

# IMPROVISATION OF SINGLE CAR RAKE TEST RIG (RTR) USED TO TEST BRAKING SYSTEM IN TRAIN COACHES

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**Abstract:** The air brake is the standard train brake used by railways all over the world. To test the braking system of single car a Rake test rig is used. It is based on the simple physical properties of compressed air. The Rake Test Rig performs the braking test at Twin Pipe Braking system of coaches. Rake Test Rig used has two pressure gauges that are Feed pipe gauge and Brake pipe gauge. The existing test rig used at workshop has number of conventional joints, complex construction and its weight. In this paper the improvement in rake test rig construction is implemented to overcome the existing problems and the brake testing procedure is also studied. The improved design and construction made the test rig more accurate than existing and problems were found to be completely resolved.

**Index Terms –** Testing procedure, Coach, Brake pipe, Feed pipe, improved RTR.

## I. INTRODUCTION:

Brake is an essential feature in order to retard and stop the railway vehicle within minimum possible time. The Air Brake system of the coaches are brought at maintenance depot, on every round trip should be tested by using a 'Rake Test Rig'. The source of compressed air supply to the test rig is through a compressor installed in the sick lines. The rake test rig works on three stages.

1. Charging stage.
2. Application stage.
3. Release stage.

The test rig performs test at braking system of coaches, as it has a pipe arrangement that are followed by air reservoir to the palm couplings. The Test rig has two different pressure gauges that are FEEDPIPE gauge and BRAKEPIPE gauge. The brake pipe and feed pipe run throughout the length of the coach. Brake pipe and feed pipe on consecutive coaches in the train are coupled to one another by means of respective hose couplings to form a continuous air passage from the locomotive to the rear end of the train. Both pressure gauges show the amount of air pressure supplied during testing and these FP (Feed Pipe) and BP (Brake Pipe) pressures are maintained at 6.0Kg/cm<sup>2</sup> and 5.0Kg/cm<sup>2</sup> respectively. A Test rig has arrangement of Main Reservoir, no of Isolating cocks, A9 Valve, Pressure Reducer and various pipe connections through which various test can be done and are mentioned below.

**Test1:** Leakage Test.

**Test2:** Sensitivity and Insensitivity Test.

**Test3:** Brake Application and Release Test.

**Test4:** Graduated Application and Release Test.

**Test5:** Emergency Brake Application Test.

**Test6:** Passenger Emergency Valve Test.

### A] Components of a Rake Test Rig:

The Rake Test Rig has connection of pipe joints and a frame on which the mentioned components are mounted. The Test rig also consist of a wheel arrangement for easy movement .The following components are mentioned as follows.

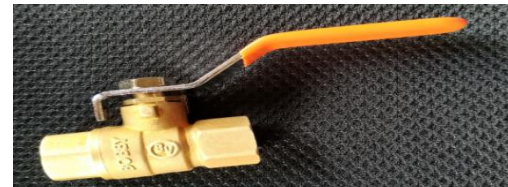
1. Main Reservoir: A 40L tank is mounted on the frame in order to store the compressed air and supply it at a required quantity during testing



2. A9 Valve: The valve is also a variable pressure reducing valve. Its duty is to send pilot air for charging/ exhausting B.P. pressure through relay valve for releasing and application of loco and formation brake. In release condition it charges BP at 5.0 Kg/cm<sup>2</sup> (max). The BP pressure can be varied by moving its handle. The handle has 5 distinct positions. The pressure will reduce when the handle is moved to application zone. [4]



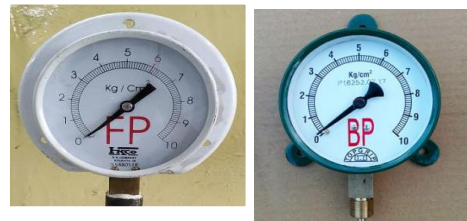
3. Isolating Cock: A 8mm Ball type Isolating Cocks are used to provide facility for cutting-off of air supply.



4. Pressure Reducer valve: This will control the Output pressure to the desired level. This valve is fitted at the outlet of limit the Brake Cylinder pressure



5. Gauges: Two different Pressure Gauges of FP and BP are mounted in rake test rig which indicates the amount of pressure drop in feed pipe and brake pipe during leakage.



