A PROJECT REPORT ON

"DESIGN, FABRICATION AND DEVELOPMENT OF SINGLE CAR TEST RIG USED FOR PNEUMATIC AIR BRAKE TESTING IN RAILWAYS"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfillment of the Requirement for the Award of

BACHELOR'S DEGREE IN
MECHANICAL ENGINEERING

BY

MEMAN AFAJAL VALEEMAHAMAD	(12ME34)
SIDDIQUE MOHD MOHSIN	(15ME112)
SIDDIQUI TAUSIF BAHARUDDIN	(15ME110)
SURME KASHIF KHALIL	(12ME79)

UNDER THE GUIDANCE OF
PROF. AMRUTA KARVE

DEPARTMENT OF MECHANICAL ENGINEERING

Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 & 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2019-2020

AFFILIATED TO

UNIVERSITY OF MUMBAI

A PROJECT II REPORT

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CERTIFICATE

This is certify that the project entitled

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

Date: / /

(Prof. AMRUTA KARVE)
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Acknowledgement

I would like to take the opportunity to express my sincere thanks to my guide **Prof. Amruta Karve**, Assistant Professor, Department of Mechanical Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

I am grateful to him/her for his timely feedback which helped me track and schedule the process effectively. His/her time, ideas and encouragement that he gave is help me to complete my project efficiently.

We take this opportunity to give sincere thanks to **Mr. BHUSHAN MOKSHE** (INSTRUCTOR, BTC) and **Mr. DEEPAK** (Junior Engineer, LUF) at **"BRIGHT ENGINEERING PVT. LTD, PUNE"** for all the help rendered during the course of this work and their Support, motivation, guidance and appreciation.

We would like to express deepest appreciation towards **DR. ABDUL RAZAK HONNUTAGI**, Director, AIKTC, Navi Mumbai, **Prof. ZAKIR ANSARI**, Head of Department of Mechanical Engineering and **Prof. RIZWAN SHAIKH**, Project Co-ordinator whose invaluable guidance supported us in completing this project.

We must thank BTC department of Bright engineering pvt. Ltd, pune for providing the opportunity to express my gratitude to all the individuals whose contribution have helped us in undergoing training and successful completion of my project at Carriage Workshop, Central Railway, CST, Mumbai-400001.

Without the support, assistance, and motivation provided by those around us. This study would never have been accomplished.

We would also like to thank all Workshop Officials, Shop Superintendents, Staff members and faculty members for their valuable help at the time.

At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped me directly or indirectly during this course of work.

MEMAN AFAJAL VALEEMAHAMAD
SIDDIQUI MOHD MOHSIN
SIDDIKI TAUSIF BAHARUDDIN
SURME KASHIF KHALIL.

Project I Approval for Bachelor of Engineering

This project entitled ***"DESIGN, FABRICATION AND DEVELOPMENT OF SINGLE CAR TEST RIG USED FOR PNEUMATIC AIR BREAK TESTING IN RAILWAYS"*** by **Meman Afajal Valeemahamad, Siddiqui Mohd Mohsin, Siddiki Tausif Baharuddin, Surme Kashif Khalil** is approved for the degree of ***Bachelor of Engineering in Department of Mechanical Engineering.***

Examiners

1.....

2.....

Supervisors

1.....

2.....

Chairman

.....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

Reliability and increased asset utilization has been the focus of railroads, particularly in heavy haul operations. The maintenance principles have shifted from time-based criteria to condition based criteria with periodic testing. The ability to accurately test, diagnose and repair the brake system of a freight car has obvious benefits to maintainers and operators. The deficiencies and subjectivity of manual testing has given way to the introduction of **Automated Single Car Testing**. This book will review the benefits of automated single car testing. Data will be presented analyzing brake equipment failure modes.

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1 ABOUT INDIAN RAILWAYS

1.1 Introduction to Indian Railway

Indian railways (IR) is the stated owned railway company of India Indian railway has a monopoly on the country's rail transport. It is also one of the largest and busiest rail networks in the world, transporting under 5 billion passengers and almost 650 million of freight actually. IR is the world's largest commercial or utility employer, with more than 16 million employees.

The Indian Railways route length network is spread over 115,000 km, with 12,617 passenger trains and 7,421 freight trains each day from 7,349 stations plying 23 million travellers and 3 million tonnes (MT) of freight daily. India's railway network is recognised as one of the largest railway systems in the world under single management.

The railway network is also ideal for long-distance travel and movement of bulk commodities, apart from being an energy efficient and economic mode of conveyance and transport. Indian Railways was the preferred carrier of automobiles in the country with loading from automobiles traffic growing 16 per cent in 2017- 18.

INDIAN RAILWAYS	
Headquarters	New Delhi
Railway Minister	Piyush Goyal
Network	67,368 km(route) 93902 km (running track) 121407 km (total track)
Foundation	1845-present
Track gauges	Broad meter, narrow
Revenue	Rs. 1.874 trillion (US $26 billion) (2017–18)
Chairman Railway Board	Vinod Kumar Yadav

Table 1.1: About Indian Railways

1.1.1 History

A plan for a rail system in India was first put forward in 1832, but no further steps were taken for more than a decade. In 1844, the governor-general of India. Lord Hardingeal lowed private entrepreneurs to set up a rail system in India. Two new railway companies were created and the east India Company was asked to assist them. Interest from investors in the UK led to the rapid creation of a rail system over the few next years.

The first train in India becomes operation on 1852-12-22 and used for the hauling of construction material in rookie. A year and a half later, on 1853-0.4-16, the first pas- sengertrainservicewasinauguratedbetweenBoribunderBombayandThana.Covering a distance of 34km (21miles),it formally heralded the birth of railways in India.

The British government encouraged new railway companies backed by private investor sundera scheme that would guarantee an annual return of five percent during the initial year of operation. Once established, the company would be transferred to the government, with the original company retaining operational control. There out emileage of this network was about 14,500 km (9,000) miles by 1880, mostly radiating in ward from the three major cities of Bombay, madras and Calcutta. By 1895, India had started its own locomotives and in1896s ends engineers and locomotives to help build the Uganda railway.

Soon various independent kingdoms built their own rail system and the network spread to the region that becomes the modern day states of Assam, Rajasthan and Andhra Pradesh. A railway board operated under aegis of the department of com- merce and industry and had time in its history; the railways began to make a tidy profit. In 1907, almost all the rail companies were taken over by the government.

