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Identifying the alignment of the Piston Ring in Turbocharger Assembly Line Process

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ABSTRACT

The Core assemblies of Turbo charger units are assembled by major parts and child parts, all the parts are assembled manually by 30% and semi automatically by70%, still there is no fully automatic assembly in the industries. In the core assembly process Poke-yoke provided for checking the presence of major child parts except piston ring. Since the piston ring is a smaller component and seated in the groove of turbine wheel which makes a vital role in the core assembly. At present scenario there is no proper detecting mechanism is available to detect or misalignment of piston ring. The Misalignment or missing ring by human error, the turbocharger has a Heavy leakage of oil and smoke, these results causes into the high risk priority number 168, Severity seven, occurrence three and the detection eight. The RPN is very high and its needs to be reduced by taking suitable actions. The aim of this paper to implements the error proofing system into the turbo charger assembly line process.

Key words - Turbocharger piston ring – Alignment Testing and Error Proofing

I. Introduction

Presently there are 12 processes in this product line assembly [7]. The Line is operated by operators at stations performing single operation. The fixtures are mounted in the assembly stations and the corresponding tools and the turbo charger are loaded in the flow test rig. The step by step assembly process are Housing Sub Assembly, Alpha Setting, Greasing Operation, Actuator Assembly, Turbine Housing Beta Assembly[1], Turbine Housing Beta Tightening, Actuator Setting flow test testing, Tube Clamp Crimping, Final Inspection[10], Protective Plugs Assembly Operation and Packing Operation, the assembly process as shown in Fig.1

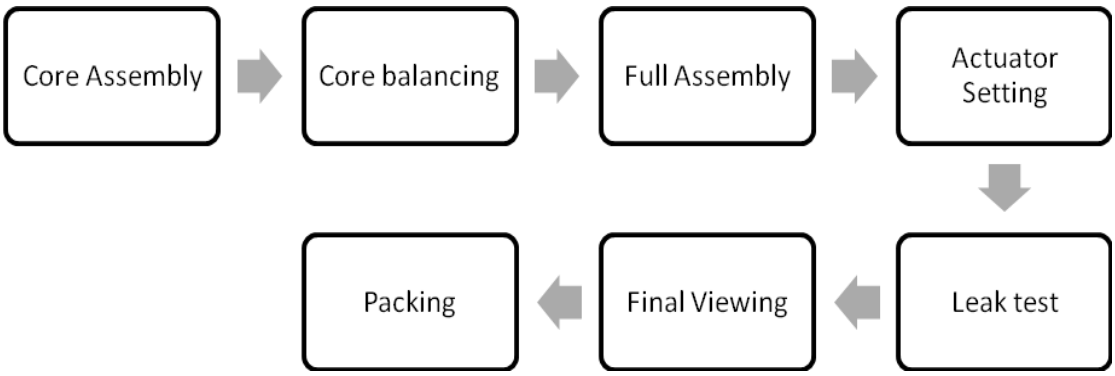

Fig.1 Turbocharger Assembly process

1.1 Turbocharger line assembly process

The operator starts assembling of sealing ring and boost feed adaptor on compressor housing sub assembly and tightening the required torque. Once the sealing ring assembly is over then it is moved to the next station for fixing of core assembly with required orientation. On completion of orientation activity it is moved to the next station to apply the grease on turbine screws for smooth separation of without damaging the internal parts whenever the service is required. Finishing of greasing activity is lead to carry out the mounting of clamp plates and actuator tightens with assistance of screws and required torque [3]. The Fixing of compressor housing sub assembly on the turbine housing is required necessary orientation before carryout the next activity [4]. The next assembly activity is Actuator setting being carried out to prevent the turbocharger not to exceed its design speeds. Special paint is applied on the screws to ensure the company sealing.

1.2 Existing inspection methods

There are two methods has been used to check the ring after the assembly as followed infrared and vision system ,these systems are in effective for detecting the very small components and also these systems is incapable for checking the misalignment of piston ring.

1.3 New inspection method

The reason is identified of heavy oil leak (oil blow) in the turbocharger effect of missing piston ring or misalignment of piston ring and oil from the oil inlet line enters into the bearing housing under the pressure. The turbulence may occur when this oil passes between the bearing and wheel journal surfaces; air is mixed with the oil and de-pressurized. This oil flows either by gravity or scavenge pump to the oil drain line and into the engine sump. Whatever thing which prevents draining causes the increasing oil level in the bearing housing to the height above the oil seals [9]. With this situation, oil

leaks out into the compressor housing and the turbine housing past the piston ring seals [8].

The flow test is suitable for testing the piston ring in the turbocharger assembly, for the flow test following are used Work stations, Fixture, FRL unit, Flow control valve, Inlet orifice Outlet closing port, Flow sensor, Air hose, Pneumatic cylinders, Hand operated valve and Pressure regulator.

1.4 Turbocharger piston ring Testing method

Once the job is assembled then it is moved to the next station which is flow test assembly. The Flow test measurement equipment is shown in Fig: 2. it is simply and directly measures the leakage or leak rate. The hand operated valve (pneumatic circuit) in the inlet and outlet port are closed to begin the test, the inlet valve opened up to 10 seconds.

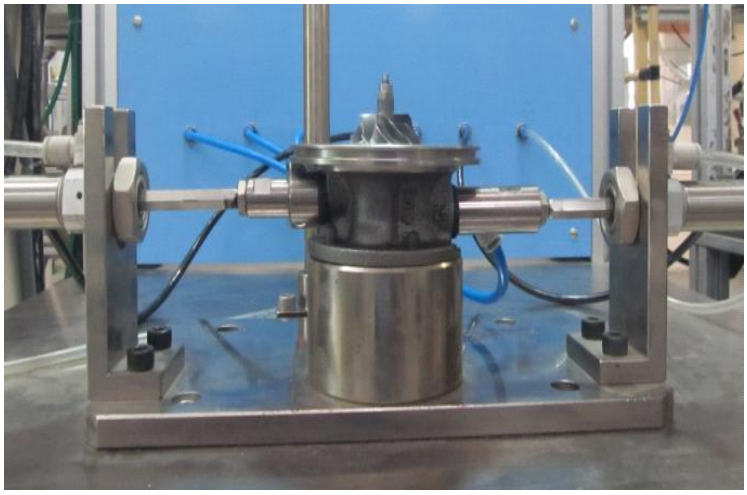

Fig.2 Turbocharger flow test unit

2. Result and discussion

The work piece during the filling stage is subject to a filling pressure slightly higher than the test pressure. Changing from the filling to the leveling stage, the filling pressure is reduced to the test pressure. In this expansion process, air in the test chamber cools down, as a result of which incomplete leveling is compensated. By varying the filling pressure, in the case of a sealed part even after a short leveling stage, a display of "zero" can be produced.

Fig.3 Flow test with and without piston ring

3. Conclusion

The flow rate has been recorded for testing the product. If there is no piston ring or miss aligned in the assembly the Flow rate is 0 lpm to 2 lpm, if the piston ring is proper in the assembly the Flow rate is 3.07 lpm Fig. 3, piston ring is properly secured in the assembly or else redo the assembly operation.

The vision and infrared testing system is entirely replaced by using the new test method and defect due to misaligned piston ring bring down in to zero. This fixture is used for testing all type turbocharger to check piston ring perfectly seated in groove or misaligned. The cost is more when compare to the existing testing method but it is the mechanical testing method so it is more effective when compare to the existing testing method.

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