UNIVERSITY OF MUMBAI

ACADEMIC YEAR 2017-2018

A PROJECT REPORT

ON

"DESIGN MODIFICATION OF SHOCK ABSORBER"

Submitted by

BAIG M. NAUMAN

KHAN SAQIB

PATEL TABISH

SOLKAR AAMIR

In partial fulfillment for the award of the Degree

Of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

UNDER THE GUIDANCE

Of

PROF. JAVED KAZI

DEPARTMENT OF MECHANICAL ENGINEERING

ANJUMAN-I-ISLAM

KALSEKAR TECHNICAL CAMPUS NEW PANVEL,

NAVI MUMBAI – 410206

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CERTIFICATE

This is to certify that the project entitled

"DESIGN MODIFICATION OF SHOCK ABSORBER"

Submitted by

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SOLKAR AAMIR

To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by **University of Mumbai**, is approved.

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(Prof. JAVED KAZI)	(Prof.____)
Head of Department	**Principal**
(Prof. ZAKIR ANSARI)	(Dr. Abdul Razzak Honnutagi)

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APPROVAL OF DISSERTATION

This is to certify that the thesis entitled

"DESIGN MODIFICATION OF SHOCK ABSORBER"

Submitted by

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In partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering, as prescribed by University of Mumbai approved.

(Internal Examiner) **(External Examiner)**

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Date: __________

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.

--- (Signature)

---(Name of student and Roll No.)

Date:

ACKNOWLEDGEMENT

After the completion of this work, we would like to give our sincere thanks to all those who helped us to reach our goal. It's a great pleasure and moment of immense satisfaction for us to express my profound gratitude to our guide **Prof. JAVED KAZI** whose constant encouragement enabled us to work enthusiastically. His perpetual motivation, patience and excellent expertise in discussion during progress of the project work have benefited us to an extent, which is beyond expression.

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SINCERE THANKS FROM,

BAIG M. NAUMAN

SOLKAR AAMIR

PATEL TABISH

KHAN SAQIB

PROJECT COMPLETION LETTER

ANJUMAN-I-ISLAM'S
KALSEKAR TECHNICAL CAMPUS, NEW PANVEL
Approved by : All India Council for Technical Education, Council of Architecture, Pharmacy Council of India New Delhi, Recognised by : Directorate of Technical Education, Govt. of Maharashtra, Affiliated to : University of Mumbai.
☑ SCHOOL OF ENGINEERING & TECHNOLOGY
☐ SCHOOL OF PHARMACY
☐ SCHOOL OF ARCHITECTURE
DEPARTMENT OF MECHANICAL ENGINEERING

Date: 21/04/2018

The following students have completed their project in Indian Railways, Matunga Carriage Workshop as a part of partial completion of BE under the supervision of Mr. Mansoor Qadri, HOD, BTC Center.

The name of the students are as follows;

Baig Mohammed Nauman Abdul Aziz.

Solkar Aamir Aleem.

Khan Saquib.

Patel Tabish.

The project completion letter is being delayed due to some in-house reasons. This letter is a provisional certificate for the completion of the project. The original project completion letter will be handed to them by 1st of May 2018.

Anjuman-I-Islam's Kalsekar Technical Campus, New Panvel

SEAL

Project guide
(Prof. JAVED KAZI)

21/05/18

H.O.D MECH. DEPT.
(Prof. ZAKIR ANSARI)

HOD, BTC CENTER
MATUNGA CARRIAGE WORKSHOP
(MR. MANSOOR QADRI)

Innovative Teaching - Exuberant Learning
Vision : To be the most sought after academic, research and practice based department of Mechanical Engineering that others would wish to emulate.

मध्य रेल

दिनांक:- 23/04/2018

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माटुंगा - 400019.

संख्या-बी.टी.सी./माटुंगा/ग्रेज्यूएट अप्रेंटिस/10

प्रति,
मुख्य कारख़ाना प्रबंधक कार्यालय
मध्य रेल, माटुंगा।

विषय – प्रोजेक्ट प्रशिक्षण पूर्ण करने हेतु
संदर्भ – आप के कार्यालय के पत्र संख्या:- MTN/EM/E1/R&T/07 दि.:- 05/08/2017.

संदर्भित पत्र अनुसार निम्नलिखित ANJUMAN-I-ISLAM's KALSEKAR TECHNICAL CAMPUS, NEW PANVEL के प्रोजेक्ट स्टूडेंट्स का प्रशिक्षण अवधि दिनांक 05/08/2017 से 27/01/2018 तक है और उन्होंने यह प्रोजेक्ट दिनांक 23/04/2018 को पूर्ण किया है। उन्हे आज दिनांक 23/04/2018 को कार्यकाल के बाद बुनियादी प्रशिक्षण केंद्र (यां) से कार्य मुक्त किया जा रहा है।

क्रमांक	प्रशिक्षु का नाम	रिमार्क
1.	BAIG NAUMAN	पुर्ण किया
2.	AAMIR SOLKAR	पुर्ण किया
3.	KHAN SAQIB	पुर्ण किया
4.	TABISH PATEL	पुर्ण किया
5.		

कृपया यह आप के सूचनार्थ एवं आवश्यक कार्यवाही हेतु।

टिप्पणी : इन्होने अपना एक प्रोजेक्ट रिपोर्ट, बी.टी.सी.(यांत्रिक) में **जमा किया / ~~नहीं किया~~** है।

मुख्य प्रशिक्षक
बी.टी.सी.(यां)

मुख्य प्रशिक्षक Chief Instructor
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ABSTRACT

This project on the Design Modification of Gabriel Shock Absorbers was carried out at the Matunga Railway Carriage Workshop. The purpose of the project is to increase the lifespan of the shock absorbers by implementing a more efficient design than the present one. This will also ensure lower maintenance cost and greater damping effect. It was found that the shock absorber used to accumulate water in its previous design leading to corrosion and reducing of its lifespan. All the other methods of corrosion resistance were considered and change in design was found most suitable. The modified design ensures that the accumulation does not occur and better damping effects. Detailed design and analysis of both the designs and complete stress analysis of the shock absorbers is given.

Table of Content

ABOUT INDIAN RAILWAYS

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 railway traverse through the length and width of the country, the routes cover a total length of 63,940km (39,230miles). As of 2005 IR owns a total 216,717wagons &7,339 & coaches & above and 7,339 & above locomotives and run a total of 14,244, trains & above daily, including about 8,002 passengers trains & above.

Railways were first introduced to India in1853. By 1947, the year of India's independence, there were forty-two rail systems. In 1951 the system was nationalized as one unit, becoming one of the largest network in the world. Indian railway operates both long distance and the suburban rail systems,

A commemorative postage stamp issued by the Indian postal service celebrated 100 year of the Indian railway in 1953

Indian Railways	
Headquarters	New Delhi
Railway Minister	Piyush Goyal
Network	67,368 km(route) 93902km(running track) 121407km(total track)
Foundation	1845-present
Track gauges	Broad meter, narrow
Revenue	INR 467.85 billion
Chairman Railway Board	Ashwani Lohani

Figure: About Indian Railways

A plan for a rail system in India was first put forward in1832, but no further steps were taken for more than a decade. In 1844, the governor- general of India. Lord Hardinge allowed 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 passenger train service was inaugurated between Boribunder Bombay and Thana. 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 investors under a 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. The route mileage of this network was about 14,500km (9,000) miles by 1880, mostly radiating inward from the three major cities of Bombay, madras and Calcutta .by 1895, India had started its own locomotives and in 1896 sends 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 commerce 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.