The following year, the first electric locomotive appeared. With the arrival of the First World War, the railway was used to meet the needs of the British outside India. By the end of the First World War, the railways had suffered immensely and were in a poor state. The government took over the management of the railways and removed the link between the financing of the railways and other government revenues in 1920, a practice that continue to date with a separate railway budget.

1.1.2 Government Initiatives

Few recent initiatives taken up by the Government are:

1. As of December 2018, the Government of India is considering a High Speed Rail Corridor project between Mumbai and Nagpur.
2. As of November 2018, Indian Railways is planning to come out with a new export policy for railways.
3. The government of India is going to come up with a 'National Rail Plan' which will enable the country to integrate its rail network with other modes of transport and develop a multi-modal transportation network.
4. A 'New Online Vendor Registration System' has been launched by the Research Designs & Standards Organisation (RDSO), which is the research arm of Indian Railways, in order to have digital and transparent systems and procedures.
5. The Government of India has signed an agreement with the Government of Japan under which Japan will help India in the implementation of the Mumbai-Ahmedabad high speed rail corridor along with a financial assistance that would cover 81 per cent of the total project cost.

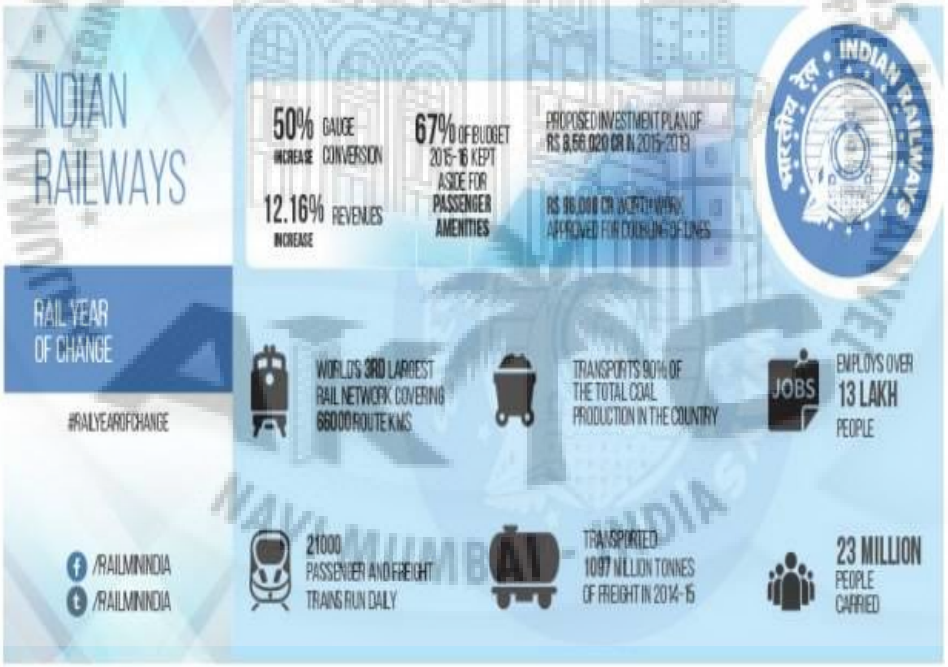


Figure 1.1: Indian Railway current year plan

1.1.3 Zonal Details

Sr.No.	Railway Zone	Zone Head-Quarters	Railway Divisions
01	Northern Railway	Delhi	Delhi, Ambala, Firozpur, Lucknow NR, Moradabad
02	Northeast Frontier Railway	Guwahati	Alipurduar, Katihar, Rangiya, Lumding, Tinsukia
03	Eastern Railway	Kolkata	Howrah, Sealdah, Asansol, Malda
04	South Eastern Rail-Way	Kolkata	Adra, Chakradharpur, Kharagpur, Ranchi
05	South Central Rail-Way	Secunderabad	Secunderabad, Hyderabad Vijayawada, GuntakalGun-tur,Nanded
06	Southern Railway	Chennai	Chennai, Tiruchirappalli, Madurai, Palakkad, Salem, Thiruvananthapuram
07	Central Railway	Mumbai	Mumbai, Bhusawal, Pune, Solapur, Nagpur
08	Western Railway	Mumbai	Mumbai WR, Ratlam, Ahmedabad, Rajkot, Bhavna- gar, Vadodara
09	South Western Railway	Hubballi	Hubballi, Bengaluru, My-suru,
10	North Western Railway	Jaipur	Jaipur, Ajmer, Bikaner, Jodh-pur
11	West Central Rail-Way	Jabalpur	Jabalpur, Bhopal Kota
12	North Central Rail-Way	Allahabad	Allahabad, Agra, Jhansi
13	South EastCentral Railway	Bilaspur	Bilaspur, Raipur, Nagpur SEC
14	East Coast Railway	Bhubaneswar	Khurda Road, Sambalpur, Waltair
15	East Central Rail-Way	Hajipur	Danapur, DhanbadMughal-sarai, Samastipur, Sonpur
16	Konkan Railway	Navi Mumbai	Navi Mumbai
17	Kolkata Metro Railway	Kolkata	Kolkata

1.2 INTRODUCTION TO BRIGHT ENGINEERING PVT. LTD.

Bright Engineering specializes in the design and development of Special purpose Machines, Assembly Line Machines, Endurance and Performance testing machines, Jigs & Fixtures, Environmental Chambers, Biotechnology Equipments, Custom Automated Test Equipments, Data Acquisition and Control Systems, Control **Panels**, AC/DC Drives applications, System Integration, Turnkey Solutions, Embedded Systems,8 Bit & Arm based Microcontroller application, Custom Software applications for PDAs, HHTs, POS, Sale automation, Etc .

Our expertise in the field of Automation, Process control, Motion, Embedded, Control and Signal processing makes us the preferred system integrator for application development in Automotive, Aerospace, Railways, Textiles, Garments, Manufacturing, Retail and power sector solutions. In addition to System Integration, we also provide offshore outsourcing services for software development and validation testing.

Bright Engineering was started in spring of 2005 to provide best in class services and customized solutions in the engineering industry. We have grown to gain experience in different streams across different industry verticals. With a dynamic team and qualified supplier base, has grown into a world class multi-disciplinary solution provider.

