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Deterrence of transaxle gearbox damage during transmission using lifting plate

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ABSTRACT:

This paper elaborates about solving the issue of the transaxle gear box damage during transmission. When transaxle gear box is placed directly on the conveyor palette for the transmission, it will get damaged due to the vibration occurs in conveyor. Due to the above mentioned problem, dimension of transaxle gear box get changes and shaft in the gear box will damage. In this paper we have suggested to implement lifting plate between palette and conveyor to avoid the above mentioned problems. Lifting plate is used to lift the palette from the conveyor during the transaxle gear box seating in the conveyor palette by gantry robotic system. Gantry robotic system is used to pick the transaxle gear box from assembly line and place it on the test line. Lifting plate is operated using pneumatic system, pneumatic cylinder is used to control the up and down movement of the lifting plate. Proximity sensor is used to sense the presence of palette on the lifting plate, when the palette presence is found on the lifting plate, then the lifting plate starts to lift the palette. After the seating of transaxle gear box in the palette, lifting plate starts to pull down the palette and place it conveyor. The conveyor starts to transmit the transaxle gear box through palette to next stage for further processing.

Keywords- Lifting Plate; Pneumatic Cylinder; Pneumatic Valve; Photo Sensor; PLC;HMI ; SCADA; RIO; Proactive Queue Management (PQM); MLM; queuing delay; Packet Delivery Ratio (PDR).

I. INTRODUCTION

Now a day's Automation is most important process in every industry. In this project we convert the manual operation into automated. The project elaborates about solving the issue of the conveyor which lifts and drags the spare parts of the gear box. So, while the conveyor is moving it experiences vibration and this issue brings damage like position change to the product during transmission. In our project we are avoiding this damage by using gantry robot with lifting plate which lifts the product. The pneumatic cylinder is used to control the up and down movement of the lifting plate. Here we are using proximity principle to sense the palette presence. After this process proximity gives input signal to the PLC. Based on required program the lifting plate gets lifted by applying air pressure. This process is controlled by After this process photo sensor gives input to PLC.

Based on the required program of PLC the lifting plate gets down position. This process will continuous as per the count of production of transaxle. They are some software involved with this process and they are Siemens PLC, PLC HMI. This is how we avoid the damage of the product and it prevents the position change and avoids noise problem. During the production of gears for different applications, Transaxle Gear boxes are manufactured into parts and assembled by separate station. There are three important lines available in the production. Each line consists of different machines. They are handled by the workers. In assembly line the spare parts of gear parts are assembled by the workers. This process is semi-automated. At the end of the assembly line the final product of gear box is given to the test line. The gear box is transferred from assembly line to the test line manually. This creates a problem like position change and damages in gear box due to vibration. Due to this manual transmission the product gets damage. We are bringing solution to this vibration issue through our project.

A. Block diagram

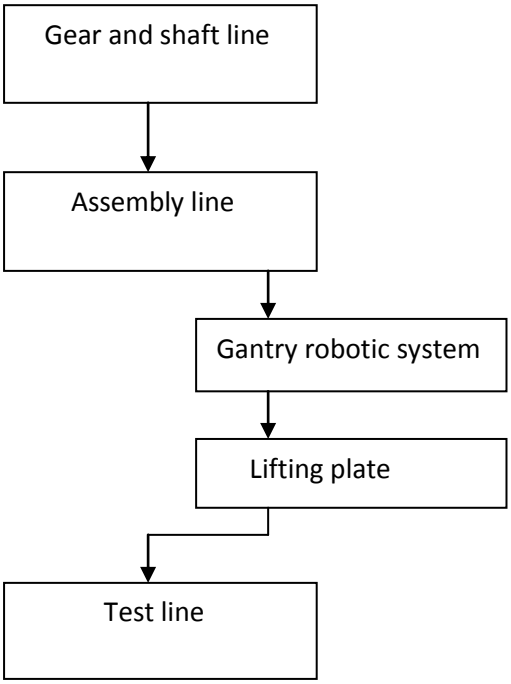


Fig 1: Block diagram for overall process

Gear boxes are assembled at assembly line then they are transferred to the test line. The process is semi automated where the gear box are transferred by a worker. This process needs a worker and takes much time. The process causes damages to the gear box. Where, there are several processes takes place by manual. There are three lines are available. They are relatively gear and shaft line, assembly line, test line. Spare parts are washed in gear and shaft line. In assembly line the input and output shafts are assembled. The spare parts are tightening by machines using defined torque and pressure. This process needs worker. Each line contains twenty workers. The workers are doing several works. They are doing assembling and tightening the spare parts by required machines. This process is semi automated. After completion of assembly line the worker have to carry the gear box from one conveyor to another. This is process causes damages to the gear box. It effects reproduction.

