



IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

e-ISSN: 2319-8753 | p-ISSN: 2320-6710



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 7, July 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Design Development Analysis & Testing of Automatic Tyre Self Inflation with Hybrid - Mechanical Valve System

Hrishikesh Gadhe ¹, Parth Kathe ², Kunal Gagare ³, Vishal Gaikwad ⁴, Prof. Sailee Shelke ⁵

U.G. Student, Department of Mechanical Engineering, Pravara Rural Engineering College, Loni,
Ahmednagar, India¹

U.G. Student, Department of Mechanical Engineering, Pravara Rural Engineering College, Loni,
Ahmednagar, India²

U.G. Student, Department of Mechanical Engineering, Pravara Rural Engineering College, Loni,
Ahmednagar, India³

U.G. Student, Department of Mechanical Engineering, Pravara Rural Engineering College, Loni,
Ahmednagar, India⁴

Assistant Professor, Department of Mechanical Engineering, Pravara Rural Engineering College, Loni,
Ahmednagar, India⁵

ABSTRACT: Studies performed earlier indicate that reduction in tyre pressure by just a small value (below 28 PSI) can result in the reduction of fuel mileage, reduction in tyre life, compromised safety, and deteriorated vehicle performance. In attempt to design and develop an automatic, self-inflating tyre system that ensures that tyres are properly inflated at all times. Earlier design proposes and successfully implements the use of a portable compressor that will supply air to all four tyres via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel. The rotary joints effectively allow air to be channelled to the tyres without the tangling of hoses. With the recent oil price hikes and growing concern of environmental issues, this system addresses a potential improvement in gas mileage; tyre wear reduction; and an increase in handling and tyre performance in diverse conditions. This system is commercially available in the market by the name AERIS ---made by STEMCO. These systems have a prerequisite of an inbuilt compressor, tyre pressure monitoring system and sea of complex components to fulfil the operation of automatic tyre inflation.

KEYWORDS: Self Inflation, Hybrid mechanical valve, efficiency, Increase life.

I. INTRODUCTION

The automatic tyre self inflation with hybrid -mechanical valve system can not only make the driver more safety, but also save fuel and protect the tyre. The United States had developed laws to enforce the TPMS installation in the car. In this project, the basic structure and the implement method, automatic filling of air are introduced. This is an excellent unique hybrid mechanical system designed to monitor air pressure inside the tyres on various types of vehicles. This system report real time tyre pressure information to the driver via a display. Appropriate good tyre inflation pressure improves fuel efficiency, reduces braking distance, improves handling, and increases tyre life, while under inflation creates overheating and can lead to accidents. The main causes of under inflation are natural leakage, temperature changes and road hazards. The accurately measured temperature and pressure values were obtained by using SMART transmitter pressure sensor. The unique excellent agreement between the pressure and temperature results measured by the sensor and the direct measurement data is presented. The practical results in the certain ranges of pressure and temperature

demonstrated that the micro sensor is able to measure temperature (20°C-100°C) and pressure (0kPsi- 150Psi) at the same time.

