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Breakdown Maintenance and Modification of Design for the Drying Machine

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Abstract:- Condition-based maintenance (CBM) is a maintenance program that recommends maintenance decisions based on the information collected through condition monitoring. It consists of three main steps: data acquisition, data processing and maintenance decision-making.The basic purpose of the paper work is the satisfaction of Tractor manufacturer's demand regarding issues of malfunctioning of PRV (Pressure relieving valve) coming from the field in warranty period. This was causing huge losses to the company as it had to replace parts which was the result of inefficient drying process. To resolve this issue a drying machine was used which later broke down. In this analysis, Breakdown maintenance of the drying machine is done and modification of design for the drying machine is proposed so that it could be used in all the seasons of the year in an efficient way.

Keywords:- Breakdown , Maintenance, Modification of design, Drying machine, Condition monitoring

I. INTRODUCTION

A production line contains a set of different operations which are carried out at different places which when combined together produce a product that can be directly used for consumption or they are further assembled to make a finished article[1]. A production line was set up in the reputed automobile assembly unit situated in central India, to assemble the Transmission of tractors. Distributor Housing is of paramount importance as far as Tractor is concerned it distribute pressurized (200 bars) oil to ADDC(automatic depth and draft control) which is for lifting and drafting actions. Before assembly, housing is reamed ,washed and necessarily dried to avoid rusting. Housing is dried with the help of pressurized air. In the recent past it was done manually. This process produced noise of higher decibel (10 db) which is not allowed from safety point of view and adds fatigue to worker and moreover process was not 100% efficient. Also there were issues of rusty housing from warranty. To solve all these problems Drying machine is proposed in CFT (cross functional team) meeting.

II. LITERATURE REVIEW

The competitive pressure on the market is forcing companies to explore every possible competitive advantage with the goal to find the potential in every single process[33].Issues of malfunctioning of PRV (pressure relieving valve) were coming from field in warranty. And this was causing a big loss to company in replacing parts. In analysis Warranty team find out that this was occurring because of rusty Distributor housing. And this was the result of inefficient drying process. To resolve this issue CFT (cross functional team) is called. Because process was not good from safety point of view also. CFT team decided to propose a drying machine. Later on drying machine was not able to cope up in all the seasons of the year and got breakdown.

A high performing production system is not only dependent on an operational design but also on the processes of taking care of the system. This includes maintenance that aims to keep the system in an operational condition or bring it back to an operational condition after a break down[14]. The cost of maintenance in reputed automobile assemble unit is estimated to be 6.2 % of the industry turnover every year. As much as one third of the maintenance cost is estimated to exist due to bad planning, badly performed preventive maintenance and overtime costs which leads to unnecessary increased production costs[34]. With a correct maintenance strategy the downtime and the maintenance cost can be radically decreased [33].

Tractor Manufacturer's was aware that different improvements could be done to reach these goals on all levels of the organization. To see if there were any general improvement possibilities on the operational level, the machine or channel level, with aim to improve the preventive maintenance an internal report was made [30].

A. Requirements During Maintenance and Modification of Drying Machine Design

- To make process 100% efficient.
- To make process noiseless.

- To eliminate fatigue of worker.
- To increase productivity.
- Ultimately to reduce issues of malfunctioning of PRV (pressure relieving valve).

III. DESIGN METHODOLOGY

A. Construction:

Drying machine consists of the following parts:

1) Air Chamber: An air chamber is rectangular compartment in distributor housing is placed for drying after washing. It is made up of Stainless Steel sheet and insulation is also provided b/w sheets. Amplified air is supplied to chamber through amplifier & nozzles. Air pressure supplied to amplifier is of 5bar. Distributor Housing carrying trolley is shown in Fig. 1.

2) Machine frame: Machine frame is made up of Rectangular tubes (50*50*10) with four legs and a table on it for mounting of Air chamber, Heater Chamber, Recirculation Duct and Control panel. Distributor Drying machine is shown in Fig. 2.

- Induction Type Air Heater:

An Air Heater of capacity 6 KW is also used for increasing temperature of air for efficiently drying Distributor housing.