	Name	Abbr.	Headquarters	Divisions
1	Central Railway	CR	Mumbai	Bhusawal, Nagpur, Mumbai (CST), Solapur, Pune
2	Eastern Railway	ER	Kolkata	Malda, Howrah, Sealdah, Asansol
3	East Central Railway	ECR	Patna	Danapur, Dhanbad, Sonepur, Mughalasarai, Samastipur
4	East Coast Railway	ECOR	Bhubaneswar	Khurda road, Waltair, Sambalpur
5	Northern Railway	NR	New Delhi	Ambala, Ferozpur, Lucknow, Moradabad, New Delhi
6	North Central railway	NCR	Allahabad	Allahabad, Jhansi, Agra
7	North Western Railway	NWR	Jaipur	Bikaner, Jodhpur, Jaipur, Ajmer
8	North Eastern Railway	NER	Gorakhpur	Lucknow, Varanasi, Izatnagar
9	Northeast Frontier Railway	NFR	Maligaon(Guwahati)	Katihar, Lumding, Tinsukhia, Alipurduar, Rangiya
10	Southern Railway	SR	Chennai	Chennai, Madurai, Palghat,
11	South Central Railway	SCR	Secunderabad	Secunderabad, Hyderabad, Guntakal, Vijayawada Guntur, Nanded
12	South Eastern Railway	SER	Kolkata	Kharagpur, Chakradharpur Adra, Ranchi
13	South East Central Railway	SECR	Bilaspur	Nagpur, Bilaspur, Raipur
14	South Western Railway	SWR	Hubli	Bangalore, Mysore, Hubli
15	Western Railway	WR	Mumbai	Bhavnagar, Mumbai Cental, Ratlam, Rajkot, Vadodara, Ahemadabad
16	West Central Railwasy	WCR	Jabalpur	Jabalpur, Bhopal, Kota.
17	Metro Railway	MTP	Kolkata	
18	Konkan Railway	KR	Navi Mumbai	

Table: Zonal details

Introduction of Matunga Railway

The Carriage Workshop, Matunga was set up in 1915 as a repair workshop for broad gauge and narrow gauge coaches and wagons of the erstwhile Great Indian Peninsular (GIP) Railway. The workshop covers a triangular piece of land/area of 35 hectares, including a covered area of about 11 hectares, skirted by the Central Railway suburban corridors on the east and the Western Railway corridors on the west.

The workshop now carries out Periodical Overhaul (POH) and heavy corrosion repairs of main line as well as EMU coaches. Last year i.e. in 2009-10, a total of 3182 coaches consisting of 2207 Non AC, 341 AC coaches and 634 EMU coaches were attended. For the year 2010-11 target is 1884 Non AC, 360AC and 720 EMU coaches.

The workshop is certified with ISO 9001/2000 and ISO 14001/1996 since 2001 & 2002 respectively. It was last recertified for ISO 9001-2000 in 2007 & ISO 1400-2004 in 2008.

Now this workshop is going one step ahead to adopt Integrated Management System covering ISO: 9000, ISO: 14000 & ISO: 18000 (Occupational Health and Safety Assessment Series). The system is likely to be implemented by July 2011.

Figure: Matunga railway station

Matunga: Mumbai's First "All-Women" Railway Station Enters Limca Book

Matunga station chugs into record book for being India's 1st all-women staffed station

Carriage Workshop, Central Railway, Matunga

The Carriage Workshop, Matunga was set up in 1915 as the repair workshop for broad gauge and narrow gauge coaches and wagons of the erstwhile Great Indian Peninsula (GIP) Railway. The covers the triangular piece of the land/area of 35 hector, including a covered area of about 11 hectares, skirted by the Central Railway Suburban Corridors on the east and Western Railway corridors on the west. The strength of the employee is not more than 8200 approx. The total no. of section is about 33 including 07 no. of electrical. The total no. of the machinery plant is about 1161. The consumption of electricity is about 6,00,000 unit per month.

Main activities for the year 2017-18

ACTIVITIES	TARGET(Per Month)
POH of Mail/Express/Passenger Coaches	203 Coaches per month including 33 AC coaches per month
POH of EMU Coaches	68 Coaches per month
Total No. of Coaches	271 Coaches per month

Table: Main activities 2016-17

A Few Firsts of Matunga Workshop

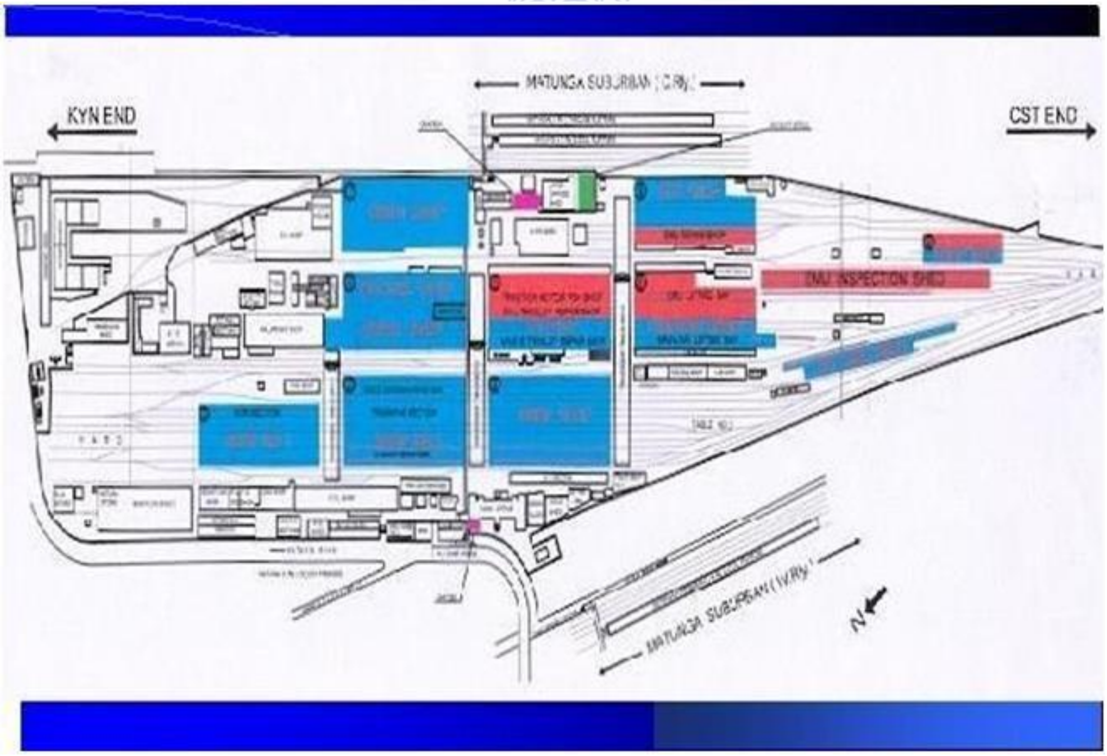
<u>Retro fitment of flooring in lavatories of passenger with non-toxic in-situ floor:</u>

In order to improve cleanliness and hygiene of the toilets in coaches. Epoxy flooring is being provided. Matunga is the first Zonal workshop on the Indian Railway to start Epoxy flooring in the toilets on a programmed basis since September 2010.

<u>Provision of cushioned seats in all gs/slr coaches during poh has been carried out:</u>

First Zonal workshop on Indian Railways to start cushioning in unreserved coaches from October 2008.

- First Zonal Workshop on Indian Railways to provide all coaches with Bogie mounted Air Brake System by the end of Jan 2011. The bogie mounted brake system is not only more reliable but also gives faster braking and release of brakes thus making the trains faster.
- First workshop to implement payment to contractors and suppliers through NEFT from 15th July 2010.
- First Zonal Workshop on Indian Railways to start cleaning of bogies by Grit Blasting in 2004. This has improved the safety standards of Rolling stock by enabling better examination.
- This workshop is awarded by ISO 9001:2004 as well as ISO 14001:1996 in 2001 & 2002 respectively.
- IMS (Integrated Management System) Certification in 2015.
- IMS, ISO 50001, ISO 3834, 5S and GreenCo.



Matunga Workshop Layout

❖ Notable Accomplishments:

- Coaches for Heritage Special.
- Lifeline Express.
- Deccan Odyssey.
- Retro fitment of DC to AC/DC EMU (Siemens).

