

Response Valve Housing and Control Valve of Sonalika Tractor: A Case Study

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Abstract

In the era of new revolution in agriculture sector, farm machinery plays a vital role specially the tractor machinery. A present case study is regarding the working of response value housing and control value which is assemble in the rear cover assembly. The main function of the rear cover is to raise or lower the lift when required in the fields. To ensure the lift in the raising position, control and response valve plays an essential role. When the engine of tractor is started, oil is sucked by pump from the oil reservoir & is discharged through delivery pipe into inlet of Response Valve housing. Here it has two passages, one going towards backpressure valve & second going towards the check valve. Initially both the valves are closed. Thus pressure starts developing inside the system, as it crosses the limit of 3-6 kg/cm² back pressure valve opens & oil starts flowing to the reservoir through backpressure valve & unloading valve.

1. INTRODUCTION

Tractor assembly shop is main shop of International Tractors Ltd., Hoshiarpur. In this shop, different tractor parts like differential, trumpet, gear box, rear cover, engine, front axle and many more accessories are joined together to make a chassis. The castings of these main components are bought from D.C.M., Ropar and Kirloskar Castings. The castings are then inspected in Quality control shop and then send to H.M.S. (Heavy Machine Shop) where these components are machined and finished and are made of appropriate size. Then, these are sent to assembly shop. After the whole chassis is made it is send to paint shop via an endless conveyer. Then, after paint the whole chassis is allowed to go through an Owen where it gets heat up so the paint gets adhered on the chassis. After that, the chassis enter the main assembly loop. Here all the accessories like Radiator, Fuel Tank, Battery, Fender, Wiring, Wheels (front & rear), Air Cleaner, Pre-Cleaner, Bonnet are made to mount on the chassis to make a complete tractor. Following are main phase of assembly

a) Differential Housing Assembly

- b) Gear Box Assembly
- c) Rear Cover Assembly
- d) Line Assembly

1.1 Rear Cover Assembly

Rear cover assembly is used to cover the differential housing. It contains lift control system, which is hydraulically operated. Driver seat is fitted on the upper side of rear cover. The response valve housing (R.V.) control valve, cylinder and other components assembly fitted inner and outer side of rear cover assembly. The main components are fitted in rear cover assembly.

- (a) Control valve assembly.
- (b) R.V. housing assembly.
- (c) Ram cylinder and piston assembly with ram arm.
- (d) Control sector assembly.
- (e) Sensor tube assembly.

1.1.1 Ram Cylinder Assembly

It contains piston inserted inside the cylinder. The relief valve assembly is mounted at top front of cylinder. The connecting rod is placed in piston rear side and one side is locked with ram arm assembly. Then rock arm, spacer and seals are placed. At the end of rock arm assembly lift arms are placed and then locked with bolts on both side. The operating pressure for relief valve is 205-210 kg/cm sq.

1.1.2 R.V. Housing Assembly

It contains response valve and release valve. Two plugs are placed at their respective place. It is also connected with control valve through delivery pipes. The knob is placed at top of response valve to close or open the response valve as per requirements. The operating pressure for release valve is 175-180 kg/cm sq.

1.1.3 Control Sector Assembly

It contains the draft crank assembly, which is placed through the hollow position crank assembly. Both these assembly are connected to their lever. The position crank assembly is connected to black mark lever and draft crank assembly is connected to red mark lever. All assembly is fastened with bolts, nuts, washer and locknuts.

1.1.4 Coupler Assembly

In coupler assembly a draft rod having a coupler for sensing action and spring. Position rod contains spring on it. Draft rod assembly is connected to the draft lever and position rod to position lever through the spool valve. Whole assembly is fitted inside rear cover.

2.1 Assembly Procedure for Rear Cover

First of all clean the casting and load it on the working trolley. Fit the sensor bush to the sensor hole. Fit the stud on the rear end. Fix the breather bolt & cap it with breather cap. Turn the rear cover down to 180 degree. Place the gasket on the position draft section on assembly section. Bolt the coupler connection bush with the rear cover. Place the ram arm on rear cover housing. Place the rock shaft in the ram arm assembly by light hammering. Place the spacers one by one with mandrel. Fit the lift arm to the rock shaft and bolt it with a retainer plate. Place the connecting shaft, ram arm inside the ram cylinder assembly. Bolt the ram cylinder assembly with the rear cover. Couple the fork on the coupler assy. to control valve and bolt the R.V housing. Gauge the position off draft assy. with gauge of 53.5 mm. lock the coupler with lock nut. Turn the rear cover upward and attach the R.V housing. Fix the sensor tube on the stud and bolt it. Lift the rear cover and place on the testing bench via E.O.T crane. Check for proper working & maximum lift capacity of the lift. Then unloading the rear cover from the testing bench is with the help of crane.

