

Technical Guide “Autonomous Maintenance”



**Small and Medium Enterprises Development Authority
Ministry of Industries & Production
Government of Pakistan**

www.smeda.org.pk

HEAD OFFICE

4th Floor, Building No. 3, Aiwan-e-Iqbal Complex, Egerton Road, Lahore
Tel: (92 42) 111 111 456, Fax: (92 42) 36304926-7
helpdesk@smeda.org.pk

REGIONAL OFFICE PUNJAB	REGIONAL OFFICE SINDH	REGIONAL OFFICE KPK	REGIONAL OFFICE BALOCHISTAN
3rd Floor, Building No. 3, Aiwan-e-Iqbal Complex, Egerton Road Lahore, Tel: (042) 111-111-456 Fax: (042) 36304926-7 helpdesk.punjab@smeda.org.pk	5TH Floor, Bahria Complex II, M.T. Khan Road, Karachi. Tel: (021) 111-111-456 Fax: (021) 5610572 helpdesk-khi@smeda.org.pk	Ground Floor State Life Building The Mall, Peshawar. Tel: (091) 9213046-47 Fax: (091) 286908 helpdesk-pew@smeda.org.pk	Bungalow No. 15-A Chaman Housing Scheme Airport Road, Quetta. Tel: (081) 831623, 831702 Fax: (081) 831922 helpdesk-qta@smeda.org.pk

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1. Disclaimer:

This information memorandum is to introduce the subject matter and provide a general idea and information on the said matter. Although, the material included in this document is based on data/information gathered from various reliable sources; however, it is based upon certain assumptions, which may differ from case to case. The information has been provided on AS IS WHERE IS basis without any warranties or assertions as to the correctness or soundness thereof. Although, due care and diligence has been taken to compile this document, the contained information may vary due to any change in any of the concerned factors, and the actual results may differ substantially from the presented information. SMEDA, its employees or agents do not assume any liability for any financial or other loss resulting from this memorandum in consequence of undertaking this activity. The contained information does not preclude any further professional advice. The prospective user of this memorandum is encouraged to carry out additional diligence and gather any information which is necessary for making an informed decision; including taking professional advice from a qualified consultant/technical expert before taking any decision to act upon the information.

1.1 Introduction to SMEDA:

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs).

With a mission "to assist in Employment Generation and Value Addition to the national income, through development of SME sectors, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify Policy, Access to Finance, Business Development Services, strategic initiatives and institutional collaboration & networking initiatives.

Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA.

Concurrent to the prefeasibility studies, a broad spectrum of Business Development Services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

For more information on services offered by SMEDA, please contact our website:

www.smeda.org

1.2 Industry Support Program

In order to enhance competitiveness of SMEs and achieve operational excellence, SMEDA established an Industry Support Cell (ISC) for provision of foreign technical support and knowledge transfer in collaboration with International Development Organizations. SMEDA's Industry Support Program (ISP) initially launched with Japan International Cooperation Agency (JICA) and actively engaged in reducing energy inefficiencies and improving production and quality of products with the support of Japanese Experts. Later on, similar activities with other international partner organizations like German Corporation for International Cooperation (GIZ), Training and Development Centers of the Bavarian Employers' Association (bfz), Germany, and United Nations Industrial Development Organization (UNIDO) were also successfully implemented.

2. What is Autonomous Maintenance?

Autonomous Maintenance (“Jishu Hozen” in Japanese) is to keep and maintain the equipment through a team work i.e. through joint responsibilities of production operators and maintenance staff instead of old conventional style in which machine maintenance is considered to be the sole responsibility of the maintenance department. Target is to prevent the machine forced/accelerated deterioration through a joint coordinated effort.

2.1. Maintenance in Autonomous Maintenance:

Maintenance is defined as the act of maintaining or keeping machines and equipment in good running order. It is not the task of person or specific group like maintenance department. Autonomous maintenance challenges the, old culture and conventional mind-set approach like

- **I Produce** (I as Production Operator Works on Machine to Produce Parts) and **You Maintain & Fix** (You as Maintenance Operator Maintain & Fix It)

Autonomous Maintenance focus on changing the mind-set and it is the new way of thinking and working

- **We all are responsible for our machines and equipment maintenance** (Thus, it tries to develop an Ownership Concept among all the stakeholders).