❖ Innovations by Matunga Workshop:

- Headstock Manipulator and Fixture.
- Gravity Conveyor System.
- Motorized Bearing and Axle Box Extraction System.
- Roof Leakage Testing by sprinkling water on the Roof.
- BSS/Brake Block Hanger Testing and Painting Integrated Workstations.
- Provision of Venturi type Ventilators and Relocating body side windows of kitchen area.
- Provisions of Model Room for ERRU training.
- Commissioning Variable Voltage Variable Frequency Drive on alternator testing beds.
- Regular Training of Matunga Staff at Basic Training Center.
- Safety.

❖ Processes Involved in Carriage Repair Workshop:

POH (Periodic Overhaul) - 18 days process

Steps for POH:

1. Receiving the coach from yard: The coach to be repaired is received from the yard. 1 car means 8 coaches

2. Shunting of coach: Each coach to be separated into two parts:

A. Shell

B. Trolley

3. Pre-inspection and cleaning under frame as well as water tank attention:
Parts to be repair are and the under frame along with water tank are also cleaned.

4. Unloading of mechanical and electrical component:

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 trolley shop:

The parts of the trolley are further sub-divider into 3 sections:

A. Wheel to and fro wheel shop: Here the wheel is repaired by first checking its diameter which should not be less than 830mm.

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.

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

7. A newly repaired bogey is obtained

8. Lowering the coach:

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

9. Painting:

10. 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, walkthrough etc.

12. Loading and unloading of mechanical components: 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 train examiner):

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

15. Dispatch to traffic:

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

CHAPTER 1

INTRODUCTION

Introduction

A shock absorber (in reality, a shock "damper") is a mechanical or hydraulic device designed to absorb and damp shock impulses. It does this by converting the kinetic energy of the shock into another form of energy (typically heat) which is then dissipated. Most shock absorbers are a form of dashpot (a damper which resists motion via viscous friction).

Pneumatic and hydraulic shock absorbers are used in conjunction with cushions and springs. An automobile shock absorber contains spring-loaded check valves and orifices to control the flow of oil through an internal piston.

One design consideration, when designing or choosing a shock absorber, is where that energy will go. In most shock absorbers, energy is converted to heat inside the viscous fluid. In hydraulic cylinders, the hydraulic fluid heats up, while in air cylinders, the hot air is usually exhausted to the atmosphere. In other types of shock absorbers, such as electromagnetic types, the dissipated energy can be stored and used later. In general terms, shock absorbers help cushion vehicles on uneven roads.

Vehicle suspension

In a vehicle, shock absorbers reduce the effect of traveling over rough ground, leading to improved ride quality and vehicle handling. While shock absorbers serve the purpose of limiting excessive suspension movement, their intended sole purpose is to damp spring oscillations. Shock absorbers use valving of oil and gasses to absorb excess energy from the springs. Spring rates are chosen by the manufacturer based on the weight of the vehicle, loaded and unloaded. Some people use shocks to modify spring rates but this is not the correct use. Along with hysteresis in the tire itself, they damp the energy stored in the motion of the unspring weight up and down. Effective wheel bounce damping may require tuning shocks to an optimal resistance.

Spring-based shock absorbers commonly use coil springs or leaf springs, though torsion bars are used in torsional shocks as well. Ideal springs alone, however, are not shock absorbers, as springs only store and do not dissipate or absorb energy. Vehicles typically employ both hydraulic shock absorbers and springs or torsion bars. In this combination, "shock absorber" refers specifically to the hydraulic piston that absorbs and dissipates vibration. Now, composite suspension system are used mainly in 2 wheelers and also leaf spring are made up of composite material in 4 wheelers.

1.1. Early history

In common with carriages and railway locomotives, most early motor vehicles used leaf springs. One of the features of these springs was that the friction between the leaves offered a degree of damping, and in a 1912 review of vehicle suspension, the lack of this characteristic in helical springs was the reason it was "impossible" to use them as main springs.[2]However the amount of damping provided by leaf spring friction was limited and variable according to the conditions of the springs, and whether wet or dry. It also operated in both directions. Motorcycle front suspension adopted coil sprung Druid forks from about 1906, and similar designs later added rotary friction dampers, which damped both ways - but they were adjustable (e.g. 1924 Webb forks). These friction disk shock absorbers were also fitted to many cars.

One of the problems with motor cars was the large variation in sprung weight between lightly loaded and fully loaded, especially for the rear springs. When heavily loaded the springs could bottom out, and apart from fitting rubber 'bump stops', there were attempts to use heavy main springs with auxiliary springs to smooth the ride when lightly loaded, which were often called 'shock absorbers'. Realizing that the spring and vehicle combination bounced with a characteristic frequency, these auxiliary springs were designed with a different period, but were not a solution to the problem that the spring rebound after striking a bump could throw you out of your seat. What was called for was damping that operated on the rebound.

Although C.L. Horock came up with a design in 1901 that had hydraulic damping, it worked in one direction only. It does not seem to have gone into production right away, whereas mechanical dampers such as the Gabriel Snubber started being fitted in the late 1900s (also the similar Stromberg Anti-Shox). These used a belt coiled inside a device such that it freely wound in under the action of a coiled spring, but met friction when drawn out. Gabriel Snubbers were fitted to an 11.9HP Arrol-Johnston car which broke the 6 hour Class B record at Brooklands in late 1912, and the Automotor journal noted that this snubber might have a great future for racing due to its light weight and easy fitment.[3]

One of the earliest hydraulic dampers to go into production was the Telesco Shock Absorber, exhibited at the 1912 Olympia Motor Show and marketed by Polyrhoe Carburettors Ltd.[3] This contained a spring inside the telescopic unit like the pure spring type 'shock absorbers' mentioned above, but also oil and an internal valve so that the oil damped in the rebound direction. The Telesco unit was fitted at the rear end of the leaf spring, in place of the rear spring to chassis mount, so that it formed part of the springing system, albeit a hydraulically damped part.[4] This layout was presumably selected as it was easy to apply to existing vehicles, but it meant the hydraulic damping was not applied to the action of the main leaf spring, but only to the action of the auxiliary spring in the unit itself.

The first production hydraulic dampers to act on the main leaf spring movement were probably those based on an original concept by Maurice Houdaille patented in 1908 and 1909. These used a lever arm which moved hydraulically damped vanes inside the unit. The main advantage over the friction disk dampers was that it would resist sudden movement but allow slow movement, whereas the rotary friction dampers tended to stick and then offer the same resistance regardless of speed of movement. There appears to have been little progress on commercialising the lever arm shock aborbers until after World War I, after which they came into widespread use, for example as standard equipment on the 1927 Ford Model A (see Lever arm shock absorber).

1.2. Types of vehicle shock absorbers

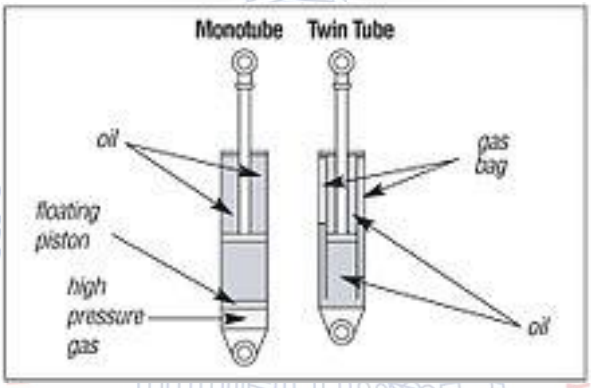


Diagram of the main components of a twin-tube and mono-tube shock absorber

Most vehicular shock absorbers are either twin-tube or mono-tube types with some variations on these themes.