3.1 Working of Response Value

It consists of three different position of rear cover as mentioned below.

a) Working in neutral position

When the engine of tractor is started, oil is sucked by pump from the oil reservoir & is discharged through delivery pipe into inlet of RV housing. Here it has two passages, one going towards backpressure valve & second going towards the check valve. Initially both the valves are closed. Thus pressure starts developing inside the system, as it crosses the limit of 3-6 kg/cm² back pressure valve opens & oil starts flowing to the reservoir through backpressure valve & unloading valve.

b) Working in raising position

As we move position lever towards raising position, the spool valve is pushed inward thus another gallery gets opened up & the oil via this gallery rushes at the back side of unloading valve & exerts pressure against the spring tension. As a result, unloading valve moves forward thus closing the gallery of back pressure valve. Now, oil rushes toward the check valve & opens it at a pressure of 9-12 kg/cm². Then after opening of check valve oil rushes into the ram cylinder. Thus oil being incompressible pushes the piston outward & thus three point linkage moves up.

c) Working in lowering position

As we move the position lever towards lowering position spool valve moves outward & hence the gallery opened in the above case get closed. So there is no pressure behind the unloading valve. Thus by spring tension it gets its position which was in the case of neutral position. Thus back pressure gallery gets opened & the oil starts flowing in to the reservoir. Figure 1.1 shows the Rear cover assembly.

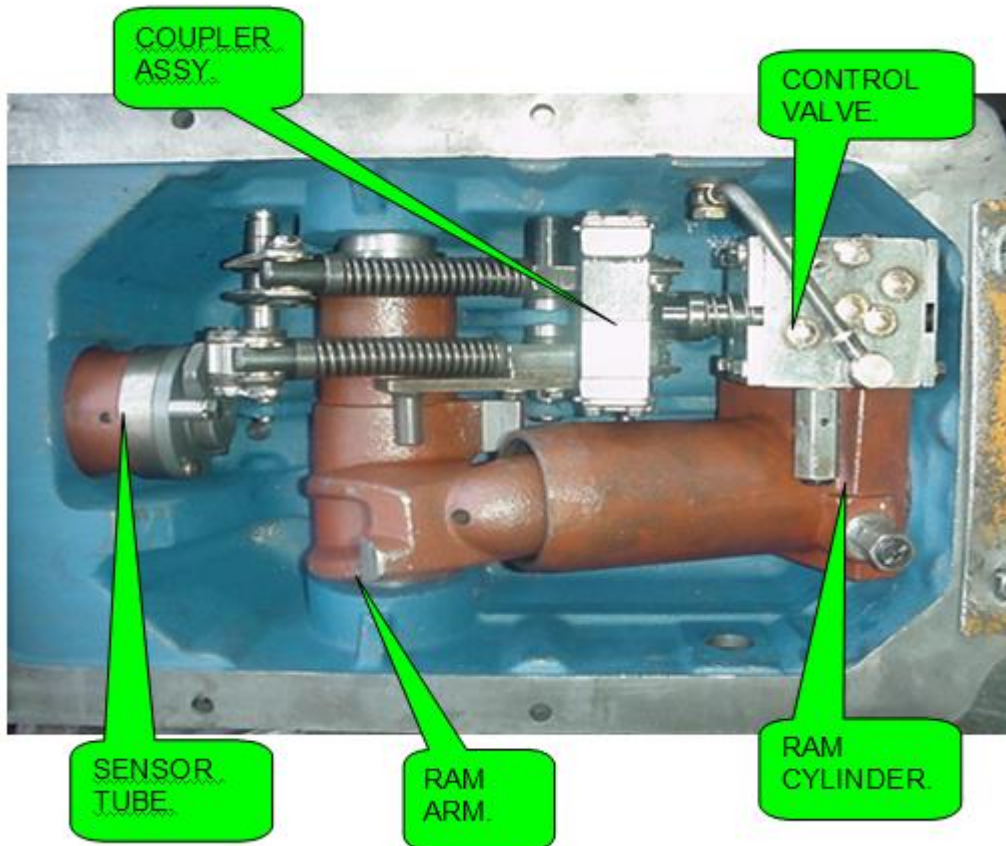


Figure 1.1 Rear cover assembly of Sonalika Tractor

4.1 Conclusion

This case study of response value housing and control value of the sonalika tractor gives the detail description about the components used in the rear cover assembly. It also provides the knowledge of working of response value in three different positions.