

*Full Length Research Paper*

# Application of preventive maintenance planning in a parquet enterprise

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**In this study, the process of a parquet enterprise's transition to preventive maintenance which has been implementing maintenance technique in case of breakdown was investigated. During that transition process, follow up forms for maintenance–repair, breakdown and spare parts were prepared and the implementation processes were followed. At the end of the implementation, it was identified that breakdowns have declined, anxiety and turmoil brought about by breakdowns have been prevented, the life span of the machines soared, labour-borne accidents declined and production quality increased.**

**Key words:** Maintenance, preventive maintenance, enterprise, planning.

## INTRODUCTION

In order to be able to extend the life span of machines, some control and repair tasks are implemented when they breakdown or at set intervals and these are generally referred to as maintenance tasks (Anonymous, 1972). Maintenance plays an important role over labor, equipment, energy, production quality and expenses (Ayyildiz, 2000).

The quality, manner and scope of maintenance vary greatly according to industry and even the types of processing in the same industry branch. The objectives and the policies of enterprises identify, to a large extent, the limits of maintenance processes, too (Sarac, 1991).

Maintenance is a cluster of processing that is composed of planning, implementation and control levels that enable the production system to operate in accordance with plan and programs; and keep it under expected labor standards (Ayyildiz, 2000; Sivri, 1986; Capkur, 1989; Baz, 1995; Goktas, 1997; Adali, 1998). Maintenance is also the

processes that are conducted so as to keep system, machine and equipments under acceptable standards with a view to controlling and preventing unexpected malfunctions and potential pauses as much as possible so that production activity could go on regularly according to the plan (Kocaalan, 1980).

The purposes of maintenance are affected by factors such as job types, time and environment etc (Alisar, 1992). Considering this, the fundamental purposes of maintenance can be listed in order as such: 1) to keep the machine in a level in which it can operate efficiently and in quality, 2) not to let unexpected interruptions brought on by breakdown and thus enable the production to happen in a regular way, 3) to decrease the costs brought on by breakdowns applying planned maintenance, 4) to enable continuity during the envisaged time in line with the operation life span of the machine, 5) to keep spare part stockings belonging to machines in the optimum level (Sarac, 1991).

Preventive maintenance is a planned maintenance method developed in order to minimize all the operating machines and equipment breakdowns in enterprises to the least extent. It is based on the principle that pre-determined maintenance processes are conducted within

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pause time by pausing machines and equipment at set periods (Ayyildiz, 2000; Capkur, 1989; Baz, 1995; Alisar, 1992). It is equipment inspection and testing that enable the avoidance of premature equipment failures, and what extend the equipment life are lubrication, cleaning, adjusting, and minor component replacement (Tomlinsong, 1993). This is realized based on a plan drawn up so as to decrease breakdown frequency (Karaoglan et al., 2007). In which maintenance times the machines will be maintained by pausing them is determined considering the experience of maintenance team, previous performances of machines, working hours and the maintenance intervals and methods indicated in technical machine books (Ayranci, 1997).

All preventive maintenance programs are based on time. That is, maintenance layouts are based on operation hours or time used. More developed preventive maintenance programs include repair, maintenance, adjustment and re-establishing (Mobley, 1990). Despite the differences in systems and shifts in enterprise policies, all preventive maintenance programs aim; 1) to expose the conditions that may damage the systems or interrupt production by conducting the periodic controls of systems and equipment, 2) to enable the normal continuity of production by conducting certain adjustments and repairs taking precautions before such conditions come into being (Anonymous, 1972; Anonymous, 1978; Anonymous, 1971).

Preventive maintenance programs are prepared in accordance with production programs. In that way, on one hand, immediate pauses in production and cost increases are prevented on the other hand, maintenance service is enabled to work efficiently because the systems will continue with uninterrupted production. Moreover, great losses stemming from sudden breakdowns and breaks can be prevented (Kocaalan, 1999).

With this study, implementation of preventive maintenance is aimed to reach a maximum level while maintenance in case of breakdown is aimed to regress to the minimum level. To this end, preventive maintenance application forms were prepared, the tasks to be fulfilled in the control lists were transformed to labor command in identified time intervals, tasks fulfilled, equipment and machines were processed into forms, control data were pursued, any type of application correspondence and knowledge requirements that the maintenance personnel will need and the reports were provided.