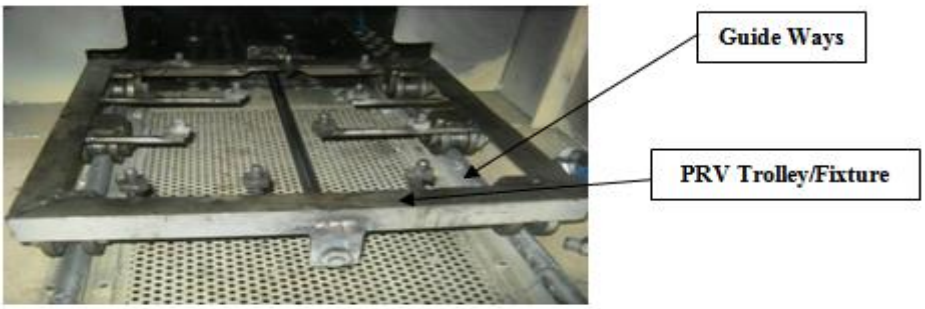

Fig. 1: Distributor Housing (PRV) carrying Trolley

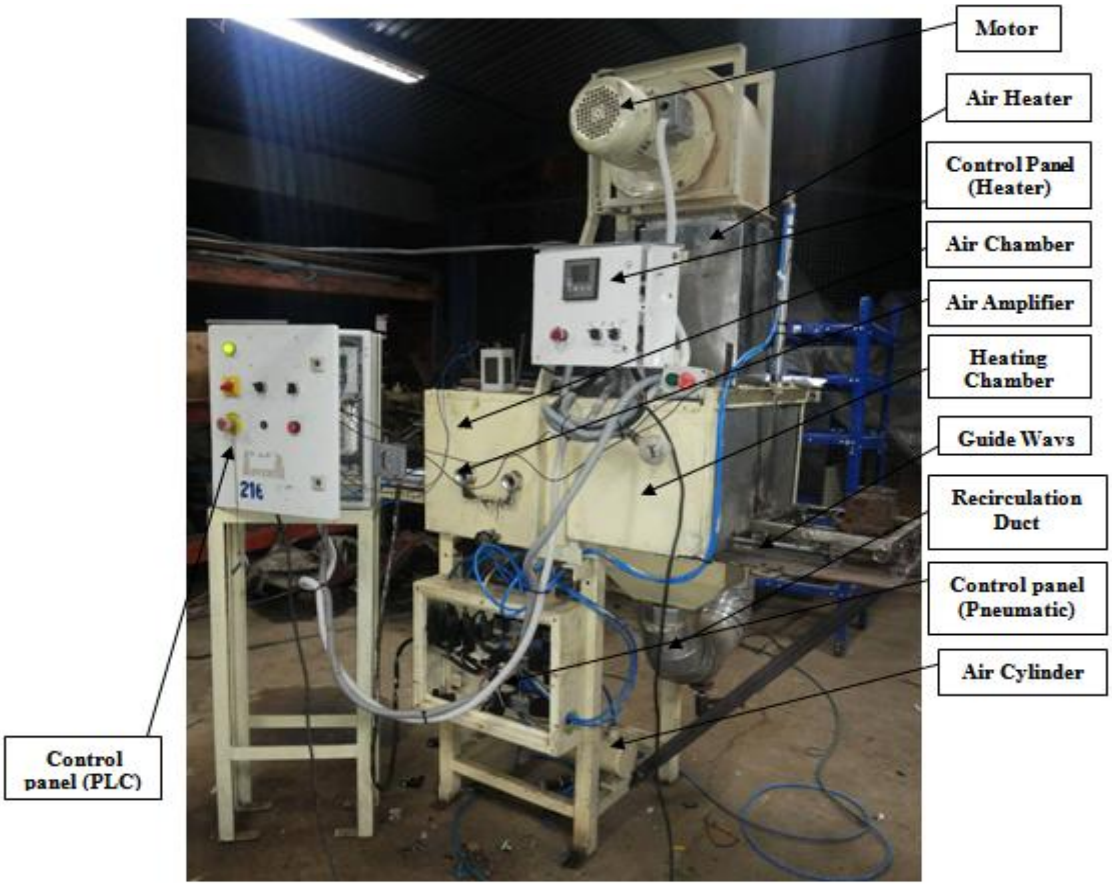

Fig.2: Distributor Housing (PRV) Drying Machine

3) Air Amplifiers, Nozzles, Pneumatic Cylinders & Pneumatic Valves: Description of each component is given as follows one by one.

- Air Amplifier: Air Amplifier as shown in Fig.3 is a device which amplifies the volume of air entering in to chamber with the help of pressurized induced air. Seven set of Amplifiers are used each consisting of two Amplifiers[2].

