

## DESIGN AND SET UP OF SNAP RING FITTING ASSEMBLY

Khush Singh, Rahul Mathur

### ABSTRACT

This project comprises of Design and Set up of Snap Ring fitting assembly for deep groove ball bearing. The aim of project is to design a set that will automatically fit a Snap Ring onto the bearing and then check whether a given Snap Ring is fitted properly onto the bearing or not. While design the set up the most important point that is considered is to maintain simplicity as well as to reduce the weight of the assembly.

### 1. INTRODUCTION

Snap Ring is a ring of around 2mm thickness which is fitted onto the bearing in the groove provided. The Snap Ring fits perfectly onto the groove but some clearance is provided. Even if there is some clearance the Snap Ring does not become loose or come out. Snap Ring has OD greater than the OD of the bearing but ID is less than the OD of the bearing. Because of this Snap Ring gets properly fitted.



Figure 1: A Snap Ring

### 2. OBJECTIVE

1. Identifying the various causes for bearing misalignment.
2. Designing of Cylinder mounting assembly, Stacker assembly, Fitting Assembly and Checking assembly separately so as to reduce the bulkiness of the entire setup.
3. Preventing the bearing after fitment of Snap Ring from getting damage.

### 3. SOLUTION

After the extensive study we came up with the following observations.

1. Application of Snap Ring and Reasons for misalignment of bearing:-

The bearing needs to be mounted onto the support for particular application. For this it is very important that

bearing should not move from its position. If due to some the bearing moves from its place, major accident might take place and the whole assembly might get fail.

Hence to avoid such accidents the bearing must be fitted with Snap Ring. The Snap Ring helps in holding the bearing at its place.

Causes of misalignment:-

- Excessive force acting on bearing
- High vibration force
- Excessive speed of operation
- Improper fitment of bearing

2. Design of the assembly:-

Entire setup can be split into 4 sub assemblies.

- Cylinder and its mounting Assembly
- Stacker Assembly
- Fitting Assembly
- Checking Assembly

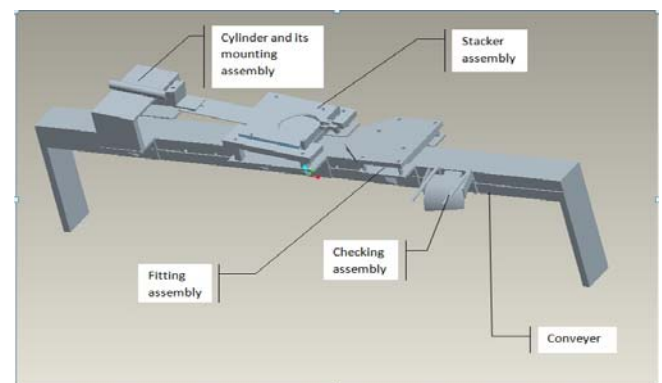


Figure 2: Entire set up of Snap Ring fitting Assembly

- Cylinder and its mounting Assembly:-

For the Snap Ring to get inserted into the bearing it is necessary to pushed Snap Ring at proper Speed in a giver direction. This function is done by cylinder. The double acting cylinder of 160mm stroke and 25mm diameter is used in this case.

The cylinder is rigidly mounted on to the conveyer with the help of L-bracket. These L-brackets are design by keeping in mind the weight reduction factor.



It is the actual assembly where Snap Ring gets pushed from Stacker on the bearing. It basically contain pneumatically operated pusher which glides in the slot provided on the Stacker plate.

The main components of Stacker assembly are,

1. Stacker Plate:-

This plate consists of hole at the center onto which stacker is welded. It contain grove for movement of pusher. Stacker plate varies according to diameter of Snap Ring. However plate gets perfectly fit on the base plate.

2. Stacker:-

It is long hollow cylindrical structure and is used to place Snap Ring in form of heap. It contains small slit which helps in occupying the groove on the Snap Ring.

