

Study & Analysis of Problems Related to Wheel Cylinder Assembly and its Solution

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Abstract— Analysis of problems means problem rises during the assembly of wheel cylinder. I completed various projects during training of 1 year. Some of the projects are included in this report such as, a) Concept of mechanical bleeder screw poka yoke, b) Time saving fixtures, c) Modification in design of rejection bin etc. In production assembly line, because of wrong bleeder size, many times the expensive tools will be breakdown. Because of this production will be stop for 1 to 2 hours. After the analysis of problem and implementation on line, problem gets solved and we achieved reduction in percentage of tool breakdown. When the model of wheel cylinder assembly is change for assembly process, fixtures of wheel cylinder also changes. For changing this type of fixtures, all nuts and bolts will be open and closed for all 8 stations. In this process the large time will be waste which is nearly equal to 15 to 20 minutes. Therefore we will provide one design of fixture which automatically changes within two to three minutes. Due to this process and design we should save ten to fifteen minutes. We should also change the design of rejection bin. Previously the rejection bin used in industry is rectangular in shape, which contains the rejected wheel cylinder bodies. When the machine put this body in rejection bin, bodies will strike highly to the surface of rejection bin. The reason behind that, there would be fifteen cm distance between the rejection bin and rejection putting machine i.e. Gripper. After striking the job on the rejection bin, it will damage the surface of wheel cylinder. Also because of this sometime blow hole will appear on it. Due to this, the wheel cylinder jobs will repeatedly goes on rejection and it will damage completely. After the analysis of problem and implementation on modification of rejection bin we will definitely reduce the quantity of blow hole wheel cylinder jobs.

Key words: Bleeder Screw, Poka Yoke, Rejection Bin, Time Saving Fixture

I. INTRODUCTION

This project work is done for the kaizen purpose i.e. continuous improvement in industry work. There was lot of things in industry which want improvement in it, to give the errorless and continuous production rate. Therefore I will suggest some improvement to our company CBI by introducing some modification concept.

This includes the absence of mechanical bleeder screw poka yoke. In our industry different models of wheel cylinder containing various sizes of bleeder screw. Because of this, sometimes wrong bleeder attachment to the wheel cylinder is possible. If the wrong bleeder or oversize bleeder is attached to the wheel cylinder body then it will damage the next station, like body leak station because of high force striking. Therefore I am suggesting mechanical bleeder screw pokayoke concept to the industry.

Also in our industry various fixtures will be used for wheel cylinder assembly. As the body size will change,

fixture also changes. There are six to eight fixtures will be used in every station. For changing every fixture we should open all the four nuts and bolts to change one fixture. Similarly the entire eight fixtures we will open and replaced it with other fixtures. It would take minimum ten to fifteen minutes. So to avoid this consumption of time, we should design time saving fixture.

We should use the rejection bin used in industry is rectangular in shape, which contain the rejected wheel cylinder bodies. When the machine put these bodies in rejection bin, bodies will strike highly to the surface of rejection bin. The reason behind that, there would be fifteen cm distance between the rejection been and rejection putting machine.

All of these problems we were solve in this research work. For that purpose we were do lots of modification and reconstruction in previous design. Company will accept all of this design at basic stage. After some official practical's and experiments we should use it in our industry.

A. Mechanical bleeder screw poka yoke

1) Problem Statement

- Different models of wheel cylinder containing various sizes of bleeder screw.
- Because of this, sometimes wrong bleeder attachment to the wheel cylinder is possible.
- If the wrong bleeder or oversize bleeder is attached to the wheel cylinder body then it will damage the next station, like continuity station because of high force striking.

2) Introduction to Bleeder Screw



Fig. 1: Bleeder Screw.

- A bleeder screw is a device used to create a temporary opening in an otherwise closed hydraulic system, which facilitates the removal of air or another substance from the system by way of pressure and density differences.
- On a hydraulic vehicle braking systems, the bleed screws are located at the top of each brake calliper to allow bleeding of the braking system. Whenever service work has been performed on the braking system which might have introduced air into the system (i.e. the hydraulic system has been opened), the air must be bled out.
- This is necessary for correct operation of the system, because air compresses (as opposed to brake fluid which is not compressible). Air in the system reduces the maximum pressure applied to the brake pistons and can lead to loss of braking ability.

3) Positioning of Bleeder Screw in wheel cylinder

- The bleeder screw should be position at the top most part of the wheel cylinder.
- At timing of assembly, bleeder screw should be very loosely fitted i.e., $\frac{1}{4}$ threads will revolve.



Fig. 2: Positioning of Bleeder Screw in Wheel Cylinder.

