**TOTAL PRODUCTIVE MAINTENANCE**

**(TPM)**

**1. INTRODUCCION TO TOTAL PRODUCTIVE MAINTENANCE**

To improve the administration of the equipment, more ago than 30 Japan years introduced in their companies the concept of original preventive maintenance of the United States, which makes emphasis in the importance that it has to involve the personnel of production and to the one of maintenance in workings of productive maintenance, because this has given good results mainly in end industries. The later incorporations included the prevention of the maintenance, the predictive maintenance and diagnosis and, of course, the total participation of the company at all level; all this under a scheme adapted to the characteristics and necessities of its companies.

The term TPM as better it is known the Total Productive Maintenance around the world, was established in 1971 by the Japanese Institute for the Maintenance of Plant with a definition that includes the following points:

a.- The Total Productive Maintenance tries to create a corporative culture to reach the maximum of possible efficiency of all the productive process.

b.- The Total Productive Maintenance establishes a management system of plant which prevents the losses and obtains the reduction of goals to zero, such as: "zero accidents", "zero defects" and "zero failures" in the equipment involved in production system.

c.- It involves all the departments of the company; designers of equipment, production, engineering, maintenance, workers, sales and others.

d.- All the employees participate actively, from the high management to the workers.

e.- Foments the participation and the motivation, through the constitution of small work groups.

The Total Productive Maintenance is defined frequently in its close sense like productive maintenance made by all the employees through activities of small groups (activities of autonomous maintenance), is based on the principle of which the improvement of the equipment must involve all the organization, from the operators to the high management. We understand like productive maintenance the use of the type of maintenance that I adapted myself more to the characteristics of the machinery in terms of importance in the line of production, availability and cost of spare parts, facility of maintenance and cost of the equipment (value of replacement) in order of extending the life utility of this.

**2. DEFINICION OF TOTAL PRODUCTIVE MAINTENANCE**

As activities TPM were contemplated firstly in the surroundings of the production departments, the TPM was defined originally by the Japanese Institute of Maintenance of Plant (JIPM) including the following strategies:

1. To maximize the global effectiveness that covers the whole life with the equipment.
2. To establish a global system p.m. that covers the whole life with the equipment.
3. To involve all the departments that plan, use and maintain equipment.

Nevertheless, The Total Productive Maintenance is applied by all the company, including the departments of development of the product, as well as the administrative ones and of sales. In order to reflect this tendency, the JIPM has introduced in 1989 a new definition of the TPM, with the following strategic components:

1. To create a corporative organization who maximizes the effectiveness of the production systems.
2. To manage the plant with an organization who avoids all type of losses (assuring the zero accidents, defects and failures) in the whole life of production.
3. To involve to all the departments in the implantation of the TPM, including development, sale and administration.
4. To involve all, from the high direction of the workers of the plant in a same project.
5. To decidedly orient the actions towards "zero losses" leaning in the activities of the small groups.

The Total Productive Maintenance in its ample sense is a management philosophy that promotes the change of the organizational culture towards the quality and productivity at all level in the company under a scheme of participate administration. In Total Productive Maintenance, three the Total word has meaning important that it determines the main expenses of the TPM:

1. **Total efficiency.-** The Total Productive Maintenance looks for the economic efficiency or yield of all the company.
2. **Total maintenance.-** Establishment of a plan of maintenance for all the life utility of the equipment (it includes preventive maintenance, maintenance of failures and medium repair or facility of the maintenance and the operation by means of improvements in the design).
3. **Total Participation of all.-** Existence of a organizational system that allows the activities of small work groups for the accomplishment in each department and each level (activities of autonomous maintenance in the plant).

**3. REASONS TO INTRODUCE THE TPM.**

The TPM does the more efficient productive process with the elimination of the problems caused by the machine considering the march of this program like a strategic weapon towards the quality (satisfaction of the client). Between some reasons of the necessity of the TPM they are:

1. Total the Productive Maintenance is the base to apply system MRPII (subject of our study) since the elimination of unexpected problems is required, for it the MRPII manages to create maintenance orders in the precise moment according to the diagnosis of the machine.
2. Necessity to incorporate the quality to the production process, to involve to workers and work in groups.
3. Necessity of a maximum of efficiency of the machine and prolongation of the life utility of the more and more expensive equipment.
4. The maintenance personnel is not sufficient to cover "emergencies" of the plant (Api Pro helps to program the personnel necessary to be able to carry out the maintenance).

**4. MAIN GOALS OF TOTAL PRODUCTIVE MAINTENANCE**

* 1. To develop an optimal man-machine system, in which, the worker is responsible for the optimal operation of the machine through activities of daily maintenance (cleaning, lubrication, adjustments and changes). To obtain an improvement of the global efficiency of the equipment.
	2. To improve the general quality of the work atmosphere, with which it is persecuted to change to the attitudes and behavior of the people. With this, the personnel learns to discover abnormalities, to make repairs and improvements based on defined facts, to confirm the positive results, to acquire the quality conscience, to improve the care of the equipment, the cleaning becomes inspection, is a property sense and of work in equipment, it is generated a sense of pride and loyalty by the company, greater motivation and greater labor security. The philosophy of the MRPII helps to apply the previous thing.
	3. Prevention: one of the most important characteristics of the TPM is the aggressive establishment of objectives and I put, such as zero labor failures, zero defects and zero accidents. By this the TPM puts emphasis in the prevention mainly, is too much late if it is expected until it happens a problem soon to fix it. As it is possible to be observed, to introduce Total the Productive Maintenance in a company is very important and takes with himself a study much more ample and detailed. In the present work a part of the application of the TPM is detailed, in where it interacts with the MRPII for the programming of the maintenance orders.