Twin-tube

Basic twin-tube

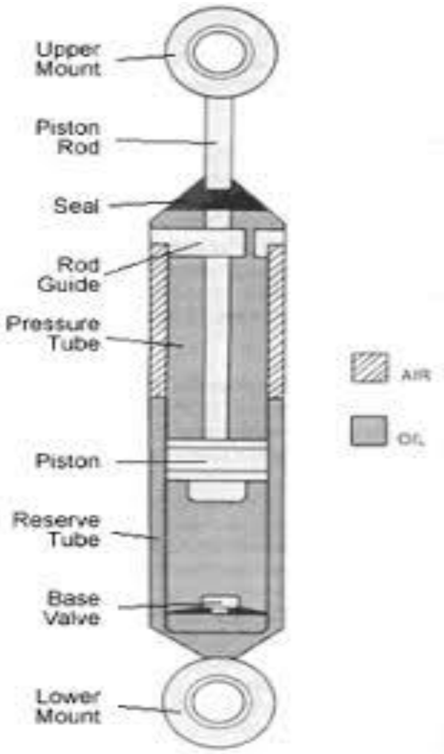
Also known as a "two-tube" shock absorber, this device consists of two nested cylindrical tubes, an inner tube that is called the "working tube" or the "pressure tube", and an outer tube called the "reserve tube". At the bottom of the device on the inside is a compression valve or base valve. When the piston is forced up or down by bumps in the road, hydraulic fluid moves between different chambers via small holes or "orifices" in the piston and via the valve, converting the "shock" energy into heat which must then be dissipated.

Twin-tube gas charged

Variously known as a "gas cell two-tube" or similarly-named design, this variation represented a significant advancement over the basic twin-tube form. Its overall structure is very similar to the twin-tube, but a low-pressure charge of nitrogen gas is added to the reserve tube. The result of this alteration is a dramatic reduction in "foaming" or "aeration", the undesirable outcome of a twin-tube overheating and failing which presents as foaming hydraulic fluid dripping out of the assembly. Twin-tube gas charged shock absorbers represent the vast majority of original modern vehicle suspensions installations.

Position sensitive damping

Often abbreviated simply as "PSD", this design is another evolution of the twin-tube shock. In a PSD shock absorber, which still consists of two nested tubes and still contains nitrogen gas, a set of grooves has been added to the pressure tube. These grooves allow the piston to move relatively freely in the middle range of travel (i.e., the most common street or highway use, called by engineers the "comfort zone") and to move with significantly less freedom in response to shifts to more irregular surfaces when upward and downward movement of the piston starts to occur with greater intensity (i.e., on bumpy sections of roads— the stiffening gives the driver greater control of movement over the vehicle so its range on either side of the comfort zone is called the "control zone"). This advance allowed car designers to make a shock absorber tailored to specific makes and models of vehicles and to take into account a given vehicle's size and weight, its maneuverability, its horsepower, etc. in creating a correspondingly effective shock.



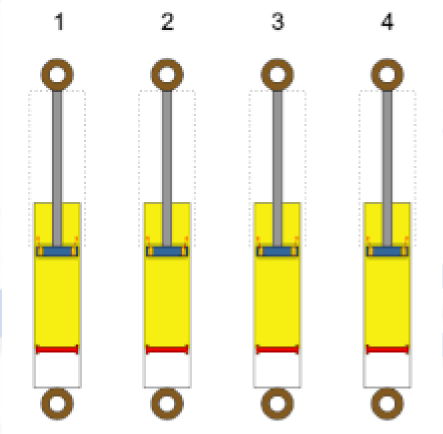
Acceleration sensitive damping

The next phase in shock absorber evolution was the development of a shock absorber that could sense and respond to not just situational changes from "bumpy" to "smooth" but to individual bumps in the road in a near instantaneous reaction. This was achieved through a change in the design of the compression valve, and has been termed "acceleration sensitive damping" or "ASD". Not only does this result in a complete disappearance of the "comfort vs. control" tradeoff, it also reduced pitch during vehicle braking and roll during turns. However, ASD shocks are usually only available as aftermarket changes to a vehicle and are only available from a limited number of manufacturers.

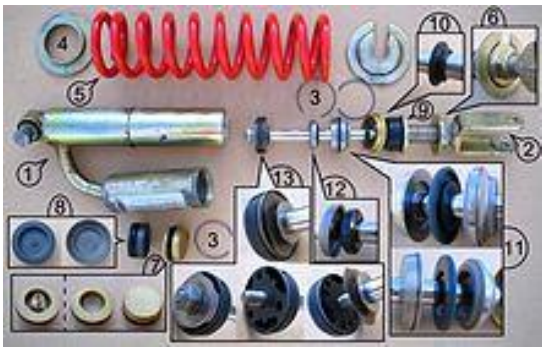
Coilover

Coilover shock absorbers are usually a kind of twin-tube gas charged shock absorber inside the helical road spring. They are common on motorcycle and scooter rear suspensions, and widely used on front and rear suspensions in cars.

Mono-tube



Hydraulic shock absorber monotube in different operational situations:
1) Drive slow or adjustments open
2) Like "1", but extension immediately after the compression
3) Drive fast adjustments or closed, you can see the bubbles of depression, which can lead to the phenomenon of cavitation
4) Like "3", but the extension immediately after the compression
Note: The volume change caused by the stem is considered.



Absorber with gas tank connected rigidly, compared to most shock absorbers. It uses a diaphragm instead of a membrane, and does not contain a control valve for expansion of the pneumatic chamber.

Description:

1) Sheath and gas tank
2) Stem
3) Snap rings
4) Plate bearing spring
5) Spring
6) End cap and preload adjustment
7) Cap gas, present in versions both with or without gas valve (inverted profile)
8) Mobile diaphragm
9) Pad switch (compression)
10) Wiper
11) Oil seal assembly, and shock seal
12) Negative buffer pad or limit switch (extension)
13) Piston with sliding blades and seal

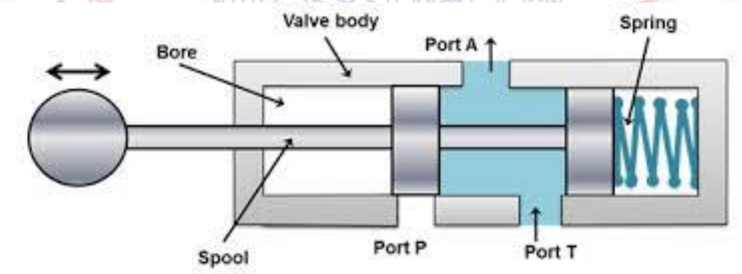
The principal design alternative to the twin-tube form has been the mono-tube shock absorber which was considered a revolutionary advancement when it appeared in the 1950s. As its name implies, the mono-tube shock, which is also a gas-pressurized shock and also comes in a coilover format, consists of only one tube, the pressure tube, though it has two pistons. These pistons are called the working piston and the dividing or floating piston, and they move in relative synchrony inside the pressure tube in response to changes in road smoothness. The two pistons also completely separate the shock's fluid and gas components. The mono-tube shock absorber is consistently a much longer overall design than the twin-tubes, making it difficult to mount in passenger cars designed for twin-tube shocks. However, unlike the twin-tubes, the mono-tube shock can be mounted either way— it does not have any directionality.[5] It also does not have a compression valve, whose role has been taken up by the dividing piston, and although it contains nitrogen gas, the gas in a mono-tube shock is under *high* pressure (260-360 p.s.i. or so) which can actually help it to support some of the vehicle's weight, something which no other shock absorber is designed to do.[6]

Mercedes became the first auto manufacturer to install mono-tube shocks as standard equipment on some of their cars starting in 1958. They were manufactured by Bilstein, patented the design and first appeared in 1954s.[7] Because the design was patented, no other manufacturer could use it until 1971 when the patent expired.

Spool valve

Spool valve dampers are characterized by the use of hollow cylindrical sleeves with machined-in oil passages as opposed to traditional conventional flexible discs or shims.[8] Spool valving can be applied with monotube, twin-tube, and/or position-sensitive packaging, and is compatible with electronic control.[9]

Primary among benefits cited in Multimatic's 2010 patent filing is the elimination of performance ambiguity associated with flexible shims, resulting in mathematically predictable, repeatable, and robust pressure-flow characteristics.[10] Multimatic also claims damper-to-damper manufacturing variance within two percent in the case of volume production dampers, and under one percent in the case of hand-built racing dampers, as compared to contemporary industry variance of up to twelve percent for shim-type units.[11] As such, Multimatic DSSV dampers have become series-mandated to ensure equality among teams in multiple pro-level racing championships.



