

Transmission Test Bench

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Abstract

A transmission is a machine in a power transmission system, which provides controlled application of the power. Transmissions can be automatic or manual. In manual transmission, the operator shift the lever to higher or lower gear to control the speed and torque of the engine and wheels. The operator presses clutch and then shift the gear for smooth transmission. In an automatic transmission, the transmission automatically shifts through different gears based on the use of the gas and brakes from the driver. There are various tests that should be performed on the gearbox to ensure its working performance which includes shift performance test, transmission test, leak test and noise test. Transmission test bench is the test bench which is situated at the end of assembly line to check the above parameters in driving and the dragging test. The synchromesh test is carried out to check the test bench is running properly or not.

Keyword:- Gearbox, Design, Clamping, Oil dispensing, extraction, filtration unit

1. INTRODUCTION

Any vehicle requires more torque while ascending on the hill and less speed. Vice versa vehicle requires less torque on level roads. High torque is not required because of the momentum of the vehicle. Hence some system is needed which can change the vehicle's torque and its speed according to the level of road or when operator requires it. This device is known as transmission box or the gearbox. Main function of gearbox is to transmit the torque and motion between prime shaft and the drive shaft in the

driving and the dragging conditions. The rotation of the front wheel and the rear wheel must be same. The vehicle will not work if the rotation of the both wheels are different. Same like rpm the torque must be same for the both wheels i.e. for the front wheel and for the rear wheel.

2. LITERATURE REVIEW

S.S.Khodwe, S.S.Prabhune¹ developed the design and analysis of gear box test bench to test shift performance and leakage .They developed the concept of test bench to given parameters

Amruta Lomate , Suhas Mohite and Rahul Shinde² in "Design and Development of Torque Testing Rig for a Gearbox" delineate the torque testing machine for the gear box. They designed and developed the hydraulically actuated multi-plate brake system is carried out for measuring torque on the gearbox.

Mats Akerblom³ has developed test rig for noise and vibration testing of cylindrical gears. Noise testing of complete gearboxes is very time-consuming and expensive. So he made a test rig that has been designed for testing gears under controlled conditions.

In the proposed design all three tests test i.e. synchromesh test, driving test and the dragging test are carried out for all five gears vehicles along with the neutral and reverse gear. Proposed system is also equipped with *supervisory control and data acquisition* i.e. SCADA.

4. TECHNICAL SPECIFICATIONS

Table -1: Technical specifications of machine

Machine Type	Semiautomatic
Component to be checked	Gear Box
Component Loading/Unloading	Manual
Clamping Arrangement	Hydraulic
Sealing Arrangement	Manual
Leak Testing	Pneumatic
No. of Stations	Two

5. METHODOLOGY

The proposed system has gear assembly, motor, RPM Sensor, torque sensor, oil filling and extracting unit and clamps to put load on gears. There are 3 motors. The drive mechanism is at both ends that is from primary shaft and through drive shaft. During Synchromesh test and gear box test in dragging condition; the power input is from drive shafts and output through primary shaft.

