

# MAINTENANCE EFFECTIVENESS BY TECHNICAL AUDIT

Prof. S. B. Srivastava

Principal, School of Engineering and Technology, Rassora, Sitapur, U.P.

## Abstract

It is quite common to listen about the failure of equipment, power, services, transport, communications, etc. Most of the time it is being announced that due to mechanical failure (Yantric Garbari ke Karan) particular type of facility is disturbed / delayed / not available / failed etc. because most of the peoples are knowing only the mechanical failure. In most of the industries, equipment stoppage hours and reasons for the stoppages are recorded. Reasons of equipment/facilities stoppage may relate with mechanical failure, electrical failure, instrumental failure, any other miscellaneous type of failures etc. In some industries, failure frequency of similar nature (repetitive) or all the failures are recorded where ever, in some industries, the availability of plant and equipment is recorded. If the plant availability norms start to decrease, then only the analysis of the stoppage hours is being done and question on reliability of maintenance starts.

Individuals doing similar nature of job for long run become habituated of doing the same job and often they search themselves, the shortcuts for doing the same job according to their own suitability. In industries, most of the time, the incentives are related with the quantities of product. So everyone takes extra care for quantity of production. If the complaint from the market starts to come for product quality then, extra attention is being given on quality of the product. Now the people starts to find out the deviation from right task, right method, right system, right parameter etc. and it becomes too late to improve the plant maintenance effectiveness, meantime, the market position of the product may exploit. Most of the failures are due to the failure of man, machine, method etc.

**Key Words: Technical audit, Technicality, Maintenance Prevention, Maintenance Effectiveness, Owner's Delight, Customer's Delight**

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## INTRODUCTION

**Technical Audit** is a useful tool to maintain and improve the maintenance effectiveness of plant and services. It is solicited that Technical Audit of plant and services should be organized at least once in a year or twice in three years as such to improve the maintenance effectiveness. Technical Audit team should consist of knowledgeable persons of their respective areas. The goal of this paper is towards maintenance prevention and

improvement in maintenance system as such to increase the maintenance effectiveness by

**Technical Audit**, adopting the method of a **Case Study**. The Technical Audit is not a Postmortem Audit like the most of the existing auditing system. Technical Audit is based on fact finding and brain storming principles. It puts its effort to find out the root cause of the problem and find out the best possible and available solutions. Technical Audit can be applied in every area of plant, facilities and services e.g. maintenance, inventory control, stores, accounting, purchase, engineering, design,

personnel management, sales and marketing etc because there is a certain **Technicality** in all these areas. Thus, it can be concluded that technical audit is useful even for home problems also. Technical Audit can short out the problems starting from very small nature to very big nature. It will look into the **technicality** in respective areas as selected. But here this tool is to be used only to **increase maintenance effectiveness.** .

In industries maintenance cost consumes approximately 20 to 25 percent of the total production cost which stands at second position after the energy cost. Technical audit is one of the important tools for converting non profitable venture into profitable venture. This audit focuses on finding out the technicality of respective area of plant and services

and to upgrade the same so as the profitability may improve. It is solicited that Technical Audit of plant and services should be organized at least once in a year or twice in three years as such to improve the maintenance effectiveness. Technical Audit team should be consists of Knowledgeable persons of their respective areas. The common asked question about the Technical Audit is that –

- What is Technical Audit?
- Why is it necessary for our firm or institution?
- What benefit will it give for organization?
- We don't need any short of audit etc., our peoples are well competent for our firm and our firm is O.K.
- Technical confidentiality will leak in the market and our competitor will give me a challenge.

The reply of these questions can be given by asking some more questions, like-

- Why people feel it necessary for their health check up when they feel quite fit?
- Why a number of foot paths are formed in rural plains in different seasons?
- Why the bike light is “ON” in day time and the driver is driving on seat?
- Why people praise for good sleep in the morning when they have taken sleeping pills in the evening?
- Whether the challenge is not a way of life?

Here the focus is to increase the maintenance effectiveness by Technical Audit for which a case study has been taken. At the end of this research the reply of all of above questions will be clear automatically. Here, a case study of an engineering industry has been taken for **Technical Audit to Improve Maintenance Effectiveness.**

## Literature Survey

Pivika, M, 2004 has pointed out on the system of maintenance only. Franka Piskar, 2006 has pointed out on quality of audit but not brain storming to improve it. Bhatt, J., Nye, C. and K Kirkbride, V, 2004 have taken only cost improvement measures. Beroft, B.D, 1996 has described Internal Quality Audits based on TQM principles. Sayle, 1985, in Management Audits, he has simply described the maintenance management system. Mills, C, 1989 has given the importance of maintenance system in management. Rajendran, M. & Devadasan, S.R., 2005, has described the Audits; their status, prowess, and future focus which represents the importance of maintenance audit. Mills, C, 1989, has proved in his research that audit is Important Management Evaluation Tool. S. Nagata, et al, 2008(April), has given the important highlights on Improving Product quality through Audit System.