B. Transaxle

Transaxle is one of the gear boxes. Transaxle gear box is used for motor vehicles.

Picture courtesy: AVTEC LIMITED, Hosur

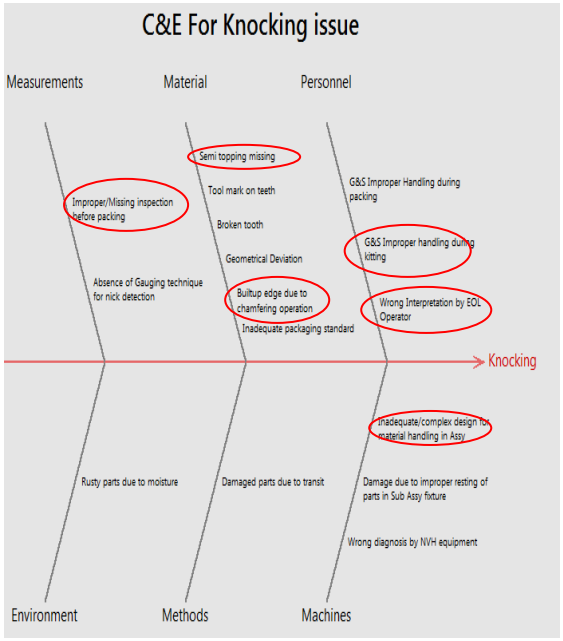
The above image is transaxle gear box. The transaxle is mainly used for mechanical applications. For example, used in motor vehicles. We are fixing the problems occurs during transmission of these gear box from assembly line to test line.

II. PROBLEMS OCCUR DURING TRANSMISSION

When transaxle gear box is placed directly on the conveyor palette for the transmission, it will get damaged due to the vibration occurs in transmission and due to the vibration in conveyor. The damages causes rework of transaxle gear box. It effect high lose to the company. The damages and noise in transaxle gear box can affect the order. The damages mainly take place during the transmission of transaxle gear box from assembly to test line. While carrying the gear box manually, it is gets damaged. This damage causes noise problem to the gear box. The main problem in gear box is noise problem and the spare parts damages. A single damage can cause rework or rejection of product. This problem creates a high lose for the company. During transmission these problems occur. It is main reason for the rework and rejection of the product. The damage can be takes place of the transaxle is,

Picture courtesy: AVTEC LIMITED, Hosur

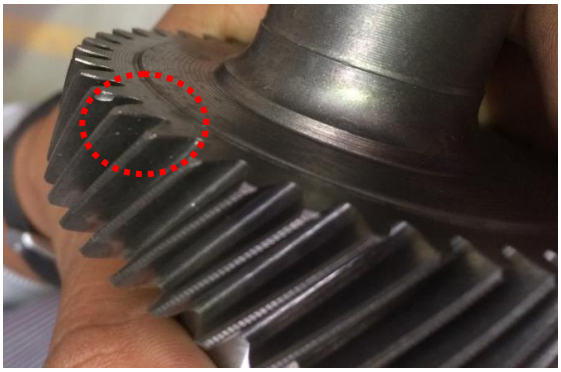
A. Problems found by us



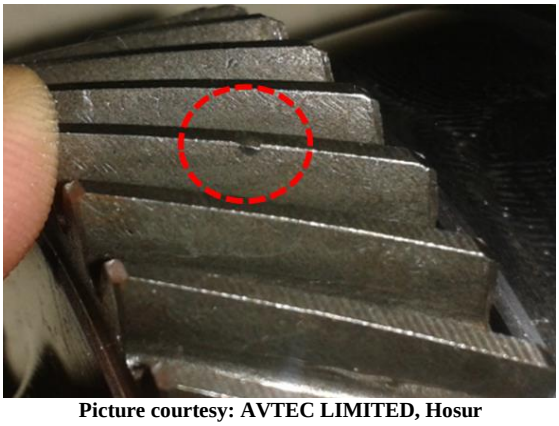
Fish diagram for problem analysis

We did an analysis of problems in the company. We have found that most of the product damages were takes place during the transmission of transaxle gear box from assembly to test line. By the above information most of the damage occurs during transmission of gear box from assembly line to test line. This effect causes noise in transaxle. These leads rework and rejection of orders. Due this problems company gets high lose in product production.