## MATERIALS AND METHODS

The enterprise that produced massive parquet as one of the pioneers in sector by 2000, continued to produce laminated parquet in which modern technology was applied after 2000 in order to be able to meet the need for polished wooden parquet. It still continues

its laminate production in its production line with TSE and ISO 9001 certificates. It has 6000 m<sup>2</sup> closed area and 8000 m<sup>2</sup> open space. Its production capacity is 40.0000 m<sup>2</sup> monthly and 480.000 m<sup>2</sup> annually. Its total personnel number is 90 and it continues production with single shift.

The enterprise that was involved in the study was an enterprise that carries out mass production. The number of machines the enterprise uses in the production system and for which breakdown maintenance forms were prepared is 21 and, band saws machine, carriage band saw machine, head cutting machine, grooving and tenoning machine, frame saw machine, glue machine, press line and varnish line are among those machines. Three layered and two layer materials are used in the production process to fulfill different requirements. Pre-finished three layer parquet floorings are produced as U.V. varnished, U.V. oiled, brushed, beveled edge, locked system, and tongue and groove system. The pre-finished three layer parquet flooring production that starts with drying process demanding precise involvement of advanced technology is performed and followed by automated material classification, combination process, press and packaging phases. After the drying process which requires an advanced technology, materials are classified automatically, joined, pressed, and packed and placed on tracks. Since the production stage is automatic in nature, product quality is at high level. The production process starts with choosing among different types of trees meticulously and transforming them into strips, which are stockpiled and kept outdoors for 3 - 12 months depending on the type of the material, and they are dried in full automatic Kiln drying systems. These materials, which are kept in special conditioning rooms and transformed into lamellas by sensitive machinery, are classified in full automatic classification machines. Following this stage, upper layer materials are joined and calibrated by being pressed in 2 or 3 layers. For laminated parquets with two layers; on the upper layer, rigid and decorative trees such as oak, beech, sapelli, iroko and merbau are used and on the lower cross-section interior (moisture absorption and scattering) operating quality trees like fir and pine trees are used. For parquets with three layers; as an addition to the one with two layers, at the lowest layer one piece of 2 mm thick fir tree paper is used. The glue used in the pressing process does not contain any carcinogenic substances. 6 layers of ultraviolet lacquer are applied to the upper surface and packed in highly sensitive machines.

In the literature study, the subjects concerning the concept of maintenance, maintenance method and applications, preventive maintenance have been discussed. By evaluating the theoretical knowledge and the data obtained, the general framework of the study was drawn and the method and the application conditions were planned. Breakdown forms, maintenance forms and spare parts follow-up forms have been prepared by gathering some information about the enterprise chosen and making use of literature and standards in order to determine the pauses in production and the causes of machine breakdown so as to be able to carry out preventive maintenance planning in parquet industry (Sevim Korkut, 2005; Alisar, 1992; TS IEC 60300-3-11, 2003; TS IEC 60300-3-12, 2001; Smith and Babb, 1973; Cunningham and Cox, 1972)

### Preparation of preventive maintenance application forms in the enterprise

Periodic controls and their being recorded, prepared for breakdown notice and maintenance-repair systems were realized by the enterprise.

**Table 1.** Breakdown notice-repair form.

BREAKDOWN NOTICE-REPAIR FORM			
Notice		Job Order Approval	
Department			
Machine code:			
Machine's name:			
Breakdown description			
Is the machine operating?	Yes                  No		
Repair	Job Order Approval (Name- Surname)		
Who interfered in the breakdown Name-Surname		Breakdown Description	
His job:			
Interference date-hour:			
Explanation of the interference			
Equipment and spare parts used			
Type-Code		Quantity	
Outcome			
Did the interference stop production?		Yes          No	Time lost:
Interference finish date and hour:			
Who took the delivery of machine Name-Surname Signature	Who repaired the breakdown Name -Surname    Signature	Approval Name -Surname    Signature	

### Breakdown forms

In order that records of breakdowns can be followed, breakdown notice form (Table 1) and monthly breakdown report form (Table 2) were prepared. With these forms, it is aimed that breakdowns that occur during production are repaired within the least amount of time possible.

### Maintenance forms

There is machine introduction form on each machine. Moreover, weekly maintenance form (Table 3), monthly maintenance form (Table 4) yearly maintenance form (Table 5) and maintenance-repair form on which maintenances conducted are followed yearly (Table 6).

### Spare part follow-up form

A control form on which the order records of machine spare parts are kept was prepared and a sample given on Table 7. With this form, stocks of spare parts belonging to machine was kept under control.