4) Poka Yoke System

- Poka Yoke is quality management concept developed by Shigeo Shingo of Matsushita Company to prevent the occurrence of human errors in the production line.
- It is one of the many components of Shingoe's Zero Quality Control (ZQC) system which aims at elimination of defective products.
- Poka Yoke comes from two different Japnies words, 'POKA' which means 'inadvertent errors' and 'Yokeru' which means 'to avoid'. Thus Poka Yoke means to avoid inadvertent errors.
- Poka Yoke is not a procedure but a concept that is governed by what people think they can do to prevent the errors in their workplace.
- Poka Yoke is implemented by using simple devices that should prevent people from committing mistakes.
- These devices include objects like jigs, fixtures, warning devices, interlocks etc. that stops the machine and / or alert the operator if something wrong is going to happen.

5) Previous problematic design in Wheel Cylinder Assembly

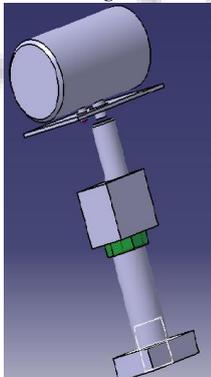


Fig. 3: Previous Problematic Design.

- In this design, if the wrong bleeder will come in contact with the wheel cylinder body then it will damage the next station.
- Because of this production will stop for more time. Also the tool breakdown will possible.

6) Improvement in Previous Design

- Mechanical Poka Yoke means the Poka Yoke which is completely made by mechanical components or not using any type of sensor.
- In the previous design, on the old twin line there was absence of mechanical type of Poka Yoke.
- Therefore in new design, we should change some arrangement, because of that mechanical Poka Yoke system is work.

- In new design, at the top surface we should provide one vertical plate.
- The arrangement of this vertical plate is like that, the top surface of vertical plate is making 'Hut' type shape.
- Because of this, when the wrong bleeder is come in assembly station, it will strikes directly to this 'Hut' type shape vertical plate.
- Due to this the cycle will immediately stop at the mechanical bleeder screw Poka Yoke station.
- Then we should remove the wrong bleeder wheel cylinder job and cycle will start automatically.
- If the job content the correct size bleeder screw, then it will passes over the 'Hut' shape surface of vertical plate without striking it.
- The vertical 'Hut' type plate will be change according to the model of wheel cylinder and size of the bleeder screw.
- The dimensions for the mechanical bleeder screw Poka Yoke will be taken by observation. It is not ideal dimensions, because company will not provide actual dimensions of the proper design

7) Advantages of Mechanical Poka Yoke

- It can detect the wrong bleeder screw, before completing the assembly.
- Because of its detection, the rejection level of bleeder screw is minimizing.
- Because of no use of any sensor, the cost should be reduced.

Accuracy level increases

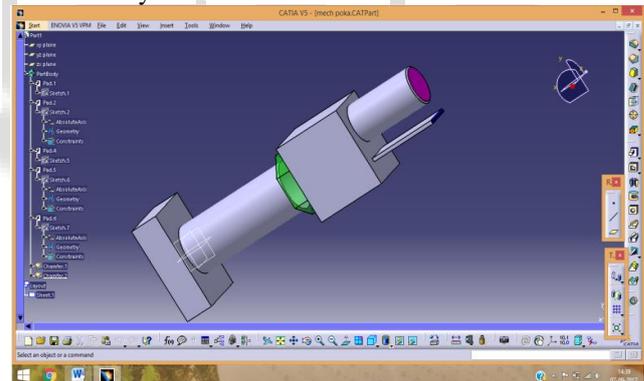


Fig. 4: Improvement in Previous Design. Software Use: - CATIA V5.

B. Time Saving Fixture Design

1) Problem Statement

- Various fixtures will be used for wheel cylinder assembly.
- As the body size will change, fixture also changes.
- There are six to eight fixtures will be used in every station. For changing every fixture we should open all the four nuts and bolts to change one fixture.
- Similarly the entire eight fixtures we will open and replaced it with other fixtures.
- It would take minimum ten to fifteen minutes.
- So to avoid this consumption of time, we should design time saving fixture.

2) Unmodified Design Used in Industry

- As seen in the figure 5, there are many fixtures we will see on the work station.
- But all the fixtures we seen, are in single circular pattern.

- Therefore, when we want to change the assembly model of the wheel cylinder, that time we should remove all the nuts and bolts of all the fixtures.
- Then we should put it in fixture box and required fixture will take from the fixture box.
- Then all the required fixtures will fit on work station by fixing all the nuts and bolts.
- Therefore minimum ten to fifteen minutes we will loss in this process.

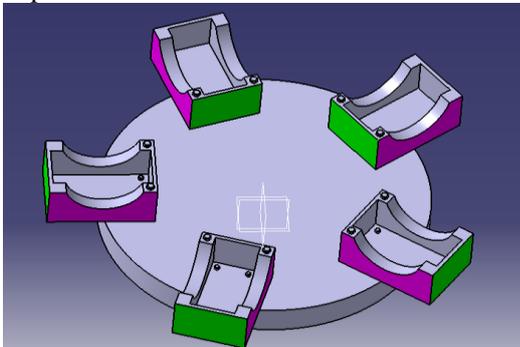


Fig. 5: Unmodified Design in industry.