Bright Engineering has demonstrated a strong customer focus over multiple projects through the entire engagement starting with requirement gathering through post commissioning support phase. As a result, customers have repeatedly called on us for solutions to some of their most challenging problems.

What began as a small group of passionate engineers is today a 360 degree organization with well defined functions Bright Engineering serves customers in multiple geographies through a robust delivery process and is piloting a global foray though several successful projects overseas.

Values:

Customer Concentration: We understand the importance of satisfying our customers. We envision their needs and strive to deliver the best to them. Our relationships with our customers are built with trust and nurtured with care.

Conception: We remain globally competitive by adopting cutting-edge technology. We solve challenging problems through innovative use of engineering principles to maximize returns for the customer. Through intelligent use of technology,

Corporate Trust & Unity: We realize and honor all team members and support to each other. We endeavor to make our members happy and ensure transparency in our organization through our processes; we believe in direct, pro-active & honest communication. We create a contributive atmosphere for members to excel & reward

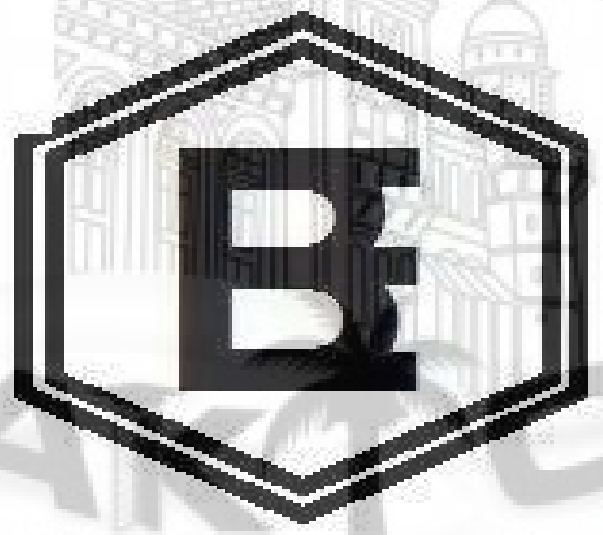


Figure 1.2: Bright engineering pvt ltd.

1.3 Processes Involved in Carriage Repair Workshop:

POH (Periodic Overhaul) - 18days process.

1. RECEIVING THE COACH FROMYARD:
   The coach to be repaired is received from the yard. 1 car means 8 coaches.

2. SHUNTING OFCOACH:
   Each coach to be separated into two parts:
   A. Shell
   B. Trolley

3. PRE-INSPECTION AND CLEANING UNDER FRAME AS WELL ASWATER TANKATTENTION:
   Parts to be repaired and the under frame along with water tank are also cleaned.

4. UNLOADING OF MECHANICAL AND ELECTRICALCOMPONENT:
   All the components which function on electrical and mechanical energy are unloaded.
   e.g.: Fans, seat, trolley, battery, doors, etc. These components are removed in order to reduce the weight of coach as well as for their repair and maintenance work.

5. LIFTING OF COACH:
   The coach is lifted at a higher position by using a lifting crane and is separated from trolley

6. TROLLEY WILL BE SENT TO TROLLEYSHOP:
   The parts of the trolley are further sub-divider into 2 sections: into 2 sections:

   A. Wheel to and fro wheel shop: Here the wheel is repaired by first checking its diameter which should not be less than830mm.

   B. Springs to and fro smithy shop: Here the springs are inspected having any cracks, abrasion, and corrosion. If the cracks are invisible to naked eye then bosh cleaning tank is used. It there are any cracks in the spring then the spring is thrown away and a new spring is used.

7. TR/ML (Trolley/Main Line) repair shop:
   All the other bogey components are sent to this shop for repairing.

8. A newly repaired Coach is obtained.

9. LOWERING THE COACH:

   Here all the repaired parts of the coach are assembled together and the coach is lowered and assembled with the bogey.

10. PAINTING

    Layers of various paints are applied to the coach. Anti-corrosive paints are used. This process requires 9 days.

11. INTERIOR FURNISHING:

    This step includes furnishing of interior coach which includes seats, walk-through etc.

12. LOADING AND UNLOADING OF MECHANICALCOMPONENTS:

    In this step all the electrical and mechanical components which were unloaded earlier are loaded back to their original place after their testing and maintenance.

13. AIR BRAKE TESTING:

    Air brake testing is done which is the most important part of this POH. It is a 1-day process. Twin pipe graduated air brake system is used.

14. . FINAL INSPECTION BY NTEX (NEUTRAL TRAINEXAMINER):

    The organizing committee is NCO (Neutral Control Organizing). NTRX will always do the final inspection of the newly obtained coach.

15. DISPATCH TOTRAFFIC:

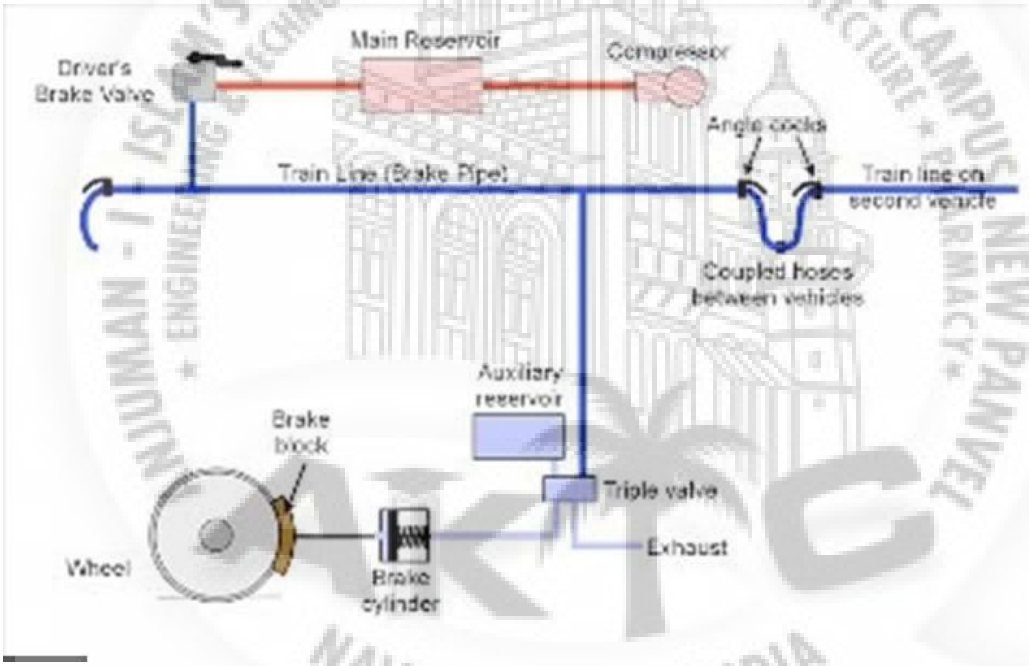
    After its final inspection the train is dispatch for its use.