## RESULTS AND DISCUSSION

In the enterprise in which the study was conducted, maintenance technique was applied in case of breakdown. The top management of the enterprise decided to go into preventive maintenance and to include the operators' in maintenance activities since they were the closest ones to the machine. The basic motive for starting preventive maintenance applications in the enterprise was to increase the performance and prevent the unexpected breakdowns. Delay in production due to the breakdowns may cause production loss, customer loss and accordingly market loss. That production should be realized with sufficient quality level is as important as its being realized in the expected level in terms of quantity. With preventive maintenance, maintenance costs will be decreased by removing any risk of breakdown in tools. In order to start the application, factory managers, electrical technician and maintenance technician were interviewed and information about their goals and the maintenance activity they applied was obtained. Some work was put in order to go into preventive maintenance from the present



**Table 5.** Yearly maintenance form.

YEARLY MAINTENANCE FORM							
Machine number:							
Machine unit:							
Maintenance part:				Maintenance code		Maintenance explanation	
Year	Maintenance code	Who conducted maintenance	Date	Year	Maintenance code	Who conducted maintenance	Date
Week				Week			

the services and controls that will be carried out the following week to the concerned maintenance technician and factory managers every week, then the machine operator does the necessary controls before the machines start the production, the control of machines in operation with control tools and equipment, activities including lubrication in machines are fulfilled at necessary time intervals and the machines are paused at set intervals and all the necessary preventive maintenance processes are conducted during the pause.

With the breakdown maintenance actions, it is aimed that the breakdown that occurs at the time of the production ought to be corrected as soon as possible. In the machines that have different qualities, the maintenance and the check over of the machines are conducted in terms of electrical parts check over, mechanical parts check over, hydraulic and air parts check over.

Periodical maintenance of machines is conducted according to the periodical maintenance tables on the machines. On these tables, the period of the maintenance, the part or area on which maintenance will be carried out, the equipment to be used and the attendant to carry out the maintenance are indicated. Daily, weekly and simple maintenances are generally fulfilled by the operator while maintenances on mechanic and electrical equipment are fulfilled by the concerned attendant from maintenance department. Time at which cleaning is started and weekly maintenance of each machine differs. Though the beginning time for daily cleaning has been set as 16:45, and the weekly maintenance day has been set as Saturday afternoons or Sundays, when necessary, this beginning time is taken to 17:15 after the office hours on weekdays. Some of the sharpening of knives or saws is fulfilled by the sharpening

expert at the sharpening workshop and the rest is fulfilled by supplier firm out of the factory.

Providing spare parts and materials for maintenance has great importance. With spare parts follow-up form, stocks of spare parts belonging to machine was kept under control. With these forms, it has become possible to keep track of the results besides identifying the major causes that lead to breakdown, pause and defective production in the enterprise. Thereby, the diagnosis and analysis of many problems and the improvement of productivity in the enterprise was assured.

**Conclusion**

In the enterprise involved in the study, a maintenance organization that was well equipped with the solutions to the problems that could come out and with the qualities of the available machines and equipment was formed once the preventive maintenance application had been decided on. 1) With the application of preventive maintenance system in the enterprise the breakdown-repair forms prepared to follow the breakdowns regularly, anxiety and carelessness brought on by breakdowns were minimized. 2) With the development of maintenance-repair forms, which machine has undergone which maintenance-repair process were regularly followed. 3) Machines have been paused by a set number of personnel on certain days and controlled according to the plan. 4) With the maintenance activities fulfilled in time, the life span of machines was extended. 5) Because maintenance personnel have been organized into planned maintenances to a large extent, job accidents fell in the enterprise. 6) Maintenance personnel were disciplined. 7) Together with maintenance personnel, production personnel have

**Table 6.** Yearly maintenance and repair follow-up form.

YEARLY MAINTENANCE-REPAIR FOLLOW-UP FORM													Date:																																			
Machine's name:	Months																																															
	1				2				3				4				5				6				7				8				9				10				11				12			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Attendant's name surname:																																																

**Table 7.** Spare parts follow-up form.

Invoice no	Machine's name	Machine code	Part's name	Part code	Order date	Proposal date	Dispatch notice	Unit cost	Quantity of order	Supply duration	Receive date	Condition

avoided daily breakdowns and they started to allocate more time to production problems. 8) Production quality improved. Moreover, with all these favorable outcomes, the profitability of the enterprise increased.

Preventive maintenance ensures the identification of faults on time, prevents the breakdowns that might lead to significant economic losses and jeopardize the work safety and increases the efficiency of the enterprise. However, it takes long for the preventive maintenance system to set in

the enterprises and to be adopted by the personnel, and obtaining the results varies from one enterprise to another.

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