See the figure # 1 below as it illustrates the basic concept of the “**Autonomous Maintenance**”. The ultimate Goal is to improve the Machine Reliability. Herein “**Machine**” is referred as a “**Child**”. Thus the shared goal is to keep the child i.e. machine, “happy and healthy”.



Figure 1: The Aim of Autonomous Maintenance Copyright Lean Manufacturing Online

Production Staff are herein referred as “**Parents**” which have the task to take care of all the basic requirements of their child i.e. their own “**Machine**” in order to keep the child healthy. The responsibilities of Production Staff are described in detail in the next section # 6 i.e. Seven Steps of Implementing Autonomous Maintenance.

Maintenance Staff are herein referred as “**Doctors**” which have the task to take care of all the specialized care that the child needs i.e. their own “**Machine**” in order to prevent them from any breakdown and emergencies etc. and keep them fit and active. The responsibilities of Maintenance Staff are described in detail in the next section # 6 i.e. Seven Steps of Implementing Autonomous Maintenance

3. Goals of Autonomous Maintenance:

Following are the main Goals of the autonomous maintenance.

1. Prevent Equipment Deterioration Through Proper Operation & Control
2. Like New Status Using Equipment Restoration & Proper Management
3. Sustain Basic Conditions
4. Raise Skill Levels, Making Operator Equipment Competent

4. Equipment Deterioration:

The root cause of the major equipment failures is deterioration. There are two types of equipment deterioration.

1. Natural Equipment Deterioration
2. Forced/ Accelerated Equipment Deterioration

4.1. Natural Deterioration:

It is natural and normal phenomenon. It occurs as a result of friction, wear and tear and equipment normal stresses as per the defined life span of the machine. Although machine operated in proper procedure recommended, effective maintenance conducted to maintain the basic conditions (Cleaning, Inspection & Lubrications) and environmental conditions due to continuous usage of machine.

Natural deterioration countermeasures include time based quality maintenance and by improving the design of the machines and its components for longer machine life.

4.2. Forced/ Accelerated Deterioration:

It is abnormal phenomenon. It occurs due to abnormal wear and tear due to Mal Operation procedures, Bad/no Machine Maintenance and harsh environmental conditions etc.

Forced/ Accelerated deterioration countermeasures include implementing and sustaining Jishu Hozen i.e. Autonomous Maintenance.

Some of the examples of Forced/ Accelerated Deterioration include;

1. Loose Nut & Bolts
2. Misalignments in Machine
3. Bad Wiring
4. Improper Cleaning Causing Dust and Dirt
5. Rusting
6. Oil Leakages

5. Key Tools for Autonomous Maintenance Team Activities:

Following are the key tools for Autonomous Maintenance Team Knowledge Enhancement and Skill Improvement Activities.

1. One Point Lessons
2. Activity Boards
3. Meetings

5.1. One Point Lessons:

As the name suggest it is a tool to communicate knowledge and skills on One Topic, One Sheet and Self Study Lesson. Contents may be as follows.

1. Basic Knowledge (Equipment & Operation Processes)
2. Safety
3. Cases of Problems
4. Cases of Improvements

One member of the team i.e. author study and prepare the lesson to express the idea to the team. After verification of the content and approval from the Kaizen Coordinator. The author explains the lesson to the team usually in 5-10 minutes session. The team discusses and understands the concept. The idea is to raise the knowledge and skill of the workers in a simple and short period of time. This will help to encourage team work and commitment in the operator. Below is the sample of “One Point Lesson”. Below is a sample of One Point Lesson.

One Point Lesson					
	Location Production Plant	Area All	Line Checkweigher	OPL #	LM29
Theme	Flat Belts Inspection			REV #	0
Objective	To show how to inspect flat belts on Checkweigher			Date:	25-Apr-18
Type	Safety	Basic Knowledge	Improvement Cases	Trouble Cases	Prepared by: Facilitator
<p style="text-align: center;">Inspection Steps for Flat Belts on Checkweigher</p> <p style="text-align: center;">Safety Alert: Lock out the machine before inspecting the Flat BELTS.</p>  <p style="text-align: center;">Inspection Step 1: Clean the belt with a rag touching and observing the belt. Step 2: Look if flat belt is worn or cracked.</p>					

Figure 2: Sample One Point Lesson Copyright Lean Manufacturing Online

5.2. Activity Boards & Daily Meetings:

These two tools are used to communicate the knowledge and skills to the team based on the following agenda.