2 INTRODUCTION

The testing of air brakes in Railway has experienced a prolonged metamorphosis, dating back to the 1930's. The manual single car test device in use today is virtually identical to the 1930 configuration.

In the 79 years from 1936 today, the manual test device configuration has evolved with the addition of a filter, pressure regulator and a flow meter. The addition of the utilization of a brake cylinder gauge was implemented in the late 1990's. Over the same eight decades, the maintenance principals have shifted from time based criteria to condition based criteria to condition based criteria with periodic testing. In 1936, all brake equipment was required to be reconditioned every 3 years and all cars were single car tested whenever they are set out on the repair track. From the mid 1960's through the late 1980's the reconditioning requirement was extended to 16-years with single car test requirements being specified depending on the defect identified. In 1992, the time based reconditioning requirement was eliminated –if a car passes the single car test, it is allowed to be returned to service.

Application of brakes and how it works:



Actual photo:

Function of project:

Automatic Single Car Test Rig is used to perform Air Brake testing on coaches to ensure proper functioning of Air Brake System. This testing procedure is generally done during the POH of coaches or change of any Air Brake sub-assembly. This machine is so designed that it can work in any climatic condition; robust and suitable for Railway working system. This is a portable machine which gives a power backup up to 6 Hours. The Automatic Single Car Test Rig minimizes the time for testing, avoids human errors, records the tested parameters and stores the data in the Database. And it gives saving of 2 employees per shift and assures accuracy in the Job.

3 LITERATURE SURVEY

3.1 Literature Review Paper:

Automated Brake Testing and The Benefits of Four Pressure Test Author: Karen J. Carriere and Edward W. Gaughan

June 2015.

The automated 4-Port single car test provides a valuable tool which offers the means for more efficient and significantly upgraded testing of freight car brakes. The test time savings are quantifiable, but the superiority in the quality and reliability of testing is even more important. Because the automated test device has the intrinsic capability to be highly efficient and precise, use of the improved test method is expected to expand in order to support new industry initiatives. For example, the browser based access, which allows for handheld device control as well as the integration with the end user's IT network for electronic record keeping capabilities, may lend itself to new application such as automatic repair billing, warranty claims,

and the generation of progressing to more accurate and detailed statistical test data. Overall, this new test system has the potential to contribute in significant ways to improved productivity for car builders, railroads and car owners alike.

Conclusion:

The objective of conducting the Single Car Test is to evaluate the general fitness of the brake system, diagnose faults and make necessary repairs. The ultimate goal is to return the car to service for an extended period of time; exception free. The introduction of automated testing has delivered a consistent, accurate test while providing the operator

with greater diagnostic and visibility to assist in the troubleshooting and remediation process. Computerized test devices offer a platform to not only display the status of the

brake system during the test, but assist in the diagnosis of a failed test. The automated, 4-Port test system has further enhanced the automated testing capability providing numerous clear

and documented benefits. Overall impact on operations is significant, with definitive benefits in the following areas:

1) Enhanced Car Effectiveness

2) Improved Maintenance Efficiency and Effectiveness

3) Reduction in repeated car maintenance.

4) Increased productivity car fleet.

4 METHODOLOGY

Step 1 : Selection of parts and their specification

1. ITV valve (Series ITV0000), model-ITV001:

Series ITV electro-pneumatic and electronic vacuum regulators control air/vacuum pressure steplessly in proportion to an electrical signal. They are light weight in design with a bright and easy to read LED display

Fig: ITV valve used in single car test rig

2. Solenoid Valve:

This solenoid valve is used for ON and OFF of air flow in single car test rig. Solenoid valve function involves either opening or closing an orifice in a valve body, which either allows or prevents flow through the valve.

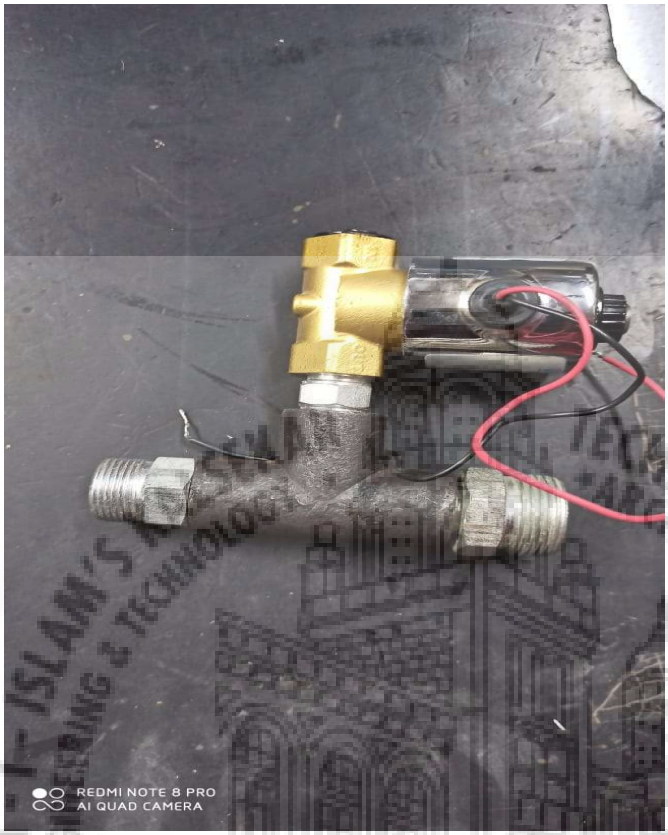


Fig: Solenoid valve used in Single car test rig

3. Relay Card:

This is the relay card used for switching of valves. It is also used wherever it is necessary to control a high power or high voltage circuit with a low power circuit.