3. Base Plate:-

It holds all the parts of the assembly. It is provided with a protrusion of 2mm length to rest snap ring under the trap. The base plate is designed in such a way that it will accommodate the Stacker Plate for various diameter snap ring. These plates are rest on inclined bars. An inclination of 7° helps in easy insertion of Snap Ring. As there is a contact between this plate and pusher, this plate is always lubricated.

4. Pusher:-

It is a long plate which pushes Snap ring forward from the protrusion. Pusher is provided with V shape (120°). The Pusher is connected to the cylinder with the use of Adapter. The adapter is designed in such a way that it should take care of angular misalignment of cylinder mounting and base plate.

5. Trap Assembly:-

The snap has to get fit on to the bearing which is moving forward on the conveyer. The motion of bearing is continuous where as Snap ring is pushed at some interval. Both these motion are synced. Trap assembly is used to trap the Snap ring before fitting on the bearing. This assembly is hold on the base plate with the help of bolts.

Fitting assembly is actual assembly where the Snap ring gets fitted onto the bearing. The bearing which moves onto the conveyer passed below this assembly and gets fitted with Snap ring. This assembly consists of slot through which bearing moves. The Slot guides the Snap ring into the groove.

This Assembly has 3 main parts:-

1. Top plate:-

This plate is designed by keeping in mind that it is used to only support fitting plate and does not serve any special purpose. The plate is designed in such a way that it will accommodate all the fitting plate whose dimension changes according to dimension of the bearing. This plate is mounted with the help of special screws.

2. Fitting plate:-

This plate is rectangular in shape with slot at inner side of the plate. The bearing moves inside the slot whereas the Snap ring glides outer side of the slot. This plate varies according to bearing diameter.

3. Special screws:-

The top plate is fitted with the help of Special Screws. These screws adjust the height of component on which they are fitted very conveniently. The special screw adjusts height as per the requirement. As the distance of the slot on bearing is fix for various types of bearing, this Special screws becomes very important part of this fitting assembly.

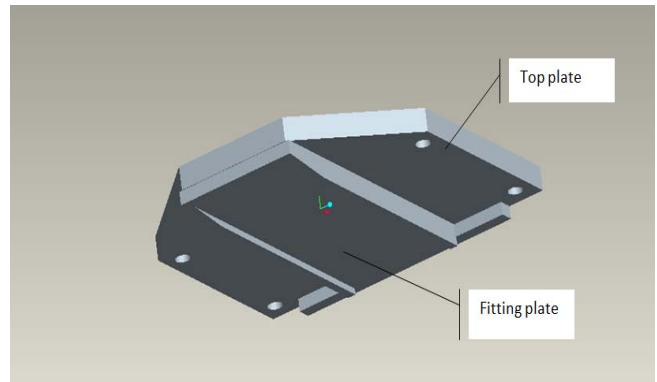


Figure 4: Fitting Assembly

• Checking Assembly:-

After the bearing passed from Fitting Assembly, it is necessary to ensure that Snap Ring is properly fitted or not. As after this stage bearing is directly send to packaging area so there is need of reliable Checking Assembly which will ensure the fitment of the Snap Ring onto the bearing and defective products are taken to separate area. Hence we used simple yet very effective mechanism of bars and chute which can serve the purpose very effectively.

The Checking Assembly consists of following 3 main parts:-

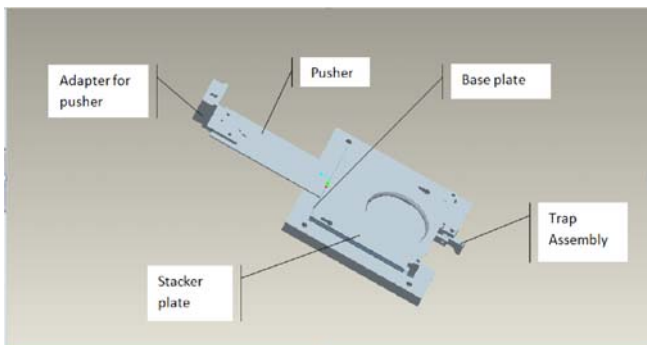


Figure 3: Stacker Assembly



### 1. Checking Bars:-

Checking Bars are simple adjustable bars which are positioned according to diameter of bearing so that it will glide onto the Snap Ring and then passed onto the outlet chute. These bars are mounted on the conveyer with the help of special type of T-bolts.