The concept was first applied by Newman/Haas Racing during their championship-winning 2002 CART ChampCar season[14], and quickly spread to sports car racing and British Formula 3[15], and eventually to Formula 1, notably with Red Bull Racing during their consecutive championship-winning seasons from 2010 to 2014[16]. Multimatic's DSSV line of spool-valve dampers remains a popular choice among teams competing in international-level endurance racing, eventually equipping nearly half the field at the 24 Hours of Le Mans.[16]

Following the design's initial racing success, Multimatic DSSV dampers have been adopted for use on select high-performance road cars including Aston Martin One-77 and Vulcan, Mercedes AMG-GT, Ford GT, and Chevrolet Camaro Z/28. A position-sensitive variant was also devised for GM's Colorado ZR2 off-road pickup.

1.3. Special features

Some shock absorbers allow tuning of the ride via control of the valve by a manual adjustment provided at the shock absorber.

In more expensive vehicles the valves may be remotely adjustable, offering the driver control of the ride at will while the vehicle is operated.

Additional control can be provided by dynamic valve control via computer in response to sensors, giving both a smooth ride and a firm suspension when needed, allowing ride height adjustment or even ride height control.

Ride height control is especially desirable in highway vehicles intended for occasional rough road use, as a means of improving handling and reducing aerodynamic drag by lowering the vehicle when operating on improved high speed roads.

1.4. PROBLEM DEFINATION

Disf-unctioning of shock absorber due to leakage of oil at the cylinder neck due to corrosion.

Corrosion occurs due to faulty design of neck which accumulates water.

CHAPTER 2

LITERATURE

REVIEW

1. Literature Review

Electronic System Monitors Damper Force For High Speed Trains……….[1]

Author: Jan Willem Kars

September 1998

Abstract

The authors describe methods for continuous electronic detection and monitoring of the accelerations arising in bogies and of the motions, speeds and forces occurring at the anti-hunting devices of high-speed trains. The monitoring system makes it possible to continuously check the dampers for proper functioning, thus ensuring safe operation of the vehicles at high speeds, reducing maintenance costs and allowing any impaired damper performance to be identified at an early stage before it results in a measurable deterioration of smooth bogie running.

Intelligent damping: Condition monitoring of railway shock absorbers………..[2]

Author: Wojciech Poprawski, Wroclaw University of Science and Technology

Abstract

The study on the application of the neural networks to the KONI condition monitoring system of the railway shock absorbers is presented. The principle of the system has been presented in April 1998 in Graz. One type of railway shock absorbers-the anti-yaw damper-is extremely important in safety of high speed trains, as they are responsible for the bogie's stability. The paper describes the development of the condition monitoring system, from the choice of the on-line measured quantities to the decision making system which alerts the vehicle control system. The back-propagation artificial neural network has been chosen. The application of the on-line condition monitoring system will enable to increase safety of the high speed trains as well as reduce maintenance costs and service time of the trains.

Corrosion in high-temperature and super critical water and aqueous solutions…[3]

Author: Peter Kritzer

Volume 29, Issues 1–2, April 2004,

In this paper, some of the common corrosion phenomena and describe the predominant corrosion mechanisms in high-temperature and super critical water. Corrosion in aqueous systems up to super critical temperatures is determined by several solution-dependent and material-dependent factors. Solution-depending factors are the density, the temperature, the pH value, and the electrochemical potential of the solution, and the aggressiveness of the attacking anions. Material-dependent parameters include alloy composition, surface condition, material purity, and heat treatment. Corrosion phenomena that are observed include inter granular corrosion, pitting, general corrosion, and stress corrosion cracking. The solubility and dissociation of both attacking species and corrosion products play the most important role for corrosion in high-temperature water.

Protection of mild steel corrosion with Schiff bases in 0.5 M H2SO4 solution…….[4]

Author: Mir Ghasem Hosseini

Abstract

Three new Schiff bases, viz., N,N′-ethylen-bis (salicylidenimine) [S1], N,N′-isopropylien-bis (salicylidenimine) [S2], and N-acetylacetone imine, N′-(2-hydroxybenzophenone imine) ortho-phenylen [S3] have been investigated as corrosion inhibitors for mild steel in 0.5 M H2SO4 using Tafel polarization and electrochemical impedance spectroscopy (EIS). The three Schiff bases function as good inhibitors reaching inhibition efficiencies of ~97–98% at 300 ppm concentration. The fraction of the metal surface covered by the inhibitor is found to increase with inhibitor concentration. Of the three Schiff bases, the S2 shows better efficiency than the other two Schiff bases. The adsorption of the inhibitor follows Langmuir isortherm. Thermodynamic calculations indicate the adsorption to be physical in nature.

Corrosion protection of mild steel by electroactive polyaniline coatings…………[5]

Author: J.Y.Lee, Volume 88, Issue 3, 15 June 1997

Abstract

The ability of polyaniline (PANi) to act as a protective coating for mild steel corrosion in saline and acid was investigated by electrochemical impedance spectroscopy. The impedance behaviour is best explained by a mediated redox reaction in which PANi passivates the metal surface and reoxidizes itself by dissolved oxygen. The effectiveness of such a process, which also provides the repassivation of damaged films, is greater in acids. The performance of PANi is further enhanced by the presence of a top coat to increase the diffusional resistance for the corrosion species.

Low-temperature atomic layer deposition of Al2O3 thin coatings for corrosion protection of steel: Surface and electrochemical analysis………[6]

Author: Andrade.C.Alonso

Volume 53, Issue 6, June 2011.

In this paper, Surface analysis shows a thickness-independent Al2O3 psychometric of the coating and trace contamination by the growth precursors. The buried coating/alloy interface has iron oxide formed in ambient air and/or resulting from the growth of spurious traces in the initial stages of deposition. Electrochemical analysis yields an exponential decay of the coating porosity over four orders of magnitude with increasing thickness, achieved by sealing of the more defective .

Corrosion in high-temperature and super critical water and aqueous solutions….[7]

Author: Peter Kritzer

Volume 29, Issues 1–2, April 2004,

In this paper, some of the common corrosion phenomena and describe the predominant corrosion mechanisms in high-temperature and super critical water. Corrosion in aqueous systems up to super critical temperatures is determined by several solution-dependent and material-dependent factors. Solution-depending factors are the density, the temperature, the pH value, and the electrochemical potential of the solution, and the aggressiveness of the attacking anions. Material-dependent parameters include alloy composition, surface condition, material purity, and heat treatment. Corrosion phenomena that are observed include inter granular corrosion, pitting, general corrosion, and stress corrosion cracking. The solubility and dissociation of both attacking species and corrosion products play the most important role for corrosion in high-temperature water.

Design of electromagnetic shock absorbers……………………[8]

Author: KOENRAAD REYBROUCK

September 2006, Volume 3, Issue 3

In this paper, energy in conventional shock absorbers gets dissipated as heat and is not used in any way. Regenerative electromagnetic shock absorbers provide a means for recovering the energy dissipated in shock absorbers. Two configurations of regenerative electromagnetic shock absorber have been developed for this purpose: a linear device and a rotary device. Performance of these shocks in a laboratory test stand and in a small all terrain vehicle is described.

<u>Evaluation of Shock Absorber Models</u>……………….[9]

Author: STEFAAN DUYM, RANDY STIENS

Published online: 27 Jul 2007

In this paper, The ability of the models to match experimental data is emphasized. Two physical models are presented that are able to extract the internal valve parameters from data without hysteresis. In order to implement a model that copes with hysteresis, most models require the numerical solution to a set of nonlinear differential equations. The use of an alternative restoring force method can get round the time consuming iterative simulation and identification routines. The alternative non-parametric method models the force as a function of velocity and acceleration. The theoretical relevance of the model is studied. Corrosion protection using polyanujne coating formulations.