6. Palm Couplings: Two palm couplings for BP and FP are connected from the test rig followed by a flexible pipe. These palm couplings are used to couple the rake test rig with wagons during testing.



## II. DETAILS OF EXISTING RAKE TEST RIG:

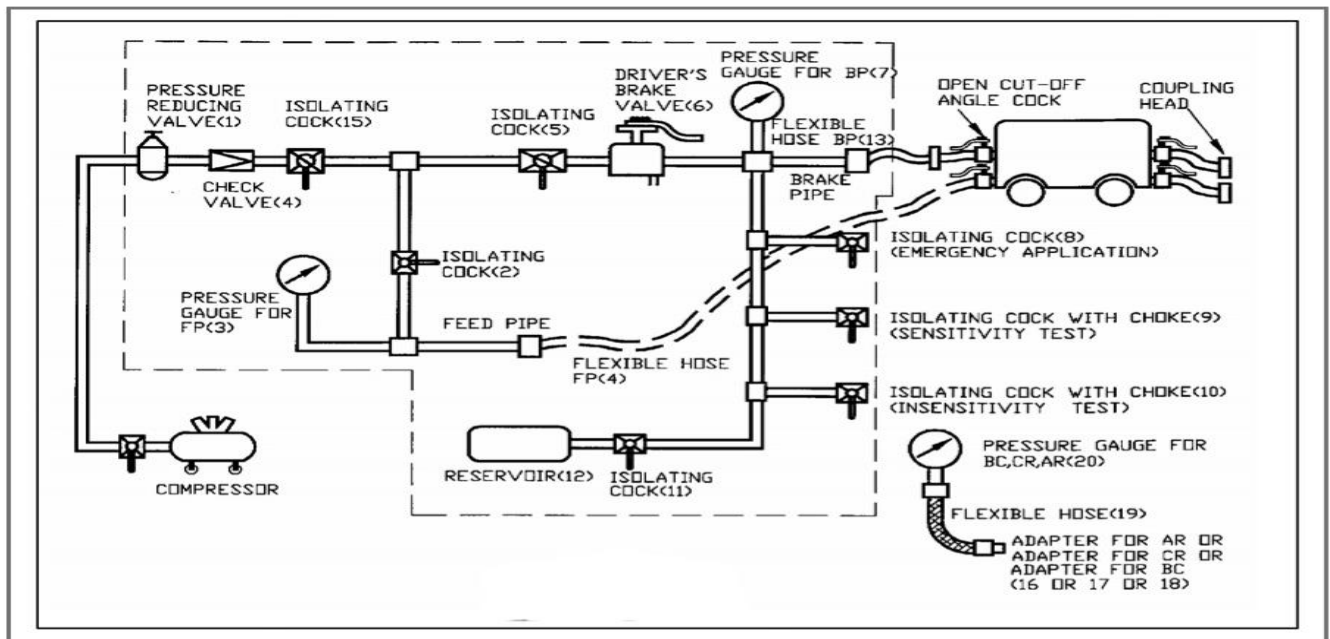


Fig: Layout of Existing Rake Test Rig.

### Procedure for Brake Testing:

- Place the coach on the pit line for single car test (Brake Test).
- Arrange the single car test rig device near the coach.
- Ensure adequate air supply so that steady pressure is maintained at the inlet of single car test device.
- Close isolating cock of the distributor valve and the pipe connected between the compressor and Single Car Test Device (SCTD).
- Open cut off angle cocks of both BP and FP on both ends of the coach.
- Connect the near end of coach under test, to the test rig by connecting both brake pipe (BP) and feed pipe (FP) through coupling heads.
- Open isolating cock (2) and (5) of the test rig that are connected to feed pipe and brake pipe of the coach. Open isolating cock (15) also.
- Blow air into both BP and FP to scavenge the pipes.
- Open dirt chamber of the Dirt Collector and clean the accumulated dirt and moisture, after cutting off air supply. Re-assemble the dirt collector.
- Connect dummy coupling to BP and FP hose coupling on the far end of the coach. Close isolating cock (2) and (5).
- Connect pressure gauges on Auxiliary reservoir and brake cylinders.
- Open isolating cocks (2) and (5) of the test rig that are connected to feed pipe and brake pipe of the coach. Close the isolating cocks (8),(9),(10) and (11) of the Test rig.
- Open isolating cock of the distributor valve.
- Open the BP and FP angle cocks of the near end of the coach.
- Close both angle cocks at the other end of the coach.
- Keep the driver's brake valve handle in release position and charge the system. Check BP and FP pressures of the test rig and these should be  $5 \pm 0.1$  kg/cm<sup>2</sup> and  $6 \pm 0.1$  kg/cm<sup>2</sup> respectively. Wait for 3 minutes to ensure stabilized pressure.
- Before conducting the tests it is important to ensure that the entire Test Rig is pressure tight. [1]