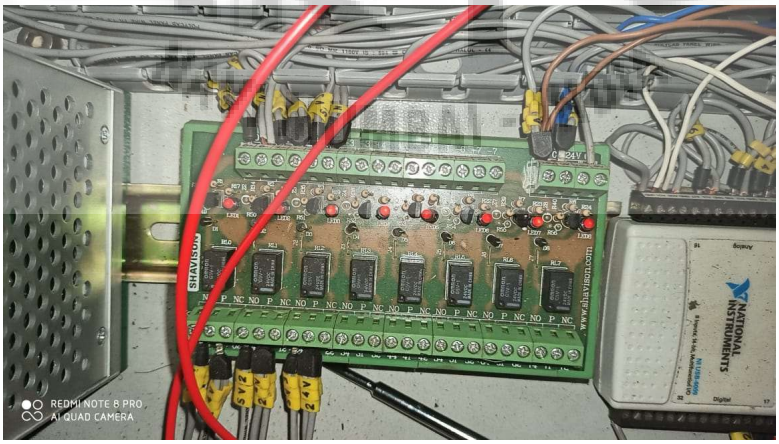


Fig: Relay card used in single car test rig

4. N.I.Module: This is pre programmed ic use as per client requirement.

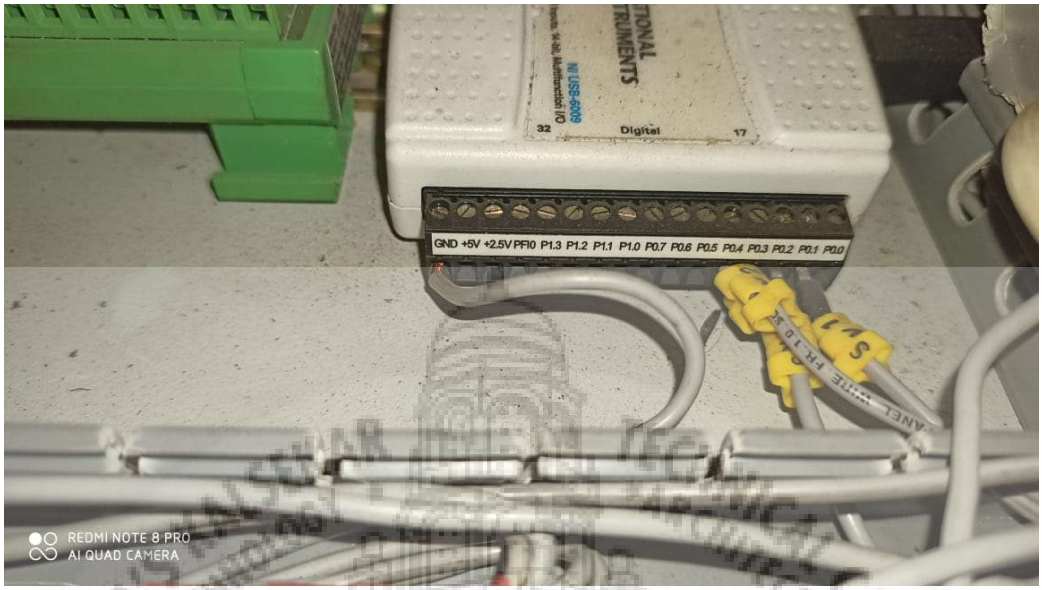


Fig: N.I.Module used in single car test rig

5. Assembly of motorized and solenoid valve: This is the assembly of solenoid valve and air filter motorized valve.

Step 2: Fabrication of Rake Test Rig:

The Fabrication of the SCTR done in the workshop, where all the necessary tools and equipments were arranged. After the completion of the Rake Test Rig, the modified SCTR will be used for testing of Brakes.

Step 3: Assembly of single car test rig:

The assembly of single car test rig contains itv valve, solenoid valve pressure transducer connected with hose pipe and nipple. Below diagram shows in detail the whole assembly of single car test rig.

5 SYSTEM DESIGN

1. System Requirements Definition

In this section, the steps related to Single Car Rake Test Rig (RTR) System design is explained in detail. This project aims to reduce the different factors that can affect the testing and cause the major damage. Below is the rough sketch of the entire system. It contains front view, side view and top view of the model.