CHAPTER 3

DESIGN AND ANALYSIS

Stress Analysis Report

AUTODESK

Analyzed File:	Assembly Modified
Autodesk Inventor Version:	2015 (Build 190159000, 159)
Creation Date:	13-04-2018, 16:58
Simulation Author:	Nauman
Summary:	

⊟ Summary

Author	Nauman

⊟ Project

Part Number	Assembly Modified
Designer	Nauman
Cost	₹ 0.00
Date Created	13-04-2018

⊟ Status

Design Status	WorkInProgress

⊟ Physical

Mass	0.355688 kg
Area	139506 mm^2
Volume	355688 mm^3
Center of Gravity	x=-11.5367 mm y=-95.0818 mm z=98.1475 mm

Note: Physical values could be different from Physical values used by FEA reported below.

⊟ Simulation:1

General objective and settings:

Design Objective	Single Point
Simulation Type	Static Analysis
Last Modification Date	13-04-2018, 16:58
Detect and Eliminate Rigid Body Modes	No
Separate Stresses Across Contact Surfaces	No
Motion Loads Analysis	No

Mesh settings:

Avg. Element Size (fraction of model diameter)	0.1
Min. Element Size (fraction of avg. size)	0.2
Grading Factor	1.5
Max. Turn Angle	60 deg
Create Curved Mesh Elements	No
Use part based measure for Assembly mesh	Yes

Material(s)

Name	Steel, High Strength, Low Alloy	
General	Mass Density	7.85 g/cm^3
	Yield Strength	275.8 MPa
	Ultimate Tensile Strength	448 MPa
Stress	Young's Modulus	200 GPa

	Poisson's Ratio	0.287 ul
	Shear Modulus	77.7001 GPa
Part Name(s)	cap Part1 mota	

⊟ **Force:1**

Load Type	Force
Magnitude	10000.000 N
Vector X	0.000 N
Vector Y	10000.000 N
Vector Z	0.000 N

⊟ Selected Face(s)

⊟ Fixed Constraint:1

Constraint Type	Fixed Constraint

Selected Face(s)

⊟ Contacts (Bonded)

Name	Part Name(s)
Bonded:1	cap:1 Part1

Results

⊟ Reaction Force and Moment on Constraints

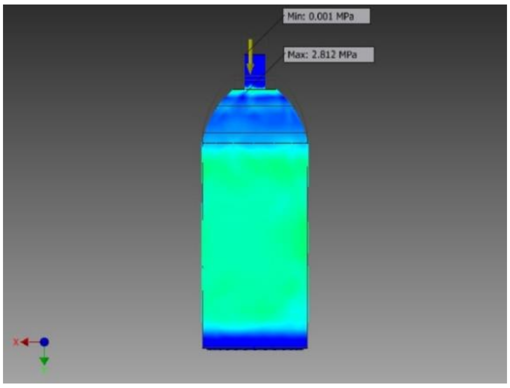
Constraint Name	Reaction Force		Reaction Moment	
	Magnitude	Component (X,Y,Z)	Magnitude	Component (X,Y,Z)
Fixed Constraint:1	1000 N	0 N	0 N m	0 N m
		-1000 N		0 N m
		0 N		0 N m

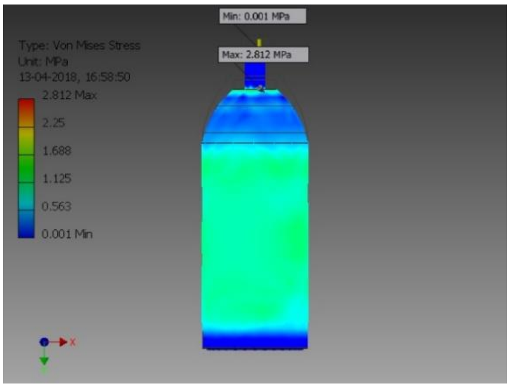
Result Summary

Name	Minimum	Maximum
Volume	355688 mm^3	
Mass	2.79215 kg	
Von Mises Stress	0.000739719 MPa	2.81216 MPa
1st Principal Stress	-1.40806 MPa	1.33153 MPa
3rd Principal Stress	-3.1309 MPa	0.233575 MPa
Displacement	0 mm	0.00185844 mm
Safety Factor	15 ul	15 ul
Stress XX	-2.93163 MPa	1.17799 MPa
Stress XY	-0.950289 MPa	0.936673 MPa
Stress XZ	-0.691145 MPa	0.634424 MPa
Stress YY	-2.05736 MPa	1.25605 MPa
Stress YZ	-0.918985 MPa	1.03186 MPa
Stress ZZ	-2.70595 MPa	1.18746 MPa