3) Time Saving Fixture Design Provided By Me

- This is ideal concept which will beneficial in increment of wheel cylinder production.
- As we should see in the figure 5, there is single circular pattern fixture is used.
- But in recent technique or concept we should provide the couple of circular pattern fixture.
- These couple content two different model fixtures.
- The benefit of this concept is we don't remove the entire fixture for changing the model.
- We just revolve the couple to change the model.
- Because of this our ten to fifteen minutes which will loss in previous design to change to change every fixture, which will save.
- The revolution of fixture will set by the programming.
- I will provide the design of two rotating fixture. But we should also increase the quantity of rotating fixture.
- It will depend on the space remains on the station.
- The diagram 6, shows the modified time saving fixture.

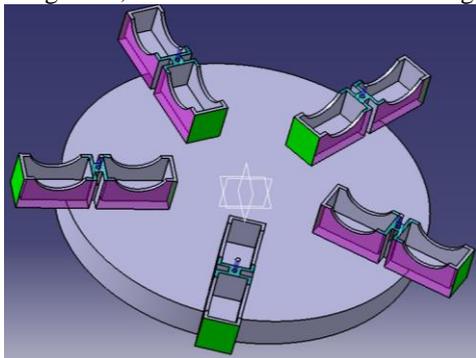


Fig. 6: Time Saving Design Provided by Me.

4) Construction and Working Procedure of Time Saving Fixture

- The couple of rotating fixture will be connecting to the pins, which are shown in figure 6.
- This pins will supported with the base of station.
- The programming for revolving the fixture will generated by programming expert.

- So after setting the programme, the entire fixture will rotate simultaneously.
 - In required fixture, we should do the assembly.
- ### 5) Advantages of Time Saving Fixtures
- There shouldn't be any need of removing the fixture, after changing the model of wheel cylinder.
 - Because of it time for removing the fixture almost save.
 - The production rate will increase.

C. Modification of Rejection Bin.

1) Problem Statement

- The rejection bin used in industry is rectangular in shape, which contain the rejected wheel cylinder bodies.
- When the machine put these bodies in rejection bin, bodies will strike highly to the surface of rejection bin.
- The reason behind that, there would be fifteen cm distance between the rejection been and rejection putting machine.

2) Previous Design Used in Industry

- Wheel cylinder used in drum brake is very sensitive part in the drum brake assembly.
- If the manure quantity of the burr should be go inside it or it can highly strike on any object then it can be damage quickly.
- In the previous design rectangular shape rejection bin will provide on the 8 BSJP station.
- The distance between these rejection been and gripper (rejection putting machine) is nearly about fifteen cm.
- This distance between the both is too high.
- Because of this the job i.e., wheel cylinder will highly strike on the surface of the rejection bin.
- After striking the job on the rejection bin, it will damage the surface of wheel cylinder.
- Also because of this sometimes blow hole will appear on it.
- Due to this, in recycle or rework, wheel cylinder jobs will repeatedly goes on rejection and it will damage completely.
- Due to this the quantity of such a blow whole job is completely damage and company will face the loss problem.
- Also the production time of other bodies will increase and production rate of wheel cylinder assembly will decrease.
- So there would be the need of change in such a type of rejection bin design, which will decrease the striking rate of wheel cylinder to the rejection bin surface.

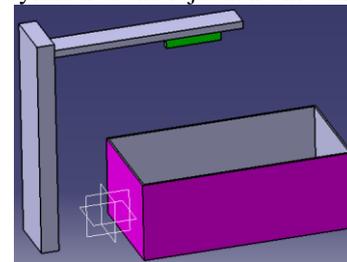


Fig. 7: Unmodified Design in industry.

3) Modified Design of Rejection Bin

- As we seen previously, the striking rate of wheel cylinder is too much high, between the rejection bin surface and gripper.

- So I will focus on reducing this striking rate.
 - In this design we should provide the slope to the rejection bin which will reduce the striking rate of wheel cylinder.
 - When the job arrives at this slope, the striking rate is too low.
 - When it slide over the slope and putt down in rejection bin, the striking become negligible.
 - Hence it is safe design for rejection bin which will safe from damaging the wheel cylinder.
- 4) *Advantages of modified design*
- The striking rate of the wheel cylinder to the surface of the rejection bin will reduce.
 - The damage ratio or blow hole quantity in wheel cylinder will reduces.
 - The rate of production will increase.
 - Quality of jobs increases.

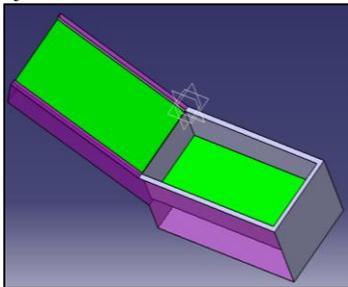


Fig. 8: Modified Design of Rejection Bin.

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