1. Previous Day Issues in (Productivity, Quality, Cost, Safety, Delivery Etc.)
2. Top Management Directions and Company's Vision
3. Today's Plan and Targets
4. Knowledge Gained
5. Improvement Activities Ongoing
6. Actions to Address the Causes & Results
7. Present Strength of Workers

Example of Autonomous Maintenance Activity Board:

Activity board is a visual tool to guide the team on production shop floor about the basic elements of problem solving.

- What we are planning to do? Our Theme
- Where we are heading towards? Our Mission and Objectives
- What is our Target? (Productivity, Quality, Cost, Safety, Delivery Etc.)
- What method should we adopt?
- What is the Schedule and Timelines of action?
- Who does what? Roles & Responsibilities
- What results to expect? (Performance Assessment)
- What are the Key Learning's (One Point Lessons)?

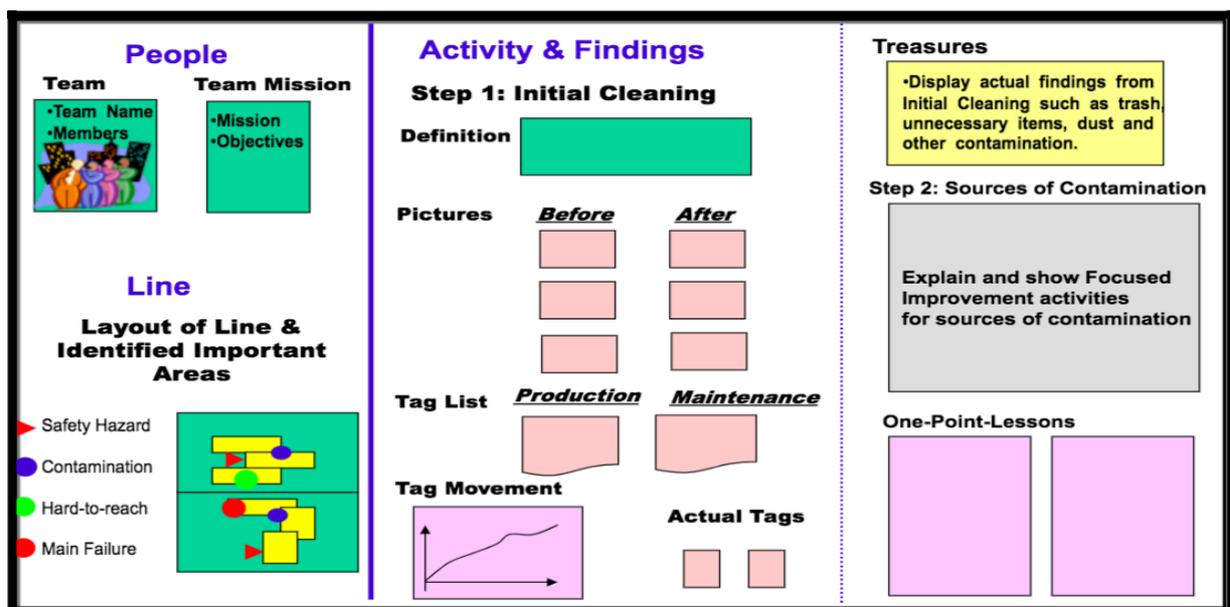


Figure 3: Example of Autonomous Maintenance Activity Board Copyright JMA Consultants

6. Seven Steps of Implementing Autonomous Maintenance

Autonomous maintenance aim is to improve the machine efficiency by preventing equipment from abnormalities that will lead to breakdowns, speed losses and quality defects etc. Below we give a basic overview of machine abnormalities.

6.1. Machine Abnormalities:

Machine abnormality can be defined as anything that is not as per the normal recommendation of the machine and its manufacturer's specification. There are seven types/categories of machine abnormalities identified in autonomous maintenance.