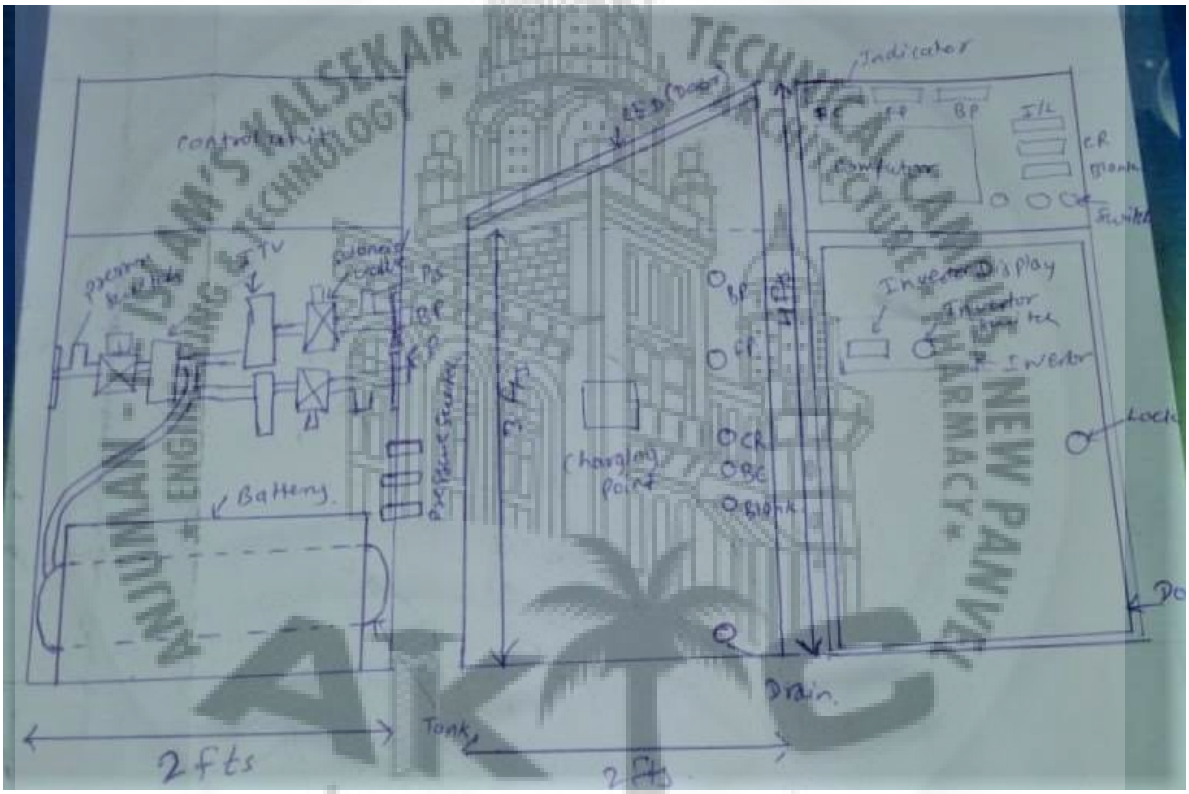


Fig: Front, Top and Side view of Single Car Test Rig.

2. Components of a Rake Test Rig:

Computerized Single Car Test Rig is suitable for LHB as well as ICF coaches. It has fully automatic software-based command, execution and data capture capabilities with generation of digital records. The graduated brake application and release tests are conducted fully automatically with 8 step verification and data recording incorporated.

The following components are mentioned as follows.

a. ITV Valve:

Series ITV electro-pneumatic and electronic vacuum regulators control air/vacuum pressure steplessly in proportion to an electrical signal. They are light weight in design with a bright and easy to read LED display.

b. Solenoid Valve:

This solenoid valve is used for ON and OFF of air flow in single car test rig. Solenoid Valve function involves either opening or closing an orifice in a valve body, which Either allows or prevents flow through the valve.

c. Multi span indicators:

These multi span indicators are used for indication of pressure. It helps to show us Pressure reading digitally.

d. Relay Card:

This relay card is used for switching of valves. It is also used wherever it is necessary To control a high power or high voltage circuit with a low power circuit.

e. 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.

f. Air reservoir tank:

This air reservoir tank is situated at the bottom of the body. It is used to reserve the air, so it acts as air reservoir.

6. SYSTEM TESTING:

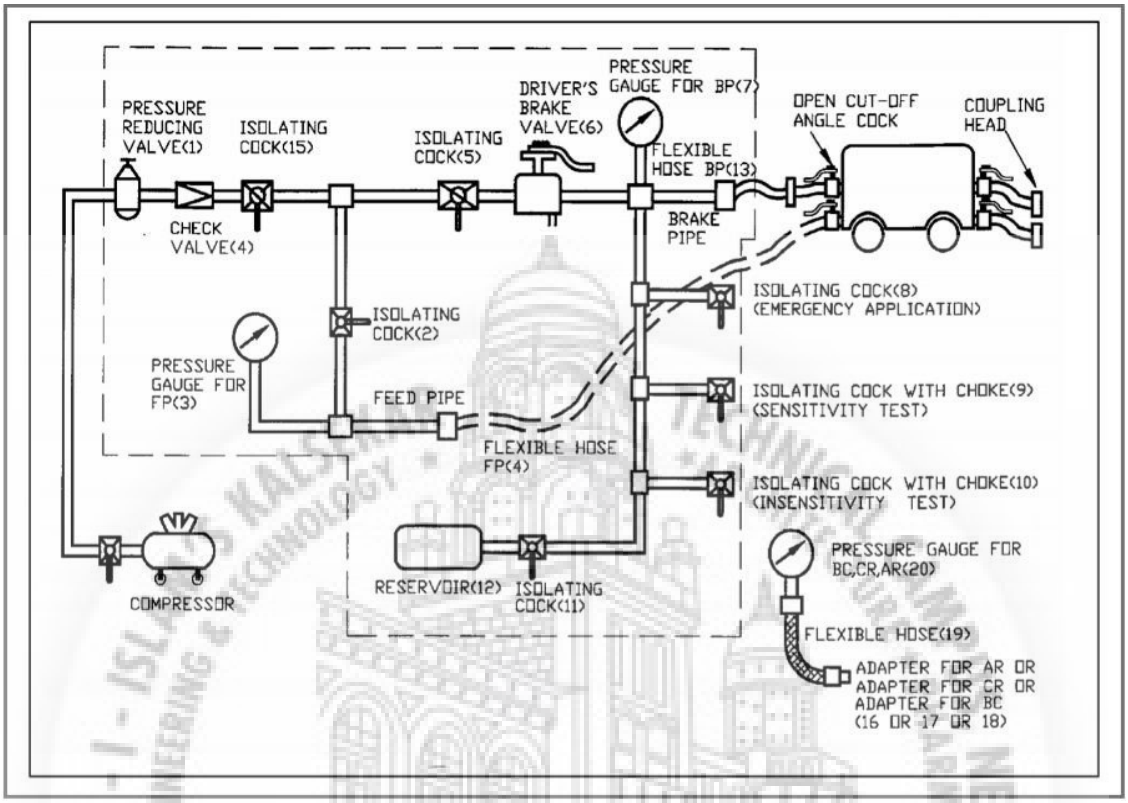


Figure 6.1: 3D Model of Rake Test Rig

6.1 AIR BRAKE RAKE TESTING PROCEDURE:

1. On arrival of the rake on pit line, the BP & FP hose of the test rig is to be coupled to the BP & FP of the hose of the rake. Charge the BP to 5 kg/cm2 & FP to 6kg/cm2.

If the pressure is not building up, then attend the leakage by the application of soap solution & arrest the leakage.

2. After building of pressure in BP & FP, disconnect the test rig BP & FP hose from the rake hoses and open both the angle cocks due to which air pressure will be exhausted in atmosphere break will be applied.

3. After 20 to 25 minutes check the complete rake from one end. Note down the coach no. found with release brake cylinder and check whether AR tank of the coaches is charged or empty. If Air tanks found empty, write empty AR on respective coach no. and if found charge, drain AR tank and pull the manual release of DV to check whether CR tank is charged/empty, if found empty write down empty CR on respective coach number.