B. Spare parts damage



Picture courtesy: AVTEC LIMITED, Hosur



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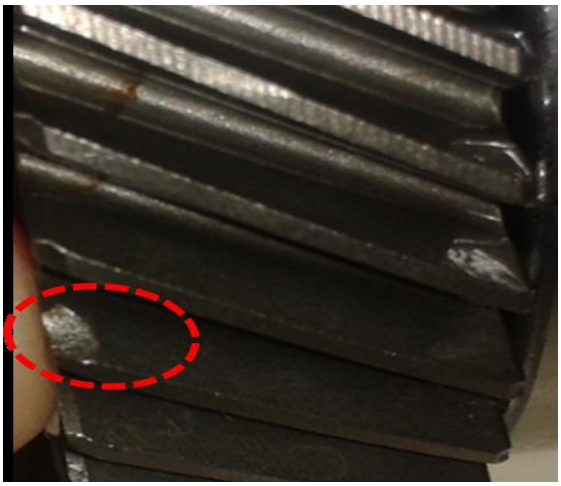


Picture courtesy: AVTEC LIMITED, Hosur

These are the damaged parts of transaxle gear box during transmission. This damages causes rework and rejection of orders. This problem can be avoided by using gantry robotic system with lifting plate. When the process is converted into automated the amount of rework and the rejection of product have reduced. It gives more advantages to the company. For that we are go for gantry robotic system with required lifting plate.

III. PROPOSED METHOD

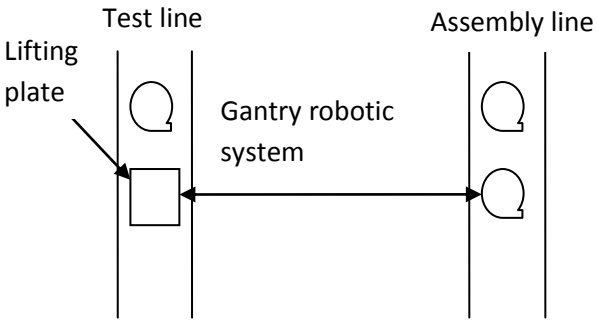
To avoid these problems we changed the process to automate. We implemented PLC program for the gantry robotic system for this process. It is used to transfer the gear box from one conveyor to another.