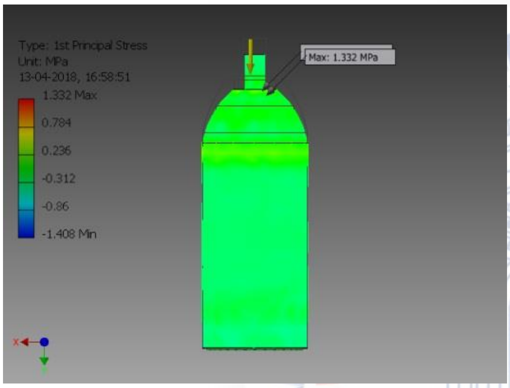
Figures

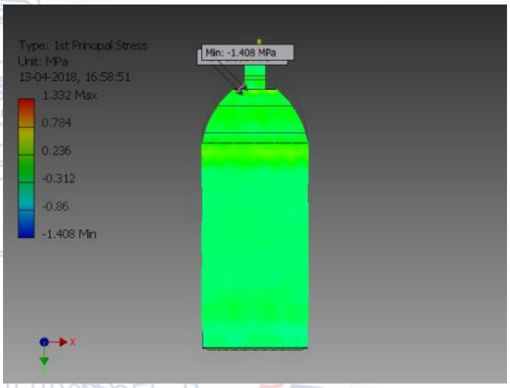
⊟ Von Mises Stress



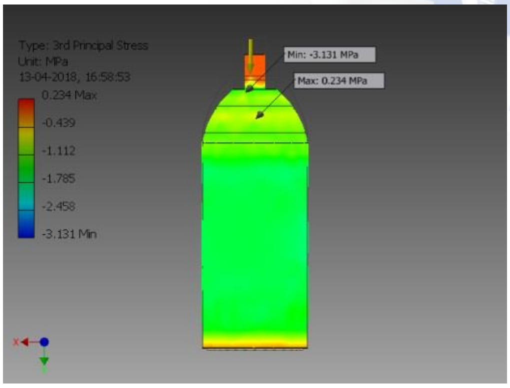


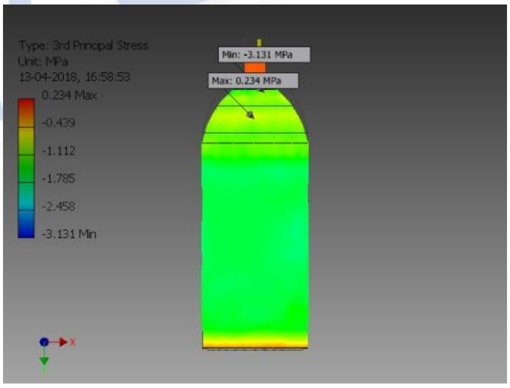
⊟ 1st Principal Stress



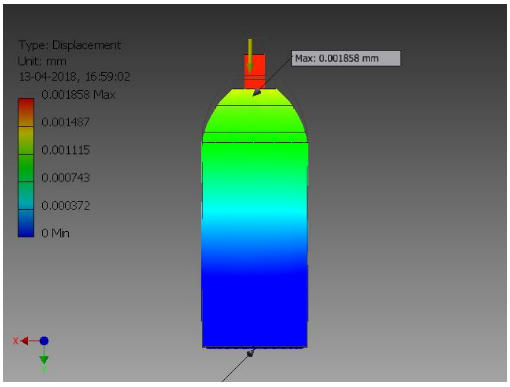


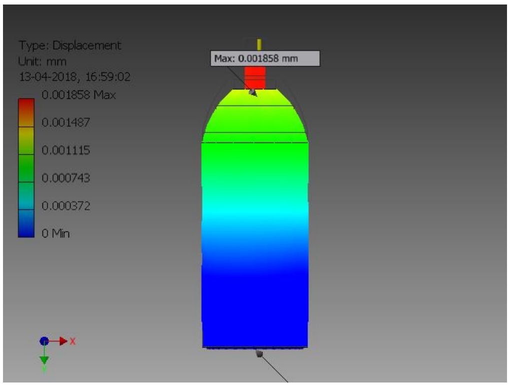
⊟ 3rd Principal Stress



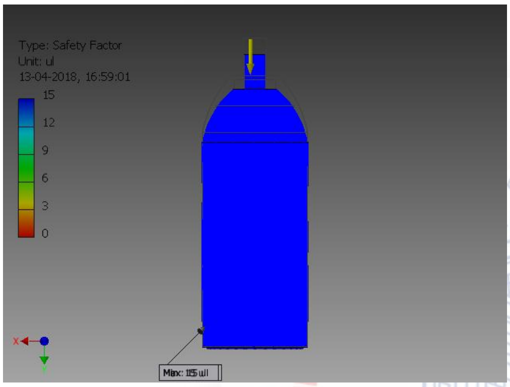


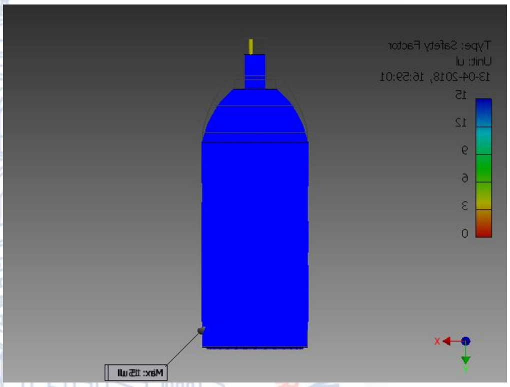
⊟ Displacement



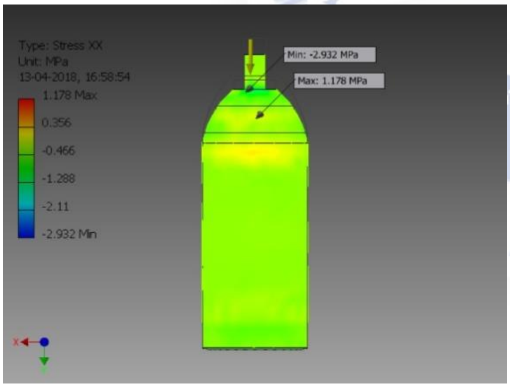


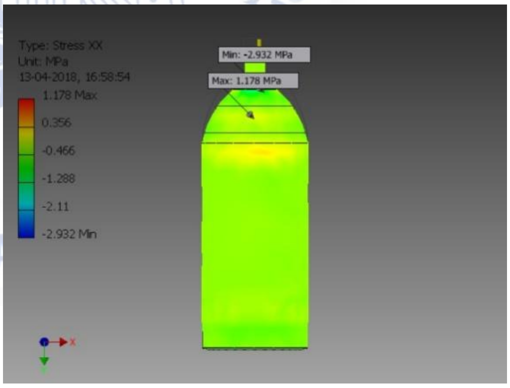
Safety Factor



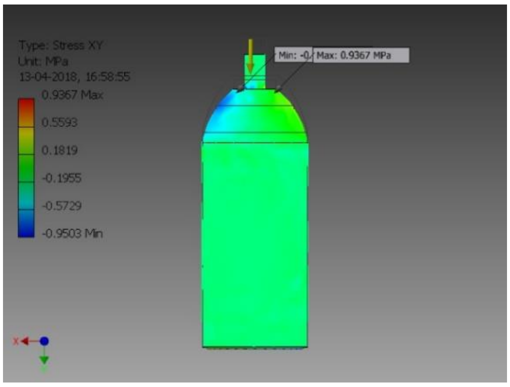


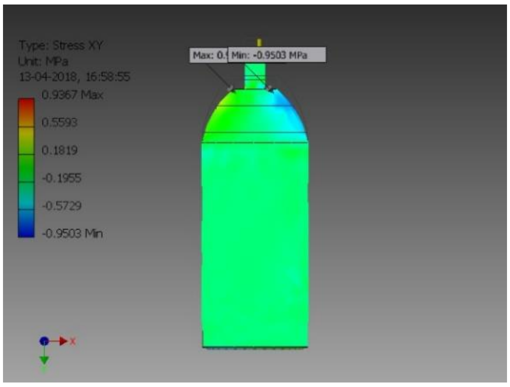
⊟ Stress XX



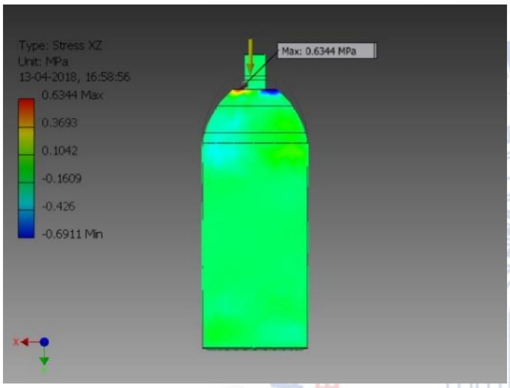


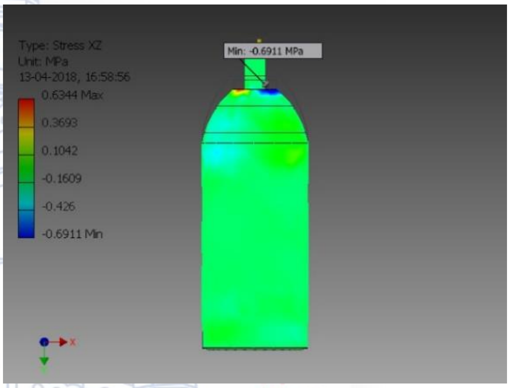
⊟ Stress XY



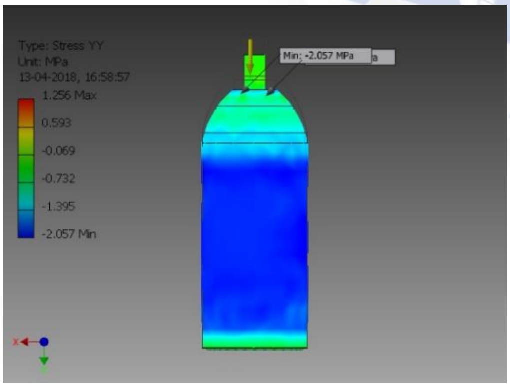


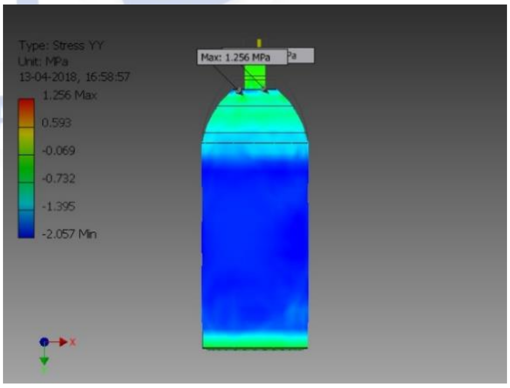
⊟ Stress XZ



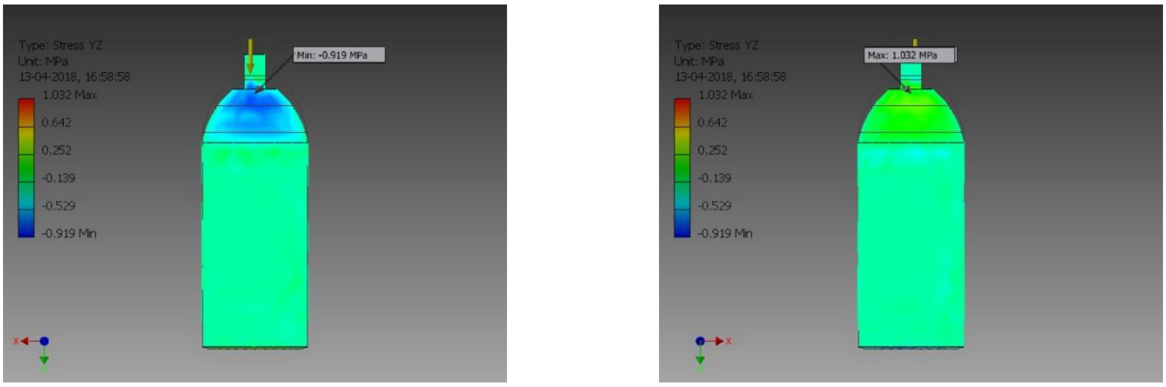


⊟ Stress YY

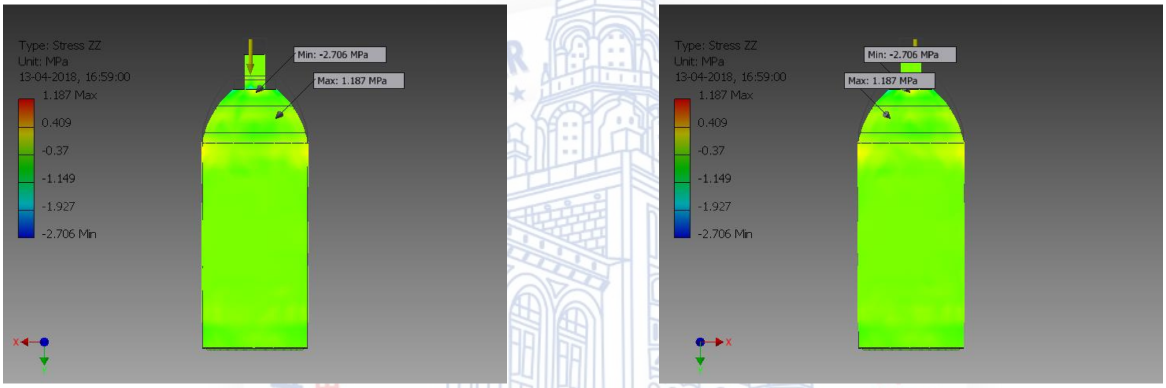




⊟ Stress YZ



⊟ Stress ZZ



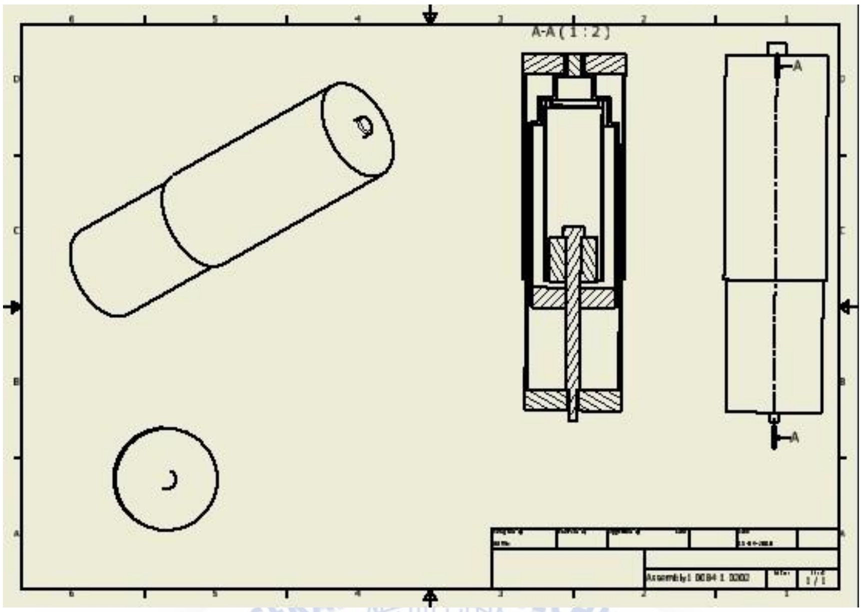
3.1. DESIGN AND MODIFICATION

The original design had steps where the accumulation of water took place that was the main cause of corrosion. To reduce the corrosion and avoid water accumulation improvements in the design were needed. Therefore, new design had to have shape where water flow easily. It can be seen in the above figure modified design has a dome shape to provide a smooth slope for water flow.

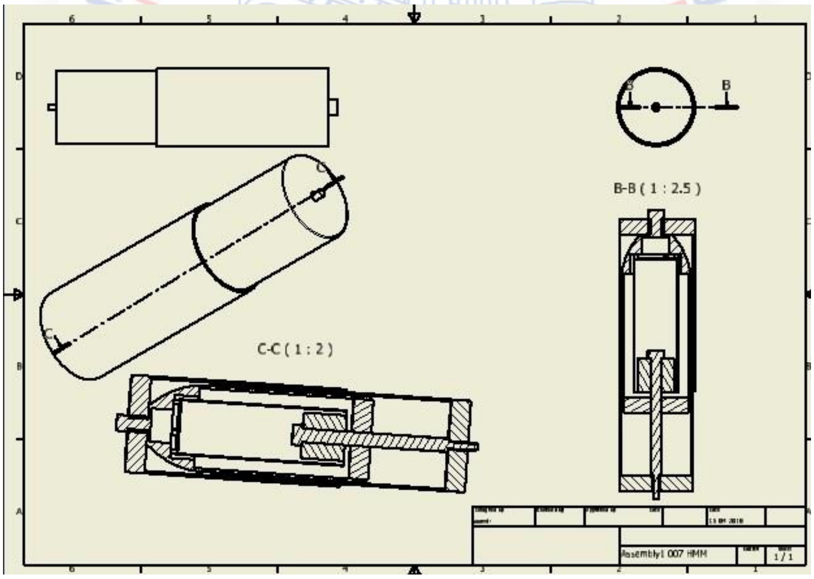
CHAPTER 4

ASSEMBLY

4.1. BEFORE MODIFICATION



4.2. AFTER MODIFICATION:



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CHAPTER 5

COMPILATION OF RESULTS