**5. EXCELLENT ASPECTS OF TOTAL PRODUCTIVE MAINTENANCE**

Summarizing the excellent aspects of Total the Productive Maintenance, we can indicate the following ones:

* The Total Productive Maintenance makes emphasis in the improvement of general the management performance and the quality.
* The TPM is concentrated in the improvement of the quality of the equipment.
* TPM tries to maximize the efficiency of the equipment through a total system of preventive maintenance that covers the life with the equipment.
* TPM rationalizes the management of the equipment that integrates the productive processes, so that it such optimizes the yield of and the productivity of such systems. For it is centered in objectives and it applies average the suitable ones.

As objective TPM identify the six great losses. All of them are directly or indirectly related to the equipment, and of course they give rise to reductions of efficiency of the productive system, in three fundamental aspects:

* Prevents the dead times or with unemployment of the productive system.
* Avoids the operation at inferior speed to the capacity of the equipment
* Prevents defective products or badly functioning with the operations in an equipment

The means which the TPM is used, is the different systems from management that has allowed to implant the suitable maintenance, as much from level of design as of the operation of the equipment, to palliate to the maximum the losses of the productive systems that can be related to such. Basically these are the fundamental aspects:

* Basic maintenance and of prevention of failures made from the own job and therefore by the own worker
* Optimized Management of preventive maintenance and corrective.
* Complete and continuous conservation of the equipment and consequent increase of its util life.
* Beyond the conservation, makes emphasis in improving the equipment, their operation and its yield.
* Requires the formation adapted to the maintenance and production personnel, about the equipment, its operation and its maintenance.

The TPM is a new concept of management of the maintenance, that treats about which this one is carried out by all the employees and to all the levels through activities in small groups that imply:

* The participation of all the personnel, from the high direction to the plant workers.
* Compromises and includes to all and each one of them successfully to reach the objective
* Establishes a corporative culture oriented to the obtaining of the Maximum effectiveness in the production system and management of equipment. It is what one occurs to know like objective:

**GLOBAL EFFECTIVENESS:** Production + Management of equipment

* Implants system of management of plants productive that facilitates the elimination of the losses before they take place and obtains the objectives of: Zero Defects - Zero Failures - Zero Accidents
* Implants of the preventive maintenance like basic to reach the objective of zero losses by means of integrated activities in small work groups and supported means in the support that provides the autonomous maintenance
* Applies systems of management in all the aspects of the production, including design and development, sales and direction.

Therefore it avoids the great losses of the equipment like:

1. Breakdown

2. Changeover

3. Cutting Blade Change

4. Star Up / Ramp Down

5. Minor Stopped (Chokotei)

6. Speed

7. Defects and Rework

8. Shutdown

9. Management

10. Operational Motion

11. Line Organization

12. Logistics

13. Measurement & Adjustment

14. Energy

15. Maintenance Spare Parts

16. Yield

All these aspects are not only own of industrial companies, but in addition to the lenders of services, example transports, banks, sanatoriums, distributors of energy among others.

Let us think about simple cases but: the cost of red stationery store and (or to toner) by bad operation of photocopier or printers, added to the cost that nowadays those inseams have.

Therefore we have the TPM establishes of positive form a new one to see and to make the actions of maintenance like:

* The operators participate in the preventive maintenance, who are enabled in the internal operation of their machine and people in charge become of which are not unemployments by breakdowns
* Diagnoses badly the operation in advance, before it happens unemployment.
* All unemployment of maintenance and all purchase of spare parts is prepared and programmed. Zero unemployments by breakdown and minimum inventory of spare parts.

6. THE TOTAL PRODUCTIVE MAINTENANCE FOR ITS GOOD IMPLEMENTATION REQUIRES:

1. A suitable program of computer to catch numbers, tendencies and commentaries about the history of the maintenance of each machine.
2. That the operation personnel is enabled as far as the internal operation of the machines that handles, and is able to diagnose its problems being in operation, by perceivable symptoms by the ear, Vista, tact and sense of smell.
3. That one has procedures so that the operator can request and receive immediate aid when he needs consultation on a new s symptoms the machine.
4. That there are agenda lists, generated by the computer or manually, that they indicate ahead of time when the parts of wearing down must be replaced.
5. That the operator counts on "Equipment SEIKETSU", the necessary thing to fix small details yet that they allow to always conserve the machine in perfect state.

Main that determines the Total Productive Maintenance is that any engineer or technician of maintenance does not have themselves that considers impossible to program the works of maintenance to the degree to obtain zero unexpected unemployments. It is necessary to exile the attitude to live to the expectation of breakdowns. The technical Total Productive Maintenance orders to be in continuous monitoring of any symptom to be able to diagnose early; this consists of knowledge that the machine has problems before it is stopped. For it the operators must be perfectly enabled as far as the internal operation of the machines of an industrial plant.