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DEVE Lopment of oil Seal Pressing Arrangement in Front Axle

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ABSTRACT*: Oil seals often called grease, fluid or dirt seals close spaces between stationary and moving components in mechanical equipment, helping prevent lubricant escape. They also stop harmful contaminants from entering machinery, particularly in severe environments. Oil seal pressing instrument used in industries especially Ashok Leyland is insufficient in performing their task. There is a problem of misalignment of the seal during fitment and also breakage of the seal due to extra force acting on it. Also some of the engines produced fail in the leak test and are rejected. They are disassembled and again the seal is pressed manually. This causes loss of time and power. In order to overcome the above problems a new method of oil seal pressing is developed using hydraulic cylinder and a tool of new design also developed. This new arrangement make use of the hydraulic cylinders and seal pressing tool that they help to provide cushioning action to the seal whereby which the seal itself fits into its place accordingly when pressed. During the test the leak of oil is reduced. It also reduces the force that is applied on the seal and prevents breakage Our paper is to use the pascal's law by designing of hydraulic cylinder and implement in the oil seal pressing arrangement in bush pressing machine.Realizing that the engineers are more concerned with the applications than with the theory, we have woven the subject-matter with this practical applications in engineering and achieved the objective.*

I. INTRODUCTION

In this project we have planned to design and modify the oil seal pressing arrangement in axle arm bush by using hydraulic power in the LA10353 axle arm bush pressing machine

1.1 Objective Of The Project

The objective of the project is to modify the oil seal pressing arrangement in axle arm bush to reduce the human effort and to use that manual power for some other application to enhance the productivity and efficiency of the production. Considering this we made detailed analysis and put a great effort to make this project.Many companies interested in projects in india.specialised services include under taling pre-investment, project development, feasibility studies, professional services that are designated to deliver project opportunity from concept to commisioning.

1.2 Front Axle :

An **axle** is a central shaft for a rotating wheel or gear. On wheeled vehicles, the axle may be fixed to the wheels, rotating with them, or fixed to the vehicle, with the wheels rotating around the axel in the former case, bearings or bushings are provided at the mounting points where the axle is supported. In the latter case, a bearing or bushing sits inside a central hole in the wheel to allow the wheel or gear to rotate around the axle. Sometimes, especially on bicycles, the latter type axle is referred to as a spindle. On cars and trucks, several senses of the word "axle" occur in casual usage, referring to the shaft itself, its housing, or simply any transverse pair of wheels. Strictly speaking, a shaft which rotates with the wheel, being either bolted or splined in fixed relation to it,

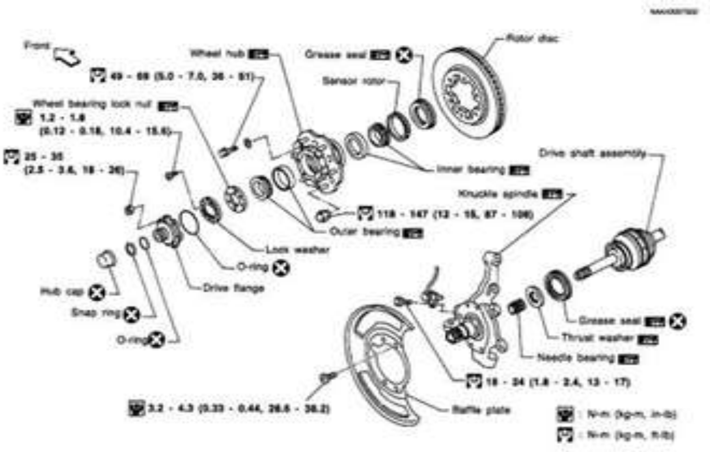


Fig 1. Parts of front axle

Is called an "axle" or "axle shaft". However, in looser usage an entire assembly including the surrounding "axle housing" (typically a casting) is also called an "axle".An even broader (somewhat figurative) sense of the word refers to every pair of parallel wheels on opposite sides of the vehicle, regardless of their mechanical connection to each other and to the vehicle frame or body. Thus, transverse pairs of wheels in an independent suspension may be called "an axle" in some contexts. This very loose definition of "axle" is often used in assessing toll roads or vehicle taxes, and is taken as a rough proxy for the overall weight-bearing capacity of a vehicle, and its potential for causing wear or damage to roadway surfaces.