6.1.1. Seven Types of Machine Abnormalities:

1. Minor Flaws
2. Unfulfilled Basic Condition
3. Inaccessible Places
4. Contamination Sources
5. Quality Defect Sources
6. Unnecessary and Non Urgent Items
7. Unsafe Places

In order to achieve this the way of thinking of the workforce need to be changed. Both production and maintenance department need to play their joint role in order to achieve this. Even with the basic work of cleaning, inspection, lubrication and tightening we can prevent equipment from breakdowns and losses.

6.2. Roles of Production & Maintenance in Autonomous Maintenance:

Two extreme mindsets observed from Production and Maintenance departments and are as follow.

- 1. I Make, You Fix Mindset (By Production Department)**
- 2. We Will Come, When We Are Called (By Maintenance Department)**

In both of the above mindset it is impossible to achieve for the maintenance to meets its purpose i.e. to keep the machines in good running order. The activities necessary to achieve the maintenance objective can be broadly divided into following activities.

1. Sustainability i.e. Preventing and Correcting equipment failures.
2. Continuous Improvement i.e. Prolonging the working life of the equipment, reducing the time spent on maintenance and eliminating the need for maintenance.

6.2.1 Production Department's Responsibilities:

In Autonomous Maintenance the production department is responsible for implementing the following activities.

1. Preventing Deterioration

- a. Operating Correctly (Avoid Negligence & Human Errors)
- b. Sustaining basic equipment conditions (Cleaning, Inspection, Lubrication and Tightening Etc.)
- c. Proper Adjustments (During Operations & Changeovers)
- d. Recording Data On All Abnormalities Found
- e. Planning maintenance improvements in collaboration with maintenance department

2. Measuring Deterioration

- a. Performing Routine Checks (Using 5 Senses)
- b. Periodic Inspection (Using 5 Senses)

3. Reversing Deterioration

- a. Simple Parts Replacement and emergency measures
- b. Reporting Problems Promptly
- c. Help Maintenance Team to Repair Unexpected Failures

1b and 2a above are the most important tasks to be performed by the production department to prevent the equipment from breakdown as they are one who knows their equipment condition the best.

6.2.2 Maintenance Department's Responsibilities:

In Autonomous Maintenance the maintenance department is responsible for implementing the following activities.

1. Core Maintenance Activities

- a. Periodic Maintenance
- b. Predictive Maintenance
- c. Corrective Maintenance
- d. Developing Maintenance & Safety Standards

2. Support for Autonomous Maintenance Program

- a. Guide & Train Production Department in Preventing Equipment Breakdowns.
 - i. Teaching operators how equipment works
 - ii. Training operators how to lubricate
 - iii. Technical Guidance for Cleaning, inspection & lubrications etc.
 - iv. Responding promptly to abnormalities in equipment
- b. Teaching Checking and Inspection Procedures
 - i. Training Techniques for tightening nuts, bolts and other fastenings.
 - ii. How, what and when to inspect

6.3. The Seven Steps of Autonomous Maintenance Steps:

Following are the seven steps of Autonomous Maintenance

- Step 0: Preparation for Autonomous Maintenance
- Step 1: Initial Cleaning (Dust & Dirt)
- Step 2: Eliminating Sources of Contamination & Hard to Access Areas
- Step 3: Preparing Cleaning, Lubrication & Tightening standard
- Step 4: General Inspection
- Step 5: Autonomous Inspection
- Step 6: Standardization through Visual Management
- Step 7: Implementing Autonomous Management

7. Sustaining Autonomous Maintenance:

Now it is time to sustain the whole process after getting lots of training, development of standards and implementation. Below we present simple tips to sustain the autonomous maintenance or Jishu Hozen.

- Provide Active Leadership
- Conduct Training and seek interdepartmental collaborations
- Follow a practical, top management supported and step by step approach.
- Use PDCA cycle or approach
- Conduct proper follow-up and review at each step
- At Each Level make small teams
- Set rules for the evaluation and audit.
- Use Activity Boards and Daily Standup Meetings
- Regular One Point Lessons & Teachings
- Data Collection for Multiple Metrics like Breakdown, MTBF, MTTR, OEE Etc.
- Analyze the root cause of the problems and take countermeasures.
- Reward and Recognition for the Best Performers Etc.