5.1. TEST RESULTS

⊟ Reaction Force and Moment on Constraints

Constraint Name	Reaction Force		Reaction Moment	
	Magnitude	Component (X,Y,Z)	Magnitude	Component (X,Y,Z)
Fixed Constraint:1	1000 N	0 N	0 N m	0 N m
		-1000 N		0 N m
		0 N		0 N m

Result Summary

⊟ Name	Minimum	Maximum
Volume	355688 mm^3	
Mass	2.79215 kg	
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Stress YZ	-0.918985 MPa	1.03186 Mpa
Stress ZZ	-2.70595 MPa	1.18746 Mpa

CHAPTER 6

CONCLUSION

CONCLUSION

After comparison with literature, we can conclude that following the literature survey we can improve the efficiency, maintenance time and cost can be reduced and the breakdown chances also reduces during the working period.

Analytical design simulation done on the Autodesk Inventor results show that the new design is capable of resisting the load that is applied during the working period.

CHAPTER 7

FUTURE SCOPE

The future scope of the project is that after the implementation of design modification the following is achieved:

The design can be used in railways even under the washroom lines and rainy environment as it is now corrosion resistant.

It can also be used in luggage boogies as it has higher endurance now. If the further designed is more identified the number of shock absorbers that are required can be reduced by giving it higher properties. A damping graph of the improved design may also be plotted to know the performance of the system.

The replacement time is reduced due to oil leakage preventions and this will also help in cost reduction.

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