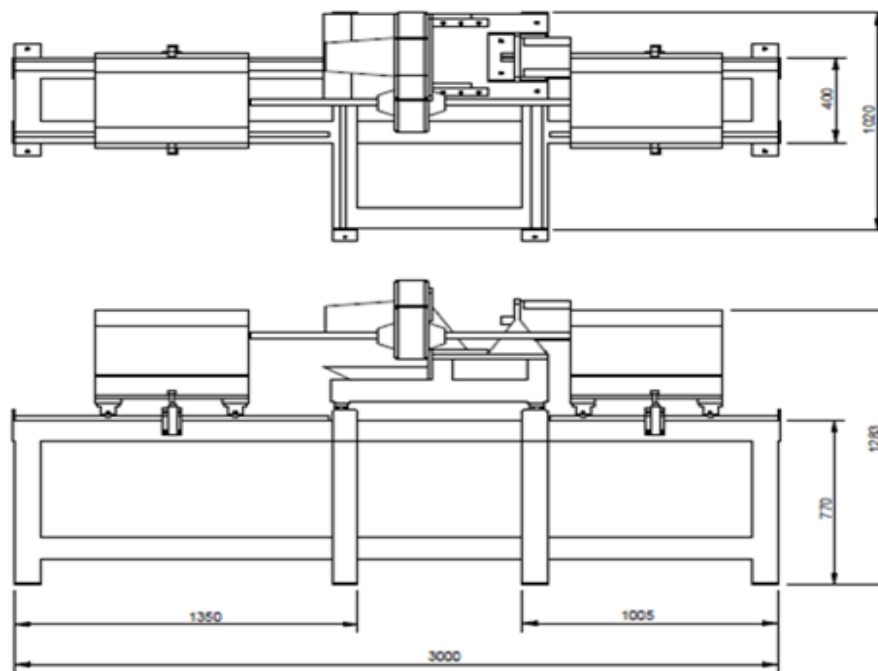


Fig -1: Structure of system

6. LEAK TEST

This is a separate station. Dry leakage test is carried out with machine. This test uses pneumatic supply. Leakage is measured by finding pressure drop. If the pressure drop is more than set point then the gearbox is NOK(Not Ok) message will be displayed on the screen.

$$\text{Leakage rate (cc/min)} = \frac{[6 * \text{allowable pressure drop (mbar)} * \text{volume (cc)}]}{[100 * \text{hold time (sec)}]}$$

Hence, from above formula allowable pressure drop is $1.25 * 10^3$ mbar. Pressure drops more than this value is not allowed. If pressure drop is more than this value, gear box is NOK (not ok) message will display on the HMI screen.

7. TRANSMISSION TEST

7.1 Synchromesh Test

This test is performed to check the internal assembly of the test bench. For this test gearbox is run at certain speed. In this mode; the power input is from drive shafts and output through primary shaft. We give torque of 0.1 N-m. to primary shaft and give different speed to driving shafts so we can get different torque reading. After rotation all data saved in the computer and check whether reading are according to predescribed values. Also shift force reading and noise reading.

7.2 Driving Test

This test will be performed to check gearbox in driving condition. Here gearbox will run at specific speeds. During gear box test in driving condition the power input will be from primary shaft and output will be through drive shafts. Input Servo motors start rotating the primary shaft of the gearbox slowly at 2500rpm. The driving servo motors are applying torque limit 22.5N-m.

7.3 Dragging test

This test will be performed to check gearbox in dragging condition. Here gearbox will run at specific speeds which are given table. In dragging test the power input is from drive shafts and output through primary shaft. This test is carried out if the certain uncertainty form while the vehicles in driving condition. so this test is carried out only for second to fifth gear.

8. GEAR SHIFT TEST

Gear test is done by using the tandem cylinder and the load cell. The shifting force should not be more than 15kgf so for the tolerance we make the cylinder for 20 kgf. The cable is attached to the cylinder stroke and to the load cell and then it is connected to the gear shifting lever.

9. OIL DISPENSING & EXTRACTION UNIT

During the operation, gearbox is to be filled with clean oil and after the operation this used oil is to be removed from the it and it should be refined. 700 ml of oil is require in the gearbox. For filling and extracting oil from the gearbox, we need to select motor and pump. This motor and pump are selected according to how much oil is to

be filled in the gearbox at one time. We are using two lines of filters with pressure switches and each line has four filters. These filters are selected with capacities of 90 microns, 56 microns, 18 microns and 10 microns.

10. CONCLUSION

The transmission test bench is developed. Design and Development of Gearbox tester is carried out for measuring the torque and rpm of the gearbox in different conditions. The test rig is calibrated with theoretical values. Synchromesh, driving and dragging tests are carried out. Performance of gears is checked with the torque for rated speed. As the speed increases torque decreases. Shift force test results and noise test results are also fulfilled. The overall performance of the gearbox is satisfactory.

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