### 2. Outlet Chute:-

The bearings which are not fitted with the Snap Ring are separated with the help of checking bars. Such bearings are taken to separate area. For this purpose Chute is used. Chute ensures safe falling of the bearing from checking bars without damaging them. The surface of Chute is provided with grooves at regular interval so as to reduce contacting area.

### 3. Front Plate Stopper:-

It is simple plate fitted in front of Chute so that the bearing will not get fall from Chute. It also gives direction for further.

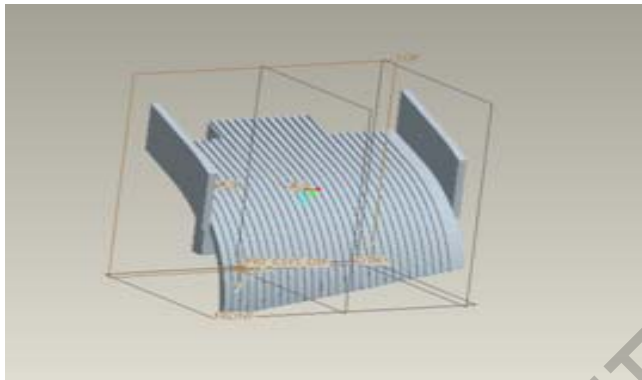


Figure 5: Chute

### 3. Final Assembly and operation:-



Figure 6: Entire Manufactured Assembly

The final Assembly is shown in the above figure. The assemblies from left to right are

- Cylinder and mounting
- Stacker Assembly
- Fitting Assembly

The bearing is fitted with the Snap ring only after final inspection. The bearings which are fitted with snap Ring are the one which directly go to consumer. Hence utmost

care and precaution must be taken to handle the bearings.

The bearing which to be fitted with Snap Ring is moving on the conveyer (termed as inlet conveyer). These are the bearings which are final finished product. The bearing moving on inlet conveyer has to push on assembly conveyer. Hence both the assembly conveyer and inlet conveyer are placed parallel to each other. The bearing is pushed onto the inlet conveyer with the help of double acting Pneumatic cylinder. The inlet conveyer has Stopper which helps in holding the bearing properly. The double acting cylinder then pushes the bearing onto the assembly conveyer. The motion of both conveyers is in the same direction. The bearing is held and driven forward with the help of Clit. The stroke of the cylinder is adjusted such that bearing moves approximately to the center of the clit. The position of bearing is very important in the entire operation. The operation of cylinder is Sensor based. The Sensor which is connected to cylinder detects signal and then operates the cylinder. The Sensor gives signal to cylinder when it detects the bearing which is passed in front of it on the inlet conveyer.

After the bearing pushed onto the assembly conveyer the bearing is carried forward with the help the Clit on the conveyer. The stacker assembly is also controlled with the help of Sensors and Cylinders. On the stacker assembly, it consists a stacker in which the Snap rings are placed in form of heap. The number of Snap ring placed is based on cycle time and its weight. These are in number of hundreds. The bottom Snap ring rests on the base plate. The base plate is the plate which supports the stacker, stacker plate and trap assembly. The base plate itself is supported by the bars which are placed on the L-brackets attached to conveyer. The L-bracket which are mounted on the conveyer have small rib on their back side. The rib gets fitted perfectly in the groove of the conveyer. The L-brackets are mounted on the conveyer with the help of T-Bolts. Because of the T-bolts the L-brackets can be moved for some linear adjustments. The L-bracket need to be strong as they have to take the weight of entire assembly. The whole stacker assembly is supported by the 4 bars. These bars are fitted on the base plate on one end and the conveyer on the other end. 2 bars are long while 2 bars are short. Long bar sit behind where as short bars sits in front. The bars are cut at an angle where the base plate fits. The angle is equal to angle of cylinder mounting. Due to angle provided, the base plate gets required inclination which is very important for easy movement of Snap ring on the assembly. The stacker plate has small slit in which the pusher moves. Pusher is a small thin plate of thickness less than 2mm. the pusher has V-groove at its front. This groove is provided for pushing the Snap ring. The length of the pusher is calculated by considering starting and end position of the pusher. The start position of pusher is just behind that of the snap ring and the end position is outside the Trap assembly. At this position pusher is able to push the Snap ring into the trap. The Pusher is moved with double acting Pneumatic Cylinder. For the Snap ring to get inserted into the bearing it is necessary to push at proper speed in a given direction. This function is done by cylinder. The selected cylinder