### Drawbacks of Existing Rake Test Rig:

- Heavy weight of existing RTR.
- Many number of pipe joints which cause leakage of compressed air.
- Piping Arrangement for Holding Gauges & Other Equipments like Isolating Cock.
- Less Accurate.

### III. IMPROVISED RAKE TEST RIG:

To overcome the problems of existing Rake test Rig a modified RTR is constructed. Figure1 shows the design for modified RTR.

**1. Design of Improved Rake Test Rig:** Autodesk Inventor a computer-aided design application for 3D mechanical design, simulation, visualization, and documentation developed by Autodesk is used to designing the Rake test rig. The constructed image of improved RTR is also shown in fig.2. Thus improvisation has lead to carry out test in less time and user friendly.

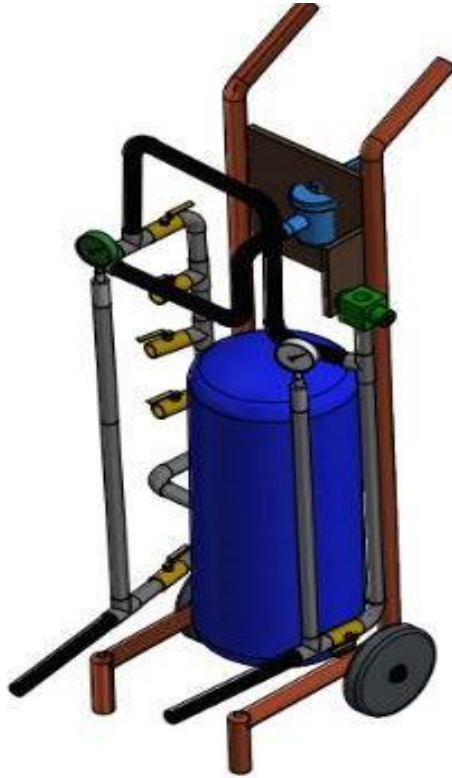


Fig1: Design of Rake Test Rig using Autodesk Inventor



Fig 2: Constructed Improved Rake Test Rig

#### 2. Advantages of Improvisation:

- Leakage of compressed air found to be minimized.
- Weight of improved RTR was minimized.
- Piping arrangement done in compact manner.
- Improved RTR is easily operated, since change in some equipment material is done.
- High accuracy in testing is obtained.

### IV. CONCLUSION:

- The test rig used at coaches to check the leakage in feed pipe, brake pipe and under-frame air brake piping by using the compressed air.
- Rake Test Rig modification eliminated the leakage of compressed air.
- Adopting the improved RTR has made the testing of brakes at coaches more efficient and leakage problems can be identified without considering any losses through main reservoir mounted on test rig.
- The model of test rig found to be user friendly.
- Using improved rake test rig is simpler and time saving and it is easily portable.
- This rake test rig is more accurate than existing and the weight was found to be minimized
- All mentioned brake application tests were found successful when tested.



**V. REFERERNCES:**

- [1] Air Brake System-Maintenance Manual for BG coaches of ICF design.
- [2] Procedure of Rake Testing for Freight Stock-IRCAMTECH/GWL/M/Rake Testing/FRT/2-8
- [3] en.wikipedia.org/wiki/Railway\_airbrake.
- [4] <http://www.irimee.indianrailways.gov.in/instt/uploads/files/1434534006809-AIR%20BRAKE%20IRAB-1.pdf>