ADJUSTABLE AIR AMPLIFIER - HOW IT WORKS:

A large volume of surrounding air is induced into the Amplifier at point (A) by the action of a small amount of compressed air which enters the annular chamber at point (B) that is then throttled through a small ring Nozzle at high velocity and into the inside of the Amplifier over a coanda profile. The compressed air stream clings to the coanda profile as it enters the inside walls of the Amplifier and thereby creating a vacuum that induces the outside air converting the pressure into amplified airflow. The amplified airflow leaves at the exit at point (C). Airflow is further amplified downstream at point (D) by entraining additional air from the surroundings at the exit.

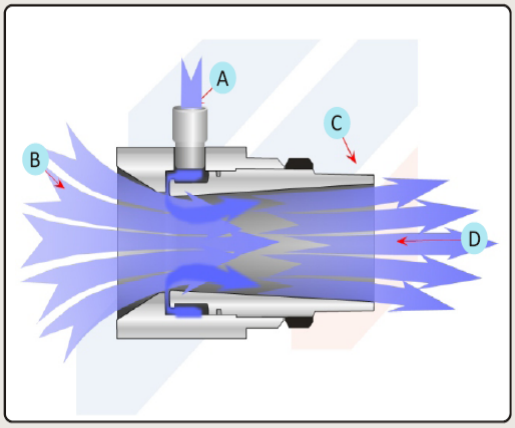

Fig.3: Air Amplifiers

- Nozzles: Four set of nozzles (each consisting of three nozzles) as shown in Fig.4 are used one set for each distributor housing for blind holes taps (M4) 5mm above the surface of component.

Fig.4: Nozzles

- Pneumatic cylinders: Pneumatic cylinders as shown in Fig.5 are also used for controlling motion of Trolley & Air Chamber door [3].

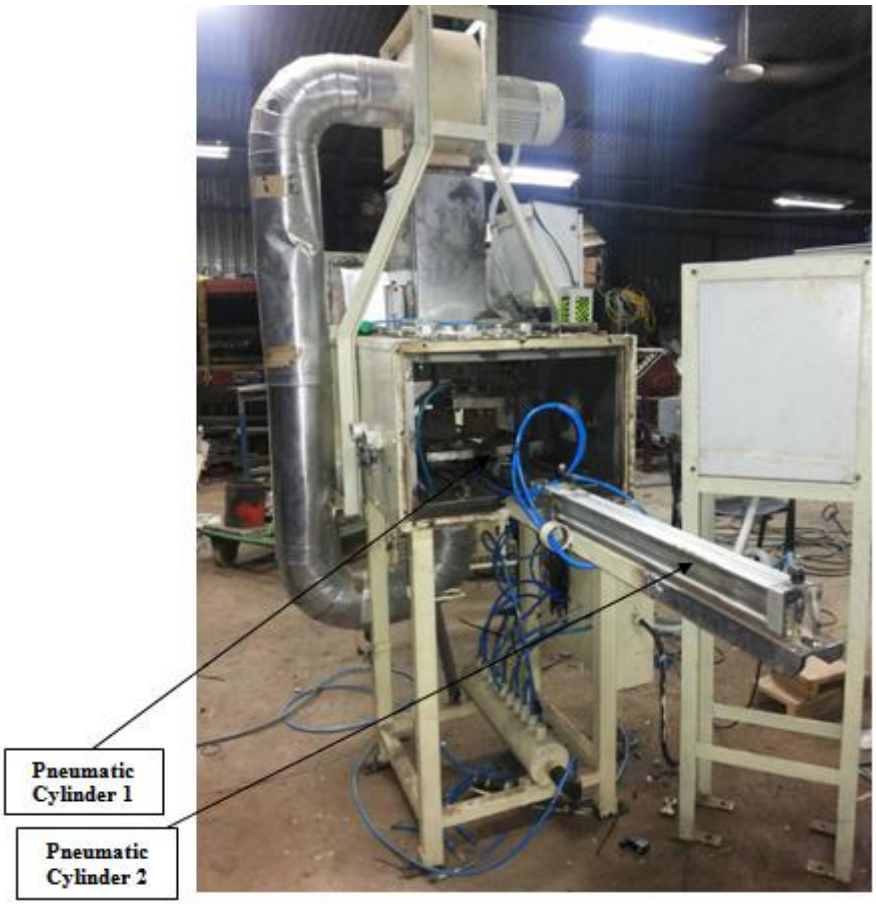

Fig.5: Pneumatic Cylinders

- Pneumatic valves: Pneumatic valves are used for regulating the supply of air in Air Chamber and motion of Trolley and door of Air Chamber.