Again, connect BP & FP hose of the rake and test rig and charge pressure to 5 kg/cm2 & FP to 6 kg/cm2 respectively.

5. Check the BP & FP gauge in guard van, if pressure not found 5 kg/cm2 & FP to 6 kg/cm2 respectively. Check by fitting master gauge. If still the pressure is not found up 5 kg/cm2 & FP to 6 kg/cm2 respectively. Check and arrest the leakage in the rake till proper pressure is attended.

6. Close the BP & FP angle cock of test rig for 03 minutes and monitor the leakage in both BP & FP which should not be more than 0.6 kg/cm2.

7. Now coach with AR empty & CR empty has to be attended. In coach with AR empty, check the brake cylinder and its pipe line for any leakage, if found leakages arrest/attend the leakage. If no leakage found than NRV is defective, change NRV. In coach with CR empty, check CR tank for any leakage if found leaky attend/arrest, if not found leaky, DV is defective, change the DV.

8. Now drop BP pressure by 1.6 kg/cm2 and start checking the rake from test rig end. Checks whether brakes are applied or not and note down the piston stroke of each cylinder. Adjust the piston stroke if necessary.

(Piston stroke : AG = 60 ±10 mm & AB = 32 mm)

Charge the BP Pressure to 5 kg/cm2 and note down the releasing time of cylinders. The difference should not be more than 10 second. The ‘A’ dimension in A type coaches should be 22 +4/-0, if not found than adjust the same. Check/test all the coach and reach the SLR on the other end.

9. The BP & FP in the SLR of another end should be between 3.2 – 3.4 kg/cm2 and 5.8 – 6.0 kg/cm2 respectively.

If pressure found other than this (i.e. BP 5.8 – 6.0 kg/cm2 and FP 5.8 – 6.0) then there is cross connection of BP & FP, attend the same & ensure pressure in BP 3.2 – 3.4 kg/cm2 and in FP 5.8 – 6.0 kg/cm2.

10. Checks PEASD of the all coach, if any found dummy should be attended.

11. Charge BP to 5.0 kg/cm2 & attend the defects noticed in above 8 & 9 & if required replace the part. Check the attended coach again.

12. After attending all the under-gear examination check the leakage rate again. The leakage in BP & FP should not be more than 0.6 kg/cm2 in 3 minutes.

13. The guard van valve in guard van, on operating the guard van valve handle the BP pressure should drop rapidly and the brake should apply and it is to be ensured that a 8 mm diameter chock is fitted in guard van valve.

14. Drop BP pressure by 1.6 kg/cm2 and check the brake power & ensure 100% brake power in the rake. Charge BP to 5.0 kg/cm2 and check whether the brake cylinders are released or not. If any cylinder found not released then attend the cylinder.

15. Isolate the isolating cock of BP & FP of the test rig and angle cock of BP & FP of the coach. Uncouple both hose pipes and dummy the coach BP & FP hose pipe on the dummy carrier of the coach. Open both the coach. Open both the angle cock of coach and after draining of pressure from both the BP & FP hose.

Release the complete rake by pulling the manual release handle/wire of the DV of each coach and ensure physically complete release of brakes. Also ensure all the BP & FP gauges are calibrated & showing correct reading.

6.2 TESTING OF BRAKE APPLICATIONS USING RAKE TEST RIG:

Rake Test Rig is used for testing the braking system of Train coaches. Since the testing also done for its applications. Various Brakes applications and its testing procedure are explained below.

TESTS:

1. Leakage Test.
2. Sensitivity and Insensitivity Test
3. Brake Application and Release Test.
4. Graduated Application and Release Test.
5. Emergency Brake Application Test.
6. Passenger Emergency Valve Test.
7. Guard emergency valve test.
8. Check and adjust slack adjuster.

Test 1: Leakage Test

- Close cock (5) of the test rig and record the drop in BP pressure for 3 minutes. The drop should not exceed 0.2 kg/cm2 in one minute
- Close FP cock (2) and record the drop. It should not exceed 0.2 kg/cm2 in one minute.
- Joints/connections to sub-assemblies. It should be tested with soap water for ascertaining leakage. Any leakage found should be rectified.

Test 2: Sensitivity and Insensitivity Test:

- Open cocks (2), (5) and (11) of the test rig, to fully charge the system including the reservoir

- Close cock (5) and open cock (9) to reduce the air pressure in the BP choke at the rate of 0.6 kg/cm2 in 6 seconds.
- Check sensitivity by recording the time within which brakes get applied.
- Close cock (9), after the test.
- Open cock (5) and charge the air brake system till brakes are released.
- Check the insensitivity by recording the time within which the brakes do not apply.
- Close cock (10) and (11) of the test rig, after the test.

Test 3: Brake Application and Release Test:

- Open cocks (2) and (5) of the test rig, and charge the system for 5minutes.
- Keep brake application to full-service position by driver's brake valve on the test rig.
- Record the Brake Cylinder (BC) filling time for BC pressure rising from 0 to 3.6 kg/cm2. The filling time should be between 3 to 5 seconds.
- Record the maximum BC pressure when it get stabilized, which should be 3.8 +/-0.1 kg/cm2.
- Record the BC piston stroke and check that brake blocks are binding on wheels. Piston stroke should be between 85 to 130 mm.
- Release the brakes through driver's brake valve by charging the BP to 5kg/cm2, after conducting the test.
- Record the draining time of both the cylinders for BC pressure dropping from 3.8 to 0.4 kg/cm2. This should be between 15 to 20 seconds. The piston should reach initial position and brake blocks should gets released fully.

Test 4 : Graduated Application and Release Test:

- Charge the brake pipe and feed pipe at 5 kg/cm2 and 6 kg/cm2respectively.

- Apply brake in steps by driver's brake valve handle and record the Brake Pipe Pressure (BP) and the Brake Cylinder (BC) pressure.
- BC pressure should rise in steps and BP pressure should decrease in steps.
- Release the brakes in steps by driver's brake valve handle and record the BP and BC pressure.
- BC pressure should decrease in steps and BP pressure should rise in steps. When the BP pressure rises to 4.85 kg/cm2 the BC will get fully released.

