEVELOPMENT PROGRAM	DESCRIPTION	INTRODUCTORY STAGE 2001	PRACTICE STAGE 2002	CONSOLIDATION STAGE 2003	2004	FINAL STAGE JIPM AWARD
Policy	Basic Objective	Proliferation and total involvement	Defects and breakdowns prevention	Zero defects and zero breakdowns through every employees' involvement		Challenge the standards
Basic TPM	Weekly WC mtgs Regular EI mtgs Regular PM mtgs					
Organisation & Main Committees						
Basic Strategy	Select Model machine, form Teams, Implement improvements on Model M/Cs & then proliferate to all similar equipments					
Employee Suggestion Scheme for Continuous Improvement	Policy Pilot Area Proliferate					
TPM Measurements	OEE/Breakdowns/ Quality					
Autonomous Maintenance (5 Pilot Lines then 85% of rest of types of equipment)	Step 1: Restoration Step 2: Eliminate Contamination Step 3 : Improve Accessibility Step 4 : Initial Standards -Prepare Inspection manuals Step 5 : General Inspection Step 6 : Autonomous Inspection Step 7 : Manage quality of work	Step 1: Rest of M/Cs Pilot M/Cs Step 2: _____ Step 3: _____ Step 4: _____ Step 5: _____ Step 6: _____ Step 7: _____	Step 1: Rest of M/Cs Pilot M/Cs Step 2: _____ Step 3: _____ Step 4: _____ Step 5: _____ Step 6: _____ Step 7: _____	Step 1: Rest of M/Cs Pilot M/Cs Step 2: _____ Step 3: _____ Step 4: _____ Step 5: _____ Step 6: _____ Step 7: _____	Step 1: Rest of M/Cs Pilot M/Cs Step 2: _____ Step 3: _____ Step 4: _____ Step 5: _____ Step 6: _____ Step 7: _____	
Equipment Improvements on 6 losses	Technical support for AM Baseline current m/c losses Model m/c basic conditions Model m/c losses improvements					
PM & QM Systems	Planned maintenance schedules (Time & condition based) Machine/Product Quality matrix		Establish systems & schedules Analysis Control Standards	Quality matrixes Implement		
TPM Training and Skills Development	AM Skills workshops PM Analysis workshops Advanced workshops	Establish	Implement			
Early Equipment & Product Control	Develop trouble prevention checklists on			Develop	Implement on test run	
Office TPM	5S Program for office			Review	Enhance	
Safety, Hygiene & Environment	Equipment Safety Workplace environment & waste treatment		tpm/moses	Review	Enhance	

{ Tech. Opr Standards}
Step 5 : General Inspection Skills
5.1 Bolts, Nuts, Lubrication
5.2 Pneumatics
5.3 Electricity & Motors
5.4 Oil Hydraulics
5.5 Participate in in-line repairs

- Technical Operators
- OEE => 85%
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THANK YOU