4) Control Panel: Control Panel of drying Machine consists of connector, contactor, PLC & Relay Board for controlling the automatic functions of drying machine. Cycle Start & Emergency push button are also provided on cover of control panel. There are basically 3 types of control panel:

- PLC
- Pneumatic
- Heater

5) Trolley/Fixture: Trolley/Fixture as shown in Fig.6 is used for inside and outside movement of Distributor Housing in Air Chamber placed on Trolley at a time. Trolley is moved inside and outside of by Air cylinder piston connected to it.

Fig 6: Trolley/Fixture

6) Recirculation Duct: Duct as shown in Fig.7 is used to carry the hot air which is being heated by the heaters with the help of blower which is being recirculated back to the blower. This makes efficient temperature to be built up in the chamber by reducing the consumption of electricity used by the heater as it makes it off till the desired temperature is maintained.

Fig.7: Recirculation Duct

IV. WORKING

Process Flow Diagram for Drying machine as shown in Table 1:

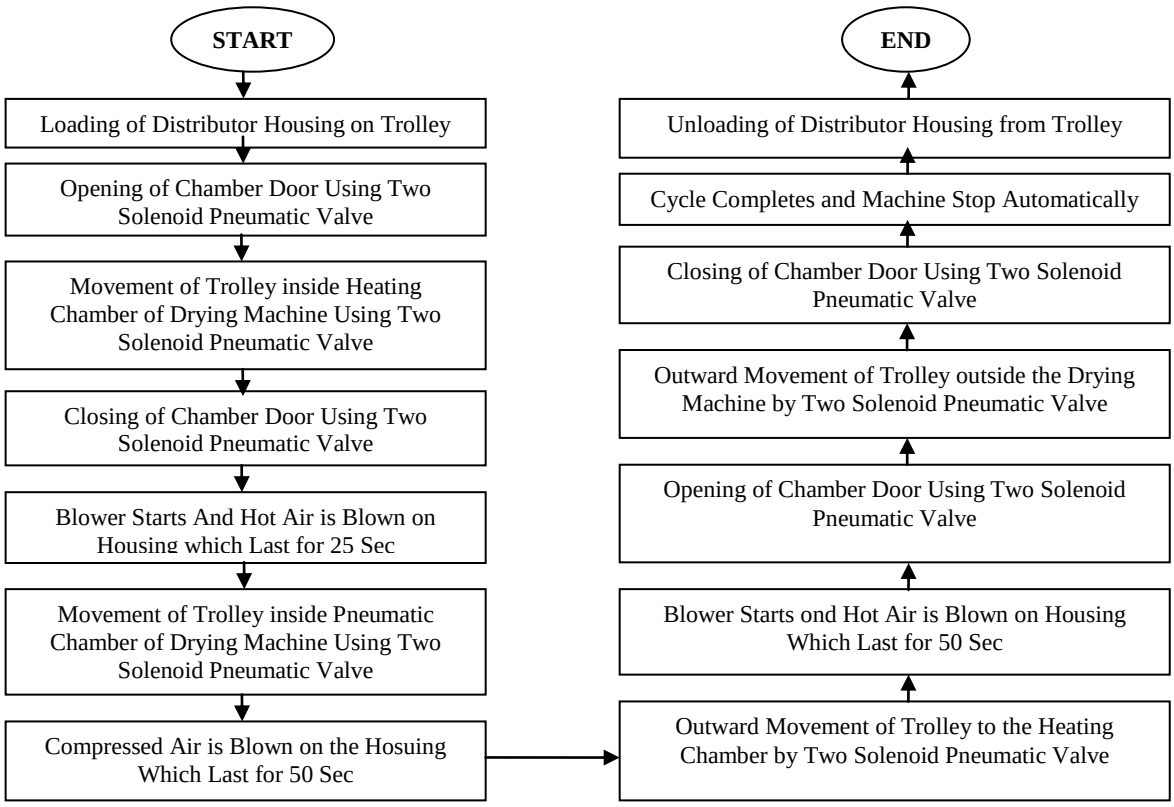

Table.1: Experimental Procedural flow Digram for the Working of PRV Drying Machine

V. CONCLUSIONS

Consumption of pneumatic air before the breakdown maintenance of the drying machine was around 142.51 liters which was consecutively reduced to about 73.87 % after performing breakdown maintenance and modification of design for the drying machine. This lead to the increment of the reliability of the machine. The major achievement of the research work was to illustrate the breakdown maintenance of the specified machine-PRV drying machine. Higher safety on shop floor is achieved as all the safety parameters considered during the design of the machine. Time consumption for drying PRV is reduced and increased no. of cycles for drying more PRV on the daily basis. Indirectly provided a good profitability about 87.6 % to the Industry.

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