While literature survey, it is observed that very good work has been done on Quality Audit, Financial Audit, Manpower Audit, Stores and Inventory Audit etc. and it was found that generally all the Audits are of postmortem type Audit. The highlight on “Technicality” in the work or audit is lacking.

**Problem and Objectives:**

The breakdown statement on an engineering industry (making engineer’s file) is given bellow for six months tenure-

S. No.	Type of Machine	Hrs Lost (Hrs)	Production Loss in Dozens	Cost of Production Loss (Rs.)
1	T-2 Cutting	12.00	44.99	5706.09
2	T-4 Cutting	22.00	93.32	7730.33
3	R-7 Cutting	07.00	33.32	4239.43
4	R-8 Cutting	12.00	66.16	3209.43
5	Auto Cutting	18.50	96.32	12216.28
6	Others like bearing fail	07.50	28.16	2344.01
Total		79	362.89	35445.74

Table No. 1, Breakdowns status before Audit

The major reasons of breakdowns are-

- i) Lever worn out and failure
- ii) Hanger and Hanger pin breakdown
- iii) Coupling bolt failure
- iv) Pressure regulator bolt failure
- v) Pneumatic failure
- vi) Bearing failure

The objective is to improve the maintenance effectiveness as such to increase the machine availability by Technical Audit. Technical Audit is also leading towards **maintenance prevention**.

**Analysis and Technical Audit Recommendations:**

**1. Lever failure:**

The major cause of failure is the lever failure. Liver fitted in the cutting machines is shown as in fig. No.1, given below. A load arm is operating this lever very quickly. This lever is hinged on machine and is spring loaded.

- a. It was observed that in most of the cases of lever failure, the pattern of failure is found similar. At first, a fine crack is developing along with the line of failure and it is propagating towards outside. The failure is due to stress concentration.

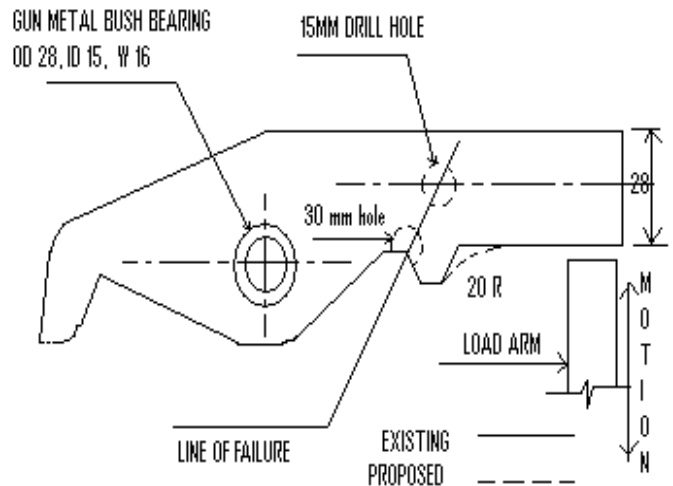


Fig. No.1: Lever Modification

- b. Due to worn out of GM Bush bearing, some time abnormal clearance is developed at hing. The lubrication of bearing is done manually once in a shift

It is suggested that-

- a. 30 MM and 15 MM holes and an arch of 20 MM radius should be made as shown in the figure No.1. The failure will be eliminated

- b. The bearing lubrication should be insured twice in a shift. Worn out bushes should be replaced timely.

the failure will reduce and reliability will increase.

**2. Hanger and hanger pin breakdown:**

The common size of hanger pin is 10 MM diameter and 65 MM length though the size is varying in different machines. The pin material was tested and it is confirmed that pin is made of mild steel. This pin is used in all the 25 machines. It is suggested that-

The material of hanger pin should be changed to EN-8 instead of Mild Steel. The life of hanger pin will increase.