Axles are an integral component of most practical wheeled vehicles. In a live-axle suspension system, the axles serve to transmit driving torque to the wheel, as well as to maintain the position of the wheels relative to each other and to the vehicle body. The axles in this system must also bear the weight of the vehicle plus any cargo. A non-driving axle, such as the front beam axle in heavy duty trucks and some 2-wheel drive light trucks and vans, will have no shaft, and serves only as a suspension and steering component. Conversely, many front wheel drive cars have a solid rear beam axle.

In other types of suspension systems, the axles serve only to transmit driving torque to the wheels; the position and angle of the wheel hubs is an independent function of the suspension system. This is typical of the independent suspension found on most newer cars and SUV's, and on the front of many light trucks. These systems still have a differential, but it will not have attached axle housing tubes. It may be attached to the vehicle frame or body, or integral in a transaxle. The axle shafts (usually constant velocitytype) then transmit driving torque to the wheels. Like a full floating axle system, the drive shafts in a front wheel drive independent suspension system do not support any vehicle weight.

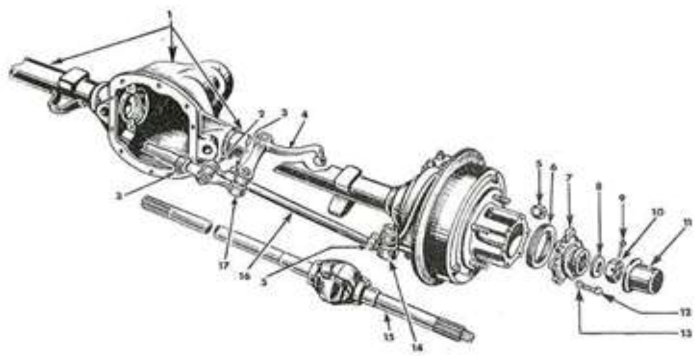


Fig 2. Front axle

1.7 Axle Assembly Shop In The Plant:
Front Axle Assembly:
STAGE 1:
Axle beam is loaded on the conveyer belt.
STAGE 2:
Number is punched on the axle beam.

STAGE 3:
Axle arm is fitted on the beam for steering.
STAGE 4:
Steering rod is fitted. It is right end of the axle according to Indian STDs.
STAGE 5:
Tracking rod is fitted. It is used for alignment of the wheel. It helps the left side of the turn along with the right side wheel.
STAGE 6:
Brake carriers with brake linings are fitted to the FR axle beam and taken to chassis assembled.

Rear Axle Assembly:
STAGE 1:
Banjo casting from outside is unloaded and fixed on the conveyer and axle shaft is removed.
STAGE 2:
Brake lining and 10 bolt and washer are fixed on the brake carrier with spring washer. Dust cover is also fitted.
STAGE 3:
Brake nut and bolt are tighten fitted 75 to 50 torques.
STAGE 4:
Ring for oil seal is fitted on the hub shim is fitted 3-6tau for the clearance flange cover is fitted with 4 bolts.
STAGE 5:
Inner oil seal is fitted on ring for inner oil seal. Inner wheel bearing is fitted.
STAGE 6:
Distance piece is fixed to align the inner and outer wheel bearing in the same axis.
STAGE 7:
Dry set, where the wheel hub is fixed roughly to verify where to increase the shim.
STAGE 8:
Where grease is packed inside the wheel hub.
STAGE 9:
Axle tube nut is fixed with counter pin and bolt, 190 tightness. The give, studs are fixed in the hub to shaft. Grease nipple is fixed on the wheel hub.
STAGE 10:
Drum is fixed 8mm blot is fitted.
STAGE 11:
Axle shaft is fitted using 8 spring washer and nut on the stud.
STAGE 12:
Complete assembly of rear axle is unloaded and taken to chassis assembly.

1.8 Sealing:

The main function of a seal is to prevent the fluid (e.g.lubricant or air) to leak from shaft and housing. It can also prevent dust and mud to contaminate the housing. If dust and mud invade the housing the life of transmission machinery will decrease greatly. The figure below is an illustration of a seal installed in one part of engine.