A. Gantry robot:

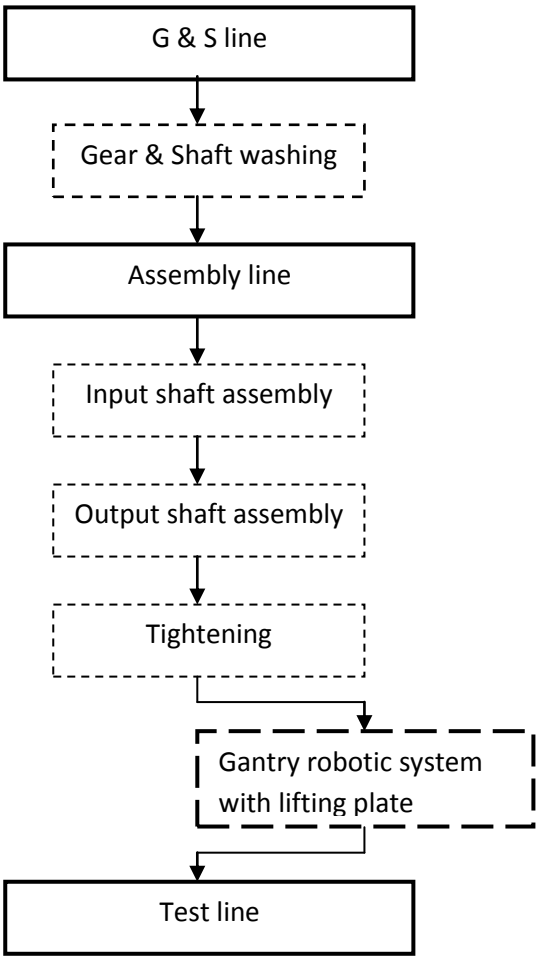
Picture courtesy: AVTEC LIMITED, Hosur

This gantry method controls the vibration. Due to this the damages in gear box is controlled. So we can control the rework of transaxle gear box. During the production of gears for different applications, Transaxle Gear boxes are manufactured into parts and assembled by separate station. At the end of the assembly line the gear boxes has to be transformed from one palette to another manually. This creates a problem like position change and damages in gear box due to vibration.

B. Layout:



We a Conveyor 1 tion to t Conveyor 2 ıe through our project. In our project we are avoiding this damage by using lifting plate which lifts the product. Now the product will be lifted and it will be kept away from vibration. So, that it will not have any damage. The pneumatic cylinder is used to control the up and down movement of the lifting plate. We control this valve by the help of relay. Here we use proximity to sense the product on the lifting plate. We use photo sensor for part identification. They are some software involved with this process and they are Siemens PLC, PLC HMI. This is how we avoid the damage of the product and it prevents the position change of the product. The block diagram for the proposed method is given which consist the block of gantry robotic system. The gantry robotic system is controlled by the PLC.



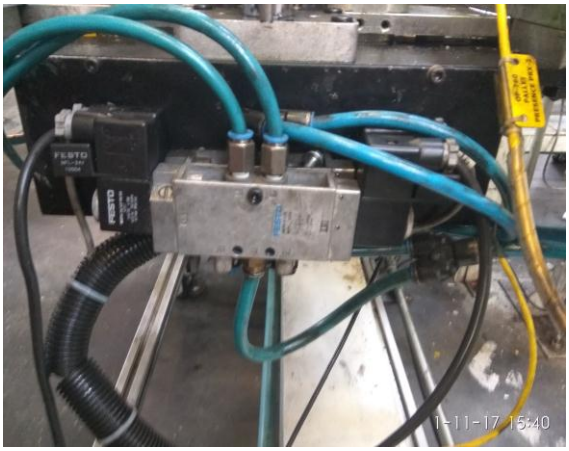
Block diagram for proposed method

This process contains lifting plate. The lifting used to lift the conveyor. Proximity senses and gives input to the PLC when the palette reaches. Pressure is given to the pneumatic cylinder when the proximity gives input. After this process the plate has lifted. The gear box is placing by the gantry robot on the lifted palette. When the gear box is placed on the palette the photo sensor senses and gives input to PLC. Then the lifted palette was gets down. This process will continues repeatedly. The components are Festo related. We designed the lifting plate and the pneumatic cylinders as required. For this process we have designed lifting plate. For both gantry and lifting plate needs designed pneumatic cylinders. The pneumatic

cylinders are controlled by the pneumatic valves. Pneumatic cylinders are designed for the movements of x axis, z axis, b axis, c axis, and y axis. The pneumatic cylinder will move by applying 5bar pressure to the cylinder. The real time pneumatic cylinder is given:

Picture courtesy: AVTEC LIMITED, Hosur

The above pneumatic cylinder is controlled by the pneumatic valve. The pneumatic valve is nothing but solenoid valve. It is Festo type pneumatic cylinder. The real time pneumatic valve can be differentiating by its working principles. Here we are using different pneumatic valves which are 2/3, 3/2, 5/1, 5/2. These pneumatic valves are using for index and de-index. The pneumatic cylinder gets down movement when the condition for pneumatic is index. The pneumatic cylinder is gets lifted when commend is de-index. The pneumatic valves are connected to the relay. Relay connected to fuse. It avoids the problem of relay damage when the process fails. . Now the product will be lifted and it will be kept away from vibration. So, that it will not have any damage. The pneumatic cylinder is used to control the up and down movement of the lifting plate. We control this valve by the help of relay. Here we use proximity to sense the product on the lifting plate. We use photo sensor for part identification. They are some software involved with this process and they are Siemens PLC, PLC HMI. Here we are using pneumatic valve. The pneumatic valve is Festo type pneumatic valves.