**3. Coupling bolt failure:**

Two types of coupling bolts are used. One bolt is used for fastening the reciprocating plate and another for holding the bearing. It is suggested that-

- a. Bearing holding bolts should be replaced with HT (high tensile) bolt.
- b. The design of coupling bolt should be changed as per figure No.2 as given below

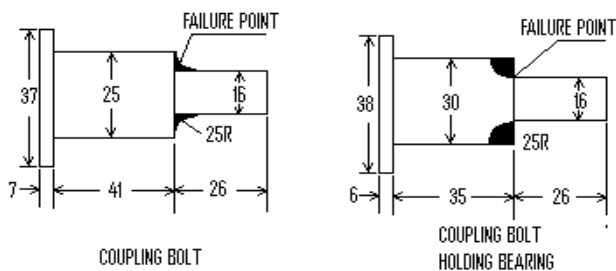


FIG. 2, COUPLING BOLT AND COUPLING BOLT HOLDING BEARING

- c. The failure point is shown in the figure. At failure point a curvature of 25 R should be given. After this modification,

**4. Pressure regulator bolt failure:**

The material of pressure regulator bolt is mild steel. The nature of failure of this bolt was analyzed. It was found that in most of the cases, the failure is tensile failure.

The similar type bolt is fitted in 27 machines and the break down occurs one by one which results the loss in production. It is suggested that-

High Tensile (HT) bolts should be used in place of ordinary mild steel bolts

**5. Pneumatic system failure:**

Total 16 number breakdowns are related with Pneumatic system failure. The preventive maintenance for pneumatic system was found poor. To reduce the break down frequency, it is suggested to take the following corrective actions-

- a. The auto lubricators installed should be filled with oil daily. This should be included in maintenance check lists.
- b. Preventive maintenance schedule should be revised for effective maintenance of cylinders, solenoid valves and pressure reducing stations.
- c. Air and moisture filter regulator should be drained timely.

**Research Findings**

After implementation of the Technical Audit report, the status of breakdowns in next six month is as under-

S. No.	Type of Machine	Hrs Lost	Production Loss in	Cost of Production
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		(Hrs)	Dozens	Loss (Rs.)
1	T-2 Cutting	04.00	14.99	1902.03
2	T-4 Cutting	03.50	14.84	1229.82
3	R-7 Cutting	01.00	04.76	0605.63
4	R-8 Cutting	03.00	16.54	0802.35
5	Auto	04.00	20.82	
6	Cutting Others like bearing fail	01.50	05.63	2641.35 0468.80
	Total	17	77.58	7649.98

Table No.2, Breakdowns status after audit

From the Table No.1, Table No.2 and the detailed report, the findings are as under-

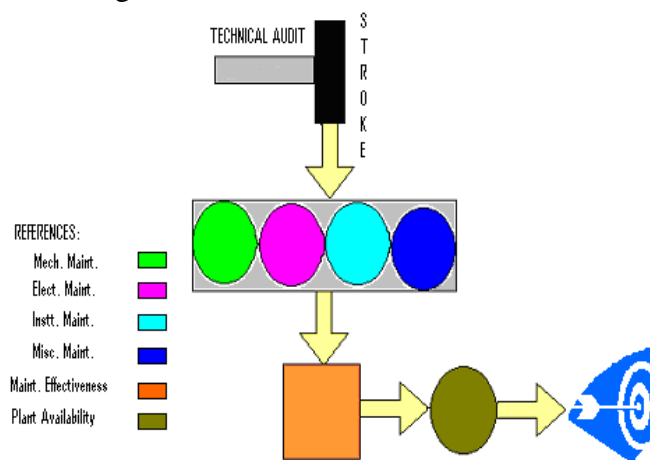
- 78.48% of non productive time was converted into productive time. It indicates that hours lost in maintenance have been come down.
- A net savings of Rs 27800/- on account of cost of production loss in six months, i.e. yearly production loss savings is Rs. 55600/ per annum.
- Similar findings can be made in the area if Electrical Engineering, Instrument Engineering and other discipline.
- Such type of Technical Audit will also increase the knowledge of the employees.
- Increased production will give the increased profit.
- This will bring the owner's delight.
- The quality of the product and services may also improve.

### Conclusion:

- Technical Audit to Improve Maintenance Effectiveness is not a Fault Finding Audit but it is a Fact Finding Audit. It is different from the postmortem type audit.
- There is Technicality in every work. If the technicality is over ruled, the problem starts. The problem may be of any type e.g.

- quality, quantity, cost increase of product and services.
- Technical Audit brings the Technicality in streamline and increases employee knowledge.
- The product design is also being done to meet the competitiveness of the market, so, some time the factor of safety of parts is taken bare minimum which results the failure.
- Technical Audit also helps in maintenance prevention and increases the reliability of operation.
- Technical Audit benefit to entrepreneurs and employees by increasing the productivity.
- Technical Audit increases the plant safety.
- Technical Audit makes the operations easy.
- Technical Audit brings delight for customers and producers.

The research conclusion is also expressed by following model-



### Owner's Delight EFFECT OF TECHNICAL AUDIT

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