Test 5: Emergency Brake Application and Release Test:

- Charge fully the Air Brake system of the coach by opening cock (5) of the test rig.
- Open cock (8) for emergency application.
- Record the Brake Cylinder (BC) pressure and check for any leakage in BC for 5 minutes.
- Pull the manual release handle for a short time (about 10seconds).
- Check BC pressure drops to zero.
- Close cock (8) and open cock (5) of the test rig, after the test is over.

Test 6: Passenger Emergency Valve Test:

- Open cock (5) and (2) of the test rig and charge the brake pipe and feed pipe at 5 kg/cm2 and 6 kg/cm2 respectively.
- Pull the alarm chain from inside the coach.
- Observe alarm disc rotates situated on the end wall.
- Observe air exhaust with hissing sound from (pilot valve) PEASD and PEAV that are connected to the Brake Pipe (BP).
- Observe partial brake gets applied.
- Observe that the Micro/limit switch operates and indication lamp on the coach glows.

- Observe the drop in brake pipe pressure on the test rig.
- Reset the alarm signal disc with the help of resetting key or with the fixed key.
- Hissing sound should stop and brakes should get released.

Test 7: Guard's Emergency Van Valve Test:

- Open cock (5) and (2) of the test rig and charge the brake pipe and feed pipe at 5 kg/cm2 and 6 kg/cm2 respectively.
- Close cock (5) and then operate guard's Valve handle.
- Observe the air from Brake Pipe (BP), exhausts with hissing sound and the brakes in the guard van gets applied depending on exhaust of air.
- Reset the handle and observe the exhaust of air stops. observe and note the drop in BP pressures on test rig.

FULL RAKE TEST RIG TEST REPORT LHB

FULL RAKE TEST RIG TEST REPORT LHB

Date		Time		Shift	
Rack no		Coach type		Tr No	
Operator		Supervisor		DV Type	

PRESSURE AT		
SECTION	SPECIFIED (Kg/cm²)	ACTUAL(Kg/cm²)
Feed Pipe	6	5
Brake Pipe	5	6

TEST DETAILS

ITEM	TEST	SPECIFIED VALUES	ACTUAL VALUES	RESULT	REMARK
1	NRV'S OF ALL COACHES TEST				
1.1	Couple BP & FP hose pipe Of Rake and Rig and charge BP only with FP valve closed	BP = 5.0 kg/cm²			-
		FP = 0.0 kg/cm²			-
2	BRAKE APPLICATION CONDITION				
2.1	Charge BP & FP	BP= 5.0 ± 0.10 kg/cm²			
		FP= 6.0 ± 0.10 kg/cm²			
2.2	Release /Reduce BP & FB Pressure to 0 kg/cm² (25 Minutes)	BP= 0.0 kg/cm²			
		FP= 0 kg/cm²			
2.3	After 25 minutes check each coach if brake is applied or not	All the brakes should be applied condition			
2.4	Check AR tank or CR tank Position filled or empty if any brake cylinder is in released condition	If any fault attend			
3	SEALING TEST(Check the rate of leakage after charging BP &FP)				
3.1	BP Pressure	5.0 kg/cm²			
3.2	FP Pressure	6.0 kg/cm²			
3.3	Close BP & FP valve and check after 3 minutes FP & BP Pressure	BP > 4.4 kg/cm²			
		FP > 5.4 kg/cm²			
4	BRAKE APPLICATION AND SOAP SOLUTION TESTING				
4.1	Charge BP and FP Then Reduce BP from 5.0 to 3.4 kg/cm²	Brake should apply in all coaches			
4.2	Start the leakage checking with the help of soap solution from one end for all parts	Check for Leakage and attend if any			
5	ISOLATING TEST				

5.1	Isolate the isolating cock on Brake panel & check all brake calipers & brake pad of all cylinders	all brake pads should be released simultaneously			
5.2	Brake condition Colour Indication	Green			
5.3	Open the isolating cock on Brake panel & check all brake calipers & brake pad of all cylinders	all Brake cylinder should operate & brakes should apply			
5.4	Brake condition Colour Indication	Red			
6	**CROSS CONNECTION OF BP AND FP LINE CHECK**				
4.3	The BP & FP pressure gauges in the others end power car	BP= 3.4 kg/cm² FP= 6.0 - 0.20 kg/cm²			
7	**FULL BRAKES RELEASE TEST**				
7.1	Charge the BP & FP pressure to 5.0 kg/cm2 & 6.0 kg/cm2 respectively	BP= 5.0 ± 0.10 kg/cm² FP= 6.0 ± 0.10 kg/cm²			
7.2	All coaches should be in released condition	All released			
7.3	Brake condition Colour Indication	Green			
8	**PEASD CHECK (AT LEAST 3 COACHES)**				
8.1	Check PEASD	3 Coach No			
8.2	Brake condition	Applied			
8.3	Brake accelerator	should respond			
9	**EMERGENCY GUARD APPLICATION**				
9.1	Close BP & FP valve andOperate the emergency guard van valve of front power car guard van	BP= 0 kg/cm² Time = 40 to 50 sec			
9.2	Close BP & FP valve andOperate the emergency guard van valve of rear power car guard van	BP= 0 kg/cm² Time = 25 to 30 sec			
10		**GUARD HAND BRAKE CONDITION**			
10.1	Rotate the hand wheel fitted in guard van clockwise	Applied in both cylinder			
10.2	Colour Indication	Red			
10.3	Rotate the hand wheel fitted	Released in both cylinder			

7 CONCLUSION AND FUTURE SCOPE

7.1 Conclusion:

- Computerized Single Car Test Rig has made reports printed in specified formats for records. The data remains stored for easy retrieval later.
- Only one skilled staff required to carry out the Single Car Test unlike manual mode which required team of staff.
- The graduated brake application and release tests are conducted fully automatically with all steps verification and data recording incorporated.
- Manual mode also available.
- Computerized testing reduced the time taken by manual testing.
- It helps to get accurate results of testing which in turn solves accidental situations.

7.2 Future Scope:

This system can be connected into the server with centralized data based i.e. Centralized processing in which a centrally located computer system processes the data. A very powerful computer is needed for the centralized processing for gaining high speed and fast access. All the data get sorted into the centralized data storage.

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