Picture courtesy: AVTEC LIMITED, Hosur

C. Lifting plate:

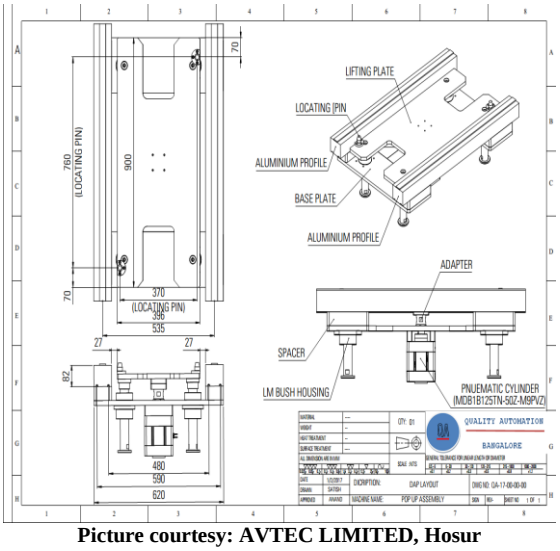
Lifting plate is used to lift and drop the product. It is specially designed for the application. The length of the lifting plate would be 50cm and width of the lifting plate would be 25cm. Conveyor contain proximity sensor for its each station. It helps the palette to stop at each station.

Picture courtesy: AVTEC LIMITED, Hosur

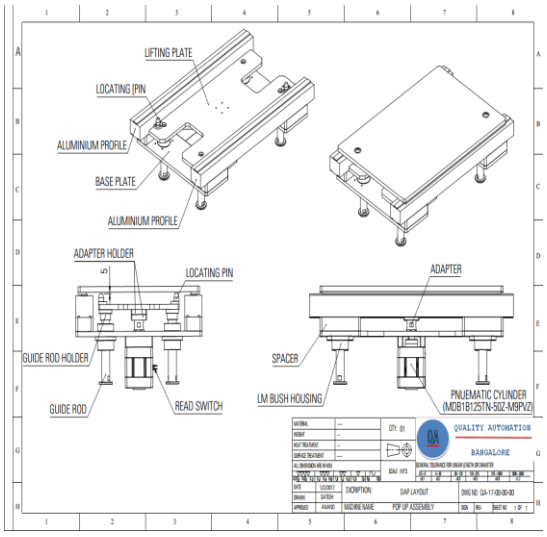
Lifting plate is operated using pneumatic system, pneumatic cylinder is used to control the up and down movement of the lifting plate. Proximity sensor is used to sense the presence of palette on the lifting plate, when the palette presence is found on the lifting plate, then the lifting plate starts to lift the palette. After the seating of transaxle gear box in the palette, lifting plate starts to pull down the palette and place it conveyor. The conveyor starts to transmit the transaxle gear box through palette to next stage for further processing. The lifting plate is connected to pneumatic cylinders mechanically. Whenever the pressure is applied to the pneumatic cylinder, it gets up. Similar process is doing for the

reverse operation. The second design for the lifting plate is given. Which is operated by applying 5 bar pressure by the air compressor. The pneumatic cylinder is used to control the up and down movement of the lifting plate. We control this valve by the help of relay. Here we use proximity to sense the product on the lifting plate. We use photo sensor for part identification. They are some software involved with this process and they are Siemens PLC, PLC HMI. Here we are using pneumatic valve. The pneumatic valve is Festo type pneumatic valves.

D. Layout designs of lifting plate



Picture courtesy: AVTEC LIMITED, Hosur



Picture courtesy: AVTEC LIMITED, Hosur

IV. CONCLUSION:

The paper clearly indicates the performance analysis of the company production problems. It reduces the rework of the product (transaxle gear box). This project elaborated about solving the issue of the conveyor which lifts and drags the spare parts of the gear. So, while the conveyor is moving and manual transmission it experiences vibration and this issue brings damage like position change, noise problem, spare part damage to the product. These problems are avoided by gantry robotic with lifting plate. This method reduces the time consumption. It reduces the manual work and rework of the product.

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