1.10 Oil Seal Functions:

Depending on the particular application oil seals may be required to seal in lubricant, seal out foreign matter, and seal or separate dissimilar fluids or gases.

a) Precision bearings rely on the oil seal to prevent lubricants formescaping the bearings or a specific area.
b) Components of modern machines rely on the oil seal to prevent abrasives, corrosive moisture, and other harmful foreign matter from entering the mechanics
c) Separation of fluids and gases may completely rely on the seal to prevent

inter mixture of two different mediums such as lubricating oil and water.

FIG 4. Grand Oil Seal

II. LITERATURE SURVEY

Oil seals are commonly employed in many applications which require that a fluid (primarily lubricating oil) be prevented from migrating along a moving shaft. An important part of the development process of a sealing system is the rigorous testing of the new design. Normally comprehensive qualification testing of the sealing systems as well as 100% functional testing of production units prior to delivery is performed. Comprehensive research, analysis and testing of metals, polymers, thermoplastics and composites enables to develop and utilize materials that are best suited for the application. Factors such as strength, hardness, corrosion, temperature, fatigue, wear, friction, lubricity, elongation and extrusion are considered. Mindful of commercial issues, the material evaluation process also takes into consideration issues such as cost, availability and sourcing. Oil leakage is a very serious problem. If oil level decreases it increases friction resistance, and overall efficiency gets reduced. For a manufacturer, leakage testing of oil seal is necessary to evaluate its performance and sustainability in the working conditions specified by the user. Before manufacturing of bulk quantities is commenced, necessary design changes need to be incorporated if the performance is not satisfactory. The main objectives of the oil seal testing machine are to test the performance of oil seals in actual operating conditions by varying the test parameters and to verify if the oil seals can sustain the conditions of the test and last for the required duration without leakage. The machine developed in the project is capable of testing different types of seals with respect to the various parameters such as temperature, viscosity of lubricant and rotational speed.

2.1existing Methods

2.1.1 Method One:

In this arrangement the tapered opening spring return oil seal fitter is placed in the center of the fixture. The oil seal can be fitted on the both the sides of this device. During the operation of the machine a ram which is provided under the fixture is moved up and made contact with the centrally placed oil seal fitter. Due to this contact the force given to this device and which makes the device to get expand and there by pressing the oil seal into the bore of the axle arm.At the same time two hydraulic cylinders provided on the both the left and right of the fixture is actuated to press the bush into the bore.

FIG 5. Oil Filter

2.1.2 Limitations Of The Method

- Due to continuous production the tapered part may get wear.
- Due to the wear the oil seal may not get perfect seating leading to the leakage of oil.
- Loss in production time as well as in production due to the reinserting of oil seal manually.
- Decrease in quality of component (i.e) front axle.

Objective of this paper is to present work on testing of oil seal of automobile, using the set up for dynamic test. This test predicts life of oil seal and analyzes the method of leakage test for oil seal.A rotating shaft is inserted in to chamber of oil, movement of shaft causes oil to rotate with centrifugal force and tries to come out from joints. To stop this leakage, oil seal is used, and here we check the performance of the oil seal a various solution.

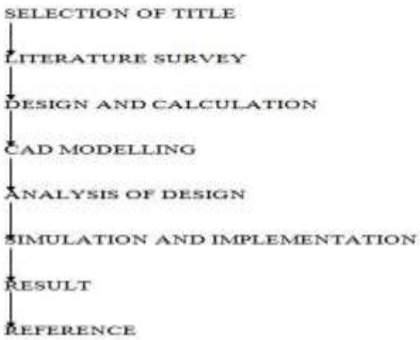
The testing of oil seals was continuously carried out for 24 hrs. After 24 hrs following results were obtained.

a) Leakage increases with increase in speed and smaller diameter of oil seal.
b) No leakage is observed for lower speeds and larger diameters.
c) Thus leakage is proportional to rubbing velocity between the shaft and the seal
d) Higher temperature of oil is observed in case of smaller size of oil seal
e) Viscosity of oil decreases with increase in temperature and so more leakage is likely.
f) No wear of hardened shaft is observed but some wear of nylon bushes is observed. This stresses the need for hardening of the shaft.

The machine developed in the project is capable of testing different types of seals with respect to the various parameters such as temperature, viscosity of lubricant and rotationalspeed. It is capable of performing the leakage performance testin which the machine is run for several hours and the leakageis measured to ascertain that the seal withstands the requiredconditions.This machine can be useful device for oilsealmanufacturingcompanies for evaluating the performance ofthe oil seals and incorporating the necessary design changesbefore mass production is commenced.