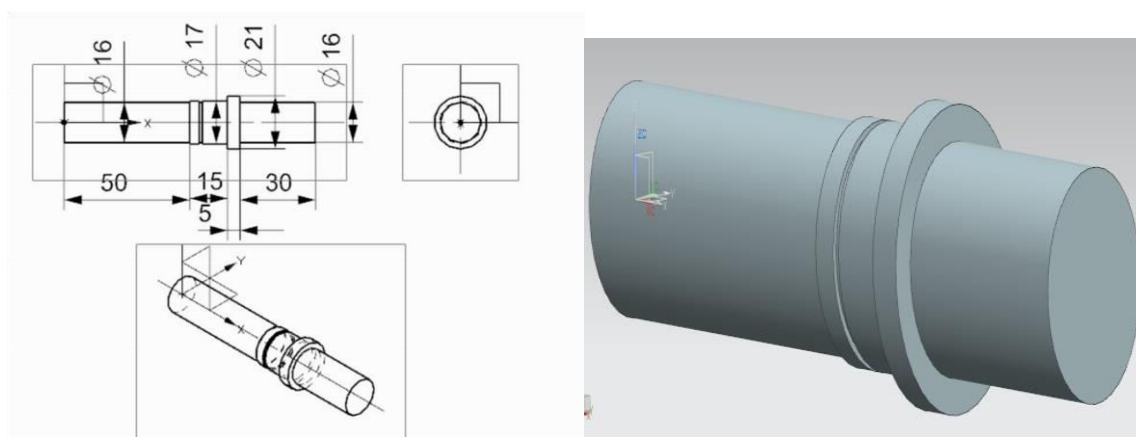
II. RELATED WORK

In Central Tyre Air Inflation System by Sagar Adakmol ,Tushar Shende, Dikshit Poriya ,Sanjot Fotedar , Prof.S.P.Shinde and The aim of this study is to design and fabricate a system in which there is proper inflation in the tyre at all times which produce fuel savings of 1-4% and increase tyre life by up to 10%. A trial was done in this case paper involving two cement tankers in NSW Australia operated over a period of 12 weeks in 2013. For first 6 weeks central inflation system was turned ON in both tankers and for another 6 weeks central inflation system was turned OFF in the both and graphs are prepared showing trucks with central inflated system is good in conditions like average vehicle idle time, average vehicle time spent using power take off, average vehicle GHG emissions, average vehicle fuel consumption across the trial period.

III. METHODOLOGY

DESIGN:

1) DESIGN OF WHEEL SHAFT:



(a) Wheel shaft

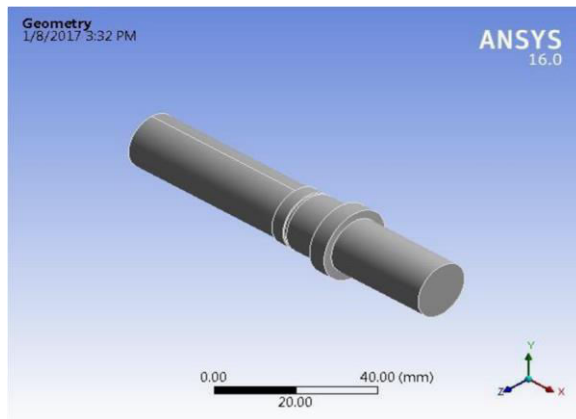
(b) Solid Model

DESIGNATION	ULTIMATE TENSILE STRENGTH N/mm ²	YIELD STRENGTH N/mm ²
EN 24	800	680

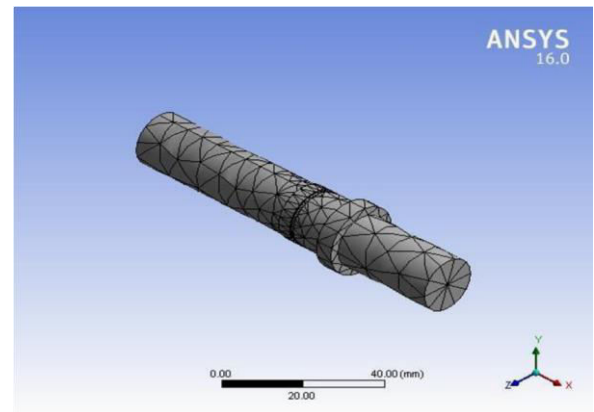
(c) Strength table of wheel shaft

FEA and Experimental Analysis

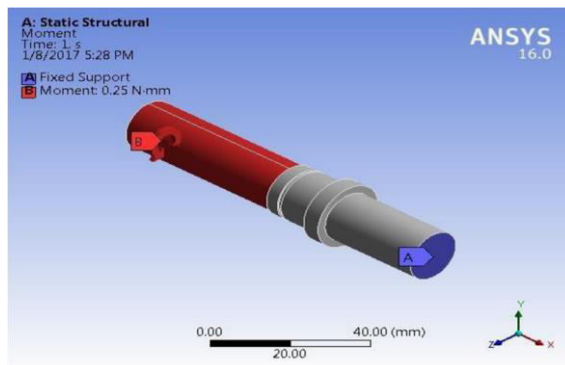
FEA Analysis



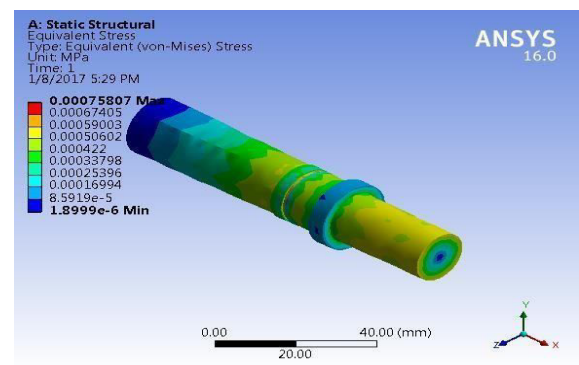
(d) Geometry of shaft



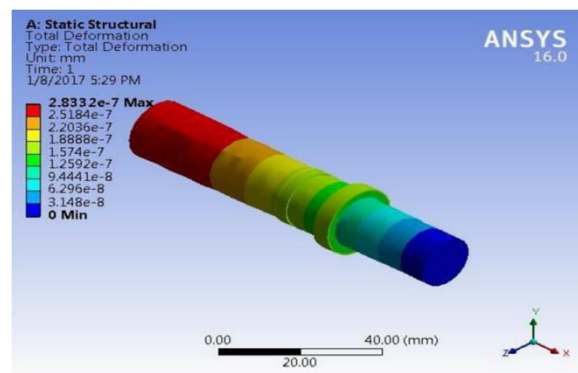
(e) Meshing of Shaft



(f) Static Structural Moment

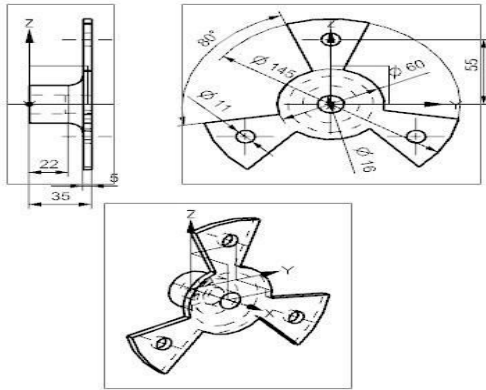


(g) Von Misses Stress

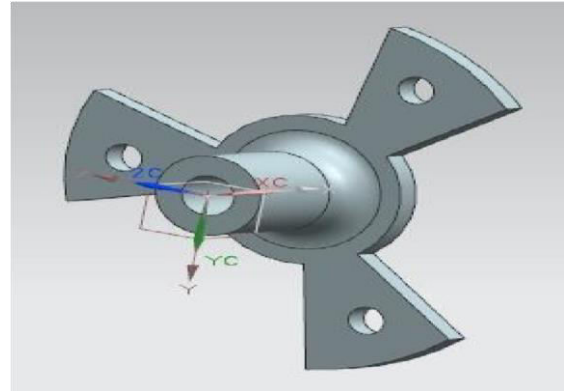


(h) Total Deformation

2) DESIGN OF LEFT HAND COUPLER DISK FOR ROLLER OF BELT CONVEYOR:



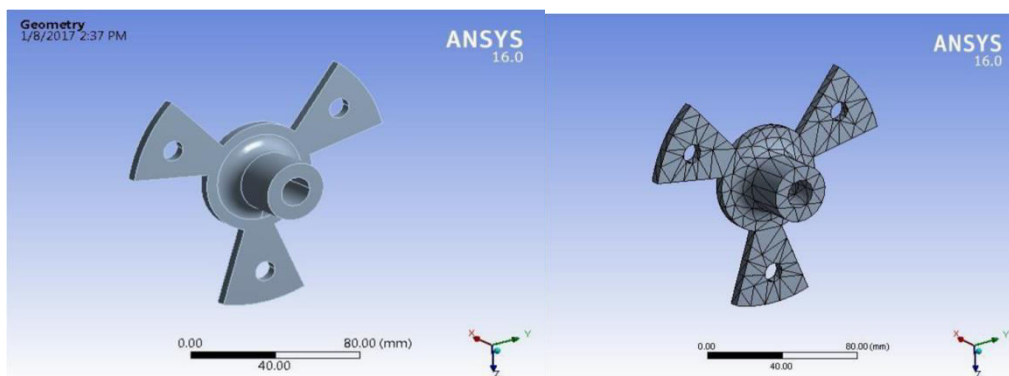
(a) Left Hand Coupler Disk for Roller of Belt Conveyor



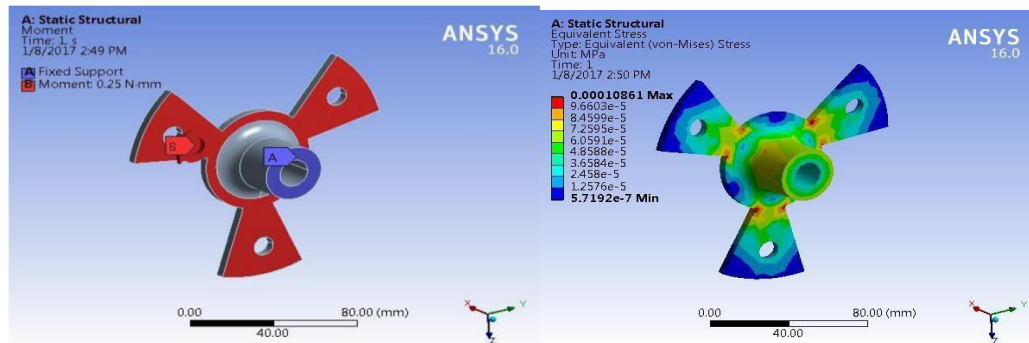
(b) Solid Model

Designation	Ultimate Tensile strength N/mm ²	Yield strength N/mm ²
EN 24	800	680

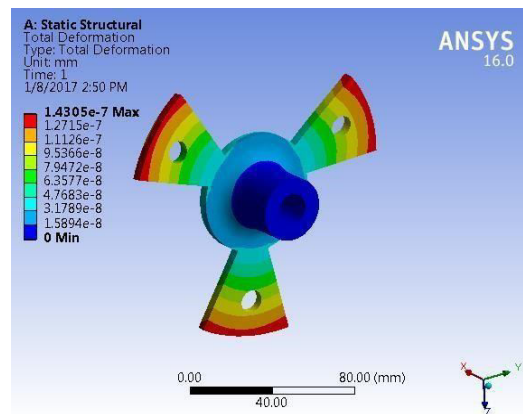
(c) Strength table of left hand coupler disk for roller of belt conveyor



(d) Geometry of coupler disc (e) Meshing of coupler disc

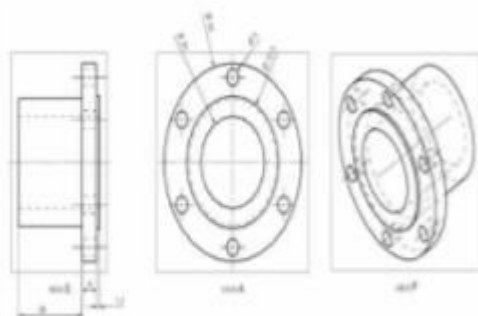


(f)Static Structural Moment(g)Von Misses Stress