should have exact stroke as per requirement so that ring gets fit onto the bearing and not fall ahead or behind it. The cylinder of FESTO Company is used. The cylinder is required to be mounted on rigid support. This support is provided by cylinder mounting assembly which is placed on conveyer with the help of L-brackets. The cylinder mounting assembly as well as L-brackets is designed by keeping in mind the weight constraint. For connecting cylinder and pusher Adapters are used. For cylinder female adapter is used and for pusher male adapter is used. The design of adapter is done by considering the movement of pusher. The cylinder is mounted behind the stacker assembly. This is to kept at an angle. However the cylinder moves linearly, so if motion between cylinder and pusher gets constrained then the assembly will get failed and may damage the components. Hence a slot is provided on it. The female part slides on the male part and thus some minor misalignment problems are taken care of.

After this the bearing moves into the fitting assembly. This is the area where Snap ring gets fitted on the bearing. The bearing which takes the Snap ring with it and moves to the fitting assembly. The assembly consists of a slot through which bearing moves. The width of this slot is equal to diameter of bearing. the slot guides the snap ring into the grooves of the bearing. the top plate is supported on the special screws whereas assembly plate is fitted on the top plate. This makes it easy for adjustments for different bearings. For different bearings the top plate does not change and only fitting plate changes. The fitting plate varies with the Snap ring. Each snap ring will have separate fitting plate. According to bearing type of plate is changed.

After the fitment of Snap ring on bearing, the next step is to check weather Snap ring is properly fitted on the bearing or not. For this purposes a simple mechanism of GO-NO GO gauge is used. This mechanism consists of bars of length just more than the bearing diameter. These bars fitted on assembly conveyer with the help of T- bolts. The distance between these bars is adjusted according to diameter of Snap ring. The distance is maintained such that it just greater than OD of bearing but less than OD of Snap ring. Because of such arrangement the bearing will glide on these bars. At the other end these bars are rested on the conveyer (called as exit conveyer) which takes bearing to the packing section. The bars are given inclined shape so that it helps for gliding the bearing. When bearing does not fitted with Snap ring it will fall in between the bars which are taken away with Chute assembly. Thus this separates the bearing fitted with and without Snap ring and taken to respective sections.

#### **4. ADVANTAGES**

- Operation of system is simple to understand as very basic and simple concepts are used while designing system
- All precautions are taken to reduce the number of components required as well as to reduce weight of the assembly. Hence the assembly is not bulky.
- For to operate different size of bearing only limited number of components are required to change and

no need to change the entire assembly. Hence this saved lot of time as well as costs.

- The concept of checking assembly is very simple which will save a lot of cost of expensive devices like sensors.
- Entire system will get fit into very small space.
- Previously this operation was carried out manually because of this system it helps in automation thus again saves a lot of time.

#### **5. FUTURE SCOPE**

- The Snap ring fitting assembly is totally new concept in India; it has been never used before anywhere in India, so this will set a perfect example for rest of plants in India.
- Concept of Checking Assembly is totally new concept. So this concept will get definitely implemented to other similar processes, which will save tremendous amount of costs as well as make system reliable.