CHAPTER 3

III. METHODOLOGY



3.1 Objectives:

- To develop a oil seal pressing arrangement in order to press the oil seal fitter in the bore of the front axle to prevent the oil leakage.To prevent the failure of bore of the front axle.
- To avoid quality defects.

3.2 Components

3.2.1 Hyraulic Cylinder:

Hydraulic cylinders get their power from pressurized hydraulic fluid which is typically oil. The hydraulic cylinder consists of a cylinder barrel in which a piston connected to a rod movesback and forth. The barrel is closed on one end by the cylinder bottom (also called the cap) and the other end by the cylinder head (also called the gland) where the piston rod comes out of the cylinder. The piston has sliding rings and seals. The piston divides the inside of the cylinder into two chambers, the bottom chamber (cap end) and the piston rod side chamber (rod end / head end).

Flanges, trunnion , clevises, Lugs are common cylinder mounting options. The piston rod also has mounting attachments to connect the cylinder to the object or machine component that it is pushing / pulling. A hydraulic cylinder is the actuator or "motor" side of this system. The "generator" side of the hydraulic system is the hydraulic pump which brings in a fixed or regulated flow of oil to the hydraulic cylinder, tomove the piston. The piston pushes the oil in the other chamber back to the reservoir. If we assume that the oil enters from cap end, during extension stroke, and the oil pressure in the rod end / head end is approximately zero, the force F on the piston rod equals the pressure P in the cylinder times the piston area A:

3.2.2oil Seal:

Oil seals - often called grease, fluid or dirt seals - close spaces between stationary and moving components in mechanical equipment, helping prevent lubricant escape. They also stop harmful contaminants from entering machinery, particularly in severe environments. Vital components of practically every type of machine and vehicle in operation, oil seals protect all types of precision-constructed, close-fitting ball, sleeve and roller bearings.

A device for preventing the entry or return of oil from a chamber.A device using oil as the sealing medium to prevent the p assage of fluid from one chamber another.T hey protect all types of bearings and serve three basic functions:

- Retaining lubricants and liquids.
- Excluding contaminants.

Seal or separate dissimilar fluids or gases

Fig 7. Oil Seal Filter

3.2.3 Seal Types:

- Induction sealing or cap sealing
- Adhesive, sealant
- Bodok seal, a specialized gas sealing washer for medical applications
- Bridgman seal, a piston sealing mechanism that creates a high pressure reservoir from a lower pressure source
- Bung
- Compression seal fitting
- Diaphragm seal

- Ferrofluidic seal
- Gasket or Mechanical packing
- O ring
- Glass-to-metal seal
- Glass-ceramic-to-metal seals
- Heat seal
- Hose coupling, various types of hose couplings
- Hermetic seal
- Hydrostatic seal
- Labyrinth seal A seal which creates a tortuous path for the liquid to flow through
- Lid (container)
- Rotating face mechanical seal
- Face seal
- Plug
- Radial shaft seal

3.2.4 O Ring:

An O-ring, also known as a packing, or a toric joint, is a mechanical gasket in the shape of a torus it is a loop of elastomer with a round cross sectiondesigned to be seated in a groove and compressed during assembly between two or more parts, creating aseal at the interface. The O-ring may be used in static applications or in dynamic applications.Dynami examples include rotating pump shafts and hydraulic cylinder pistons. O-rings are one of the most common seals used in machine design because they are inexpensive, easy to make, reliable, and have simple mounting requirements. They can seal tens of megapascals (thousands of psi) of pressure.

Fig 8.O Ring

IV. WORKING PRINCIPLE

4.1axle Arm Bush Pressing Machine:

Axle arm bush pressing machine is a machine which is used to press the bush and oil seal into the bore of the front axle arm. The fitting of oil seal and bush is to avoid the leakage of oil ,leading to avoid the frequent failure due to leakage. The fitting of bush is also used to perfectly fit the king pin between the two jaws of the front axle arm. The machine has a horizontal work table and carries a sliding type conveyor provision to move the component (i.e) axle arm after the completion of fitting the both the bush and the oil seal. The machine has two fixtures. In one fixture an operator can perform the fitting of both the oil seal and bush at a same time. This is done by providing two hydraulic cylinders at the both sides of the fixture and providing the ram which can move up and down at the center of the fixture. At the center of the fixture an arrangement is there to fix the oil seal fitter which is a spring return type. At both the sides of the sides of the oil seal fitter an oil seal can be placed. This device has a tapered opening, when the ram is moved up it will expand the oil seal fitter device there by it will fit the oil seal in the axle arm. At the same time the bush can be inserted into the bore of axle arm by using reciprocating of piston of the hydraulic cylinder. In this method the tapered opening gets wear and the device gets damaged. Due to this the oil seal fitter is not expanding in a equal manner and the oil seal is not seated perfectly. This will lead to the wastage of oil seal and during quality inspection the component may rejected. So the oil seal is has to be fitted again by manually by hammering action.

Fig 9. Axle bush pressing machine

4.2 Operating Controls And Procedures

- Push button - to start the machine
- Push button - for loading the bushes in the bush load box.
- The bush load box should be kept at -5 degree Celsius.
- Push button- for supplying the hydraulic fluid into the cylinder.
- Fix the oil seal in the two sides of the oil seal fitter.
- Push button – to bring the bush to the face of the cylinder piston
- Push button- to press the bush into the bore of the axle arm
- Push button – to bring the ram up and expand the oil seal fitter.
- Push button – to fix the stroke length of the hydraulic cylinder piston
- Push button – for forward stroke
- Push button- for reverse stroke
- Unload the axle arm after fitting of both the oil seal and the bush.
- Emergency stop push button for emergency stop.
- Push button- for turn off the machine.

4.3 Cad Modelling:

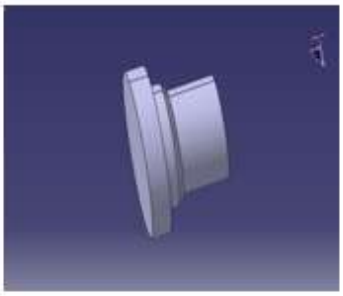


Fig 10.CAD Modeling of oil filter

An **oil seal filter** is a filter designed to remove contaminants from engine oil, transmission oil, lubricating oil, or hydraulic oil. Oil filters are used in many different types of hydraulic machinery. A chief use of the oil filter is in internal-combustion engines in on- and off-road motor vechicles light aircraft and various naval vessels .other vechicle hydraulic system, such as those in automatic transmission and power steering, are often equipped with an oil filter. Gas turbine engines, such as those on jet aircraft, also require the use of oil filters. Aside from these uses, oil production, transport, and recycling facilities also employ filters in the manufacturing process.

Mechanical:

Mechanical designs employ an element made of bulk material (such as cotton waste) or pleated

Filter paper to entrap and sequester suspended contaminants. As material builds up on (or in) the filtration medium,oil flow is Progressively restricted this requires periodic replacement of the filter element (or the entire filter, if the element is not separately replaceable).

4.3.1design Of New Method

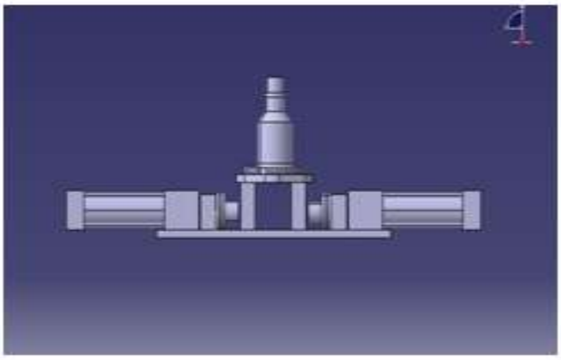


Fig 11.Front view of the model

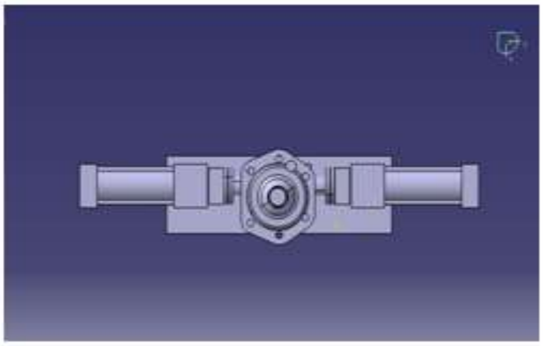


Fig 12.Top view of the model

4.4 Calculations:

4.4.1 Calcultions Of Hydraulic Cylinder

4.4.1.1 Calculation Of Push Force:

Diameter of cylinder piston D= 60mm = 0.06m

Diameter of piston rod d = 40mm = 0.04m

Assume presure acting p

$= 4 \text{ bar} = 4*10^5 \text{ N/m}^2$

Area on which the force acting AP

$= \pi/4*(D^2)$

$= \pi/4*(0.06^2)$

$A_P = 2.827 * 10^{-3} \text{ m}^2$

Force acting $F_P = p * A$

$= 4 * 10^5 * 2.827 * 10^{-3}$

$F_P = 1130.97\text{N}$

4.4.1.2 Calculation Of Pull Force:

Pull force $F_r = \pi/4 * (D^2 - d^2) * p$

Area on which the force

is acting $A_r = \pi/4 * (0.06^2 - 0.04^2)$

$= 1.570 * 10^{-3} \text{ m}^2$

Pressure $p=4*10^5 \text{N/m}^2$

Pull force $F_r = 1.570 * 10^{-3} * 4 * 10^5$

$=628.31 \text{ N}$

4.4.2calculation Of Flow Rate

Speed calculation
Extending speed
$v_{e=}$ 300mm/10s
= $3 * 10^{-3}$ mm/s = 0.03 m/s
Retraction speed
v_a= 200mm/5s
= $4 * 10^{\wedge -3}$ mm/s = 0.04 m/s Flow rate on the piston side $Q_{p=} A_1 * v_e$
= $\pi/4 * (D^2) * 0.03$
= $\pi/4 * (60^2) * 0.03$
= $8.482 * 10^{-5}\ m^3/s$
Flow rate on the rod side $Q_r = A_2 * v_r$
= $\pi/4 * (D^2 – d^2) * 0.04 = 6.283 * 10^{-5}\ m^3/s$.

CHAPTER 5

V. ANALYSIS OF PROBLEM

In the above two cycle of operations, the pressing of oil seal into the axle arm bore to avoid leakage is being a issue in the Ashok Leyland. In the first method wear out of tapered part and in second method the manual hammering of oil seal producing the limitations in every manner. These limitations includes imperfect seating of oil seal, wastage of oil seal, loss of man power, decrease in quality, loss in production time, loss in production, quality defects, etc,.

5.1 Possible Solutions:

The possible solutions to overcome the above problems is to make the process to automatic without the usage of the spring return tapered oil seal fitter and manual hammering. For this various options are analysed and the following three options were short listed.

- Mechanical system
- Hydraulic system
- Pneumatic system

5.2 Mechanical System:

Mechanical actuation is possible using gears, levers, cranks and pulleys which might then increase the cost of automization since mechanical componentsare costlier compared to other devices. Using mechanical actuator would gradually increase the weight which might not be suitable to place on the machine.

5.3 Pneumatic System :

Pneumatic actuators are light in weight and are less expensive compared to hydraulic system. There is no need for separate power pack as like in hydraulic system since it is fully depends on the compressed air.
Though it seems to be advantageous it is not suited for this application. Since air is compressible it can be compressed up to the maximum extent. So the pressure produced by this system will be many times greater than the hydraulic system. Also, slow motion of piston is needed, which is difficult to attain in pneumatic system.

5.4 Hydraulic System:

Though the cost of hydraulic actuators are quite high and need of separate hydraulic power pack it is been considered as a perfect suit for this application. This is why because means we can obtain the slow motion which is exactly needed to press theoil seal into the bore of the axle arm. Also the pressure requirement can be obtainable. The advantage over pneumatic system is hydraulic fluid cannot be compressed so it can be very much used for high load applications. This is cannot be made with the pneumatic system.

5.5 Best Solution:

Though the hydraulic system has a fewer advantages than the pneumatic, it is considered to be the best solution because of the achievement of slow motion needed to press the oil seal and the pressure neededand also the withstand of high load applications.Hence the hydraulic system is considered to be the best solution for this process.

5.5.1hydraulic Cylinder:

A Hydrauliccylinder (also calleda linearhydraulic motor)is mechanical actuator that isusedto give a unidirectional lforce through a unidirectional stroke. It has many applications, notably in constructionequipment (engineering vehicles), manufacturing machinery,and civil engineering.Flanges, trunnions, clevises,Lugsare common cylinder mounting options. The piston rod also has mounting attachments to connect the cylinder to the object or machine component that it is pushing / pulling.A hydraulic cylinder is the actuator or "motor" side of this system. The "generator" side of the hydraulic system is the hydraulic pump which brings in a fixed or regulated flow of oil to the hydraulic cylinder, to move the piston. The piston pushes the oil in the other chamber back to the reservoir. If we assume that the oil enters from cap end, during extension stroke, and the oil pressure in the rod end / head end is approximately zero, the force F on the piston rod equals the pressure P in the cylinder times the piston area A:

$$F = P \cdot A$$

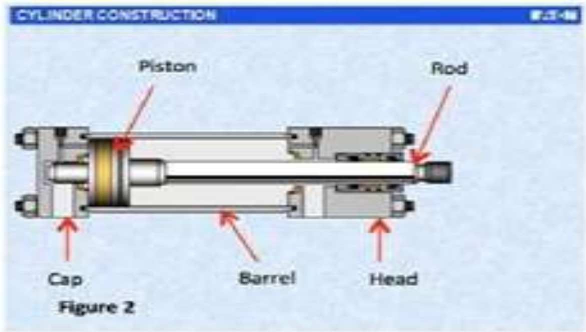


Fig 13. Working of the hydraulic cylinder

5.5.1.1Retraction force difference:

For double-acting single-rod cylinders, when the input and output pressures are reversed, there is a force difference between the two sides of the piston due to one side of the piston being covered by the rod attached to it. The cylinder rod reduces the surface area of the piston and reduces the force that can be applied for the retraction stroke. [2] During the retraction stroke, if oil is pumped into the head (or gland) at the rod end and the oil from the cap end flows back to the reservoir without pressure, the fluid pressure in the rod end is (Pull Force) / (piston area - piston rod area):

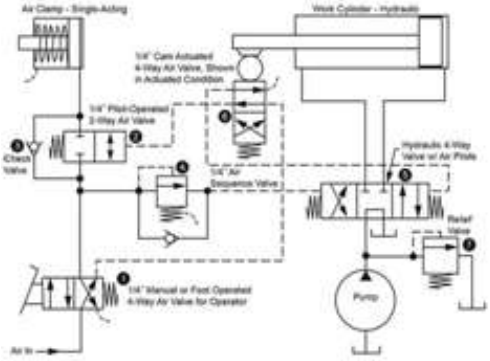
$$P = \frac{F_p}{A_p - A_r}$$

Where P is the fluid pressure, F_p is the pulling force, A_p is the piston face area and A_r is the rod cross-section area. For double-acting, double-rod cylinders, when the piston surface area is equally covered by a rod of equal size on both sides of the head, there is no force difference. Such cylinders typically have their cylinder body affixed to a stationary mount.The forces on the piston face and the Piston Head Retainer vary depending on what Piston Head retention system is used.If a circlip (or any non preloaded system) is used, the force acting to separate the Piston Head and the Cylinder Shaft shoulder is the applied pressure multiplied by the area of the Piston Head. The Piston Head and Shaft shoulder will separate and the load is fully reacted by the Piston Head Retainer.If a preloaded system is used the force between the Cylinder Shaft and Piston Head is initially the Piston Head Retainer preload value. Once pressure is applied this force will reduce. The Piston Head and Cylinder Shaft shoulder will remain in contact unless the applied pressure multiplied by Piston Head area exceeds the preload.

The maximum force the Piston Head Retainer will see is the larger of the preload and the applied pressure multiplied by the full Piston Head area. It is interesting to note that the load on the Piston Head Retainer is greater than the external load, which is due to the reduced shaft size passing through the Piston Head. Increasing this portion of shaft reduces the load on the Retainer

Fig 14. Hydraulic cylinder

5.6 Circuitofhydraulic System:



A hydraulic circuit is a system comprising an interconnected set of discrete components that transport liquid. The purpose of this system may be to control where fluid flows (as in a network of tubes of coolant in a thermodynamic system) or to control fluid pressure (as in hydraulic amplifiers). For example, hydraulic machinery uses hydraulic circuits (in which hydraulic fluid is pushed, under pressure, through hydraulic pumps, pipes, tubes, hoses, hydraulic motors, hydraulic cylinders, and so on) to move heavy loads. The approach of describing a fluid system in terms of discrete components is inspired by the success of electrical circuit theory. Just as electric circuit theory works when elements are discrete and linear, hydraulic circuit theory works best when the elements (passive component such as pipes or transmission lines or active components such as power packs orpumps) are discrete and linear. This usually means that hydraulic circuit analysis works best for long, thin tubes with discrete pumps, as found inchemical process flow systems or microscale devices.

CHAPTER 6

VI. RESULTS AND IMPLEMENTATION

6.1 Implementation Of New Method:

- The hydraulic circuit with the hydraulic cylinder is kept on a both the sides of the fixture.
- To load and unload the front axle arm sliding type conveyor is used with the work table
- The dimensions of hydraulic cylinder are calculated to fit for the application and thus calculated diameter is used in this method.
- The pressure required to press the oil seal to the axle arm bore is calculated and the calculated pressure was set by use of hydraulic power pack and the pressure is supplied by hydraulic fluid stored in the power pack.
- Next a device that is used to fit the oil seal perfectly in the bore of front axle is designed.
- The design of this device is in such a manner that it can perfectly seat the oil seal.
- The stoke of the piston should be set till the combination of piston and oil seal fitter perfectly seat the oil seal.
- Before applied into the usage please ensure that proper cushioning action is occurring.
- In this method pressing of oil seal and pressing of bush is carried out in two separate process.
- First the oil seal is fitted then the axle arm is brought to the next fixture on the same work table.
- Here the bush is pressed by the method that is used earlier.

6.1 Working Of The New Proposed Method:

- First the axle arm is brought to the worktable fixture.
- Then the oil seal is fixed in the oil seal fitter that connected to the piston of the hydraulic cylinder.
- It is done on the both the sides of the fixture because two oil seal is to fitted.
- Then the pressure is supplied to the hydraulic fluid by pressing the push button on the control panel of the machine.
- After the button is pressed, the oil seal fitted to the axle arm bore to avoid oil leakage.
- Next the axle arm is brought to the next fixture on the same work table provided just before to the oil seal arrangement.
- Then by pressing the push button from control panel the already loaded bush is brought up to the work point.
- Then the hydraulic cylinder will perform the action to place or insert the bush into the axle arm bore on the both the upper and lower jaws of axle arm.

- Then the component after completion of inserting both the oil seal and the bush is given to other machine for performing further operations leading to production.

6.3limitations Of Old Methods:
- Wear out of taper part of oil seal fitter leads to imperfection in seating.
- Wastage of oil seal.
- Quality of component is reduced.
- More number of components can be rejected during quality inspection.
- Loss in production time.
- Loss in productivity.
- Due to the losses number of vehicles disposed can be reduced.
- Time consuming process.
- Less efficiency.
- Hammering leads to shock and molecular distruption.

6.4merits Of The New Method:
- Better leak proof quality when the axle arm passes to the quality test
- Proper and perfect alignment of oil seal compared to the earlier methods.
- Cushioning of seal helps it to align itself correctly
- Economical & Time saving.
- Increase in productivity.
- Loss of production time can be reduced
- Less human effort.
- Increase in turn over of the company.
- Due to the viscocity of fluid in hydraulic cylinder slows down the piston movement.
- Process lean time reduces.

CHAPTER 7

VII. CONCLUSION

It is concluded that the projec―Modification of oil seal pressing arrangement in axle arm and seal pressing machine in the axle shop to avoid quality defects‖ has been completed successfully as per our objective oriented in the beginning. Thus by using hydraulic system and a newly designed oil seal fitter device with the axle arm bush pressing machine, the perfection in cushioning and seating of oil seal into the bore of the axle arm is obtained. There by we achieved the no leakage as well as the increased quality in the component Hence due to this new arrangement on LA10353 Axle arm bush pressing machine, quality defects is reduced and productivity is increased.

Future Scope:
- Testing of different material for oil seals.
- Testing of oil seals using different types of oils.
- Testing of oil seals at different temperatures.
- Testing of oil seals at different humidity.
- Testing of leakage of oil seals at perfect fixture.
- Testing of leakage of oil seal at pressure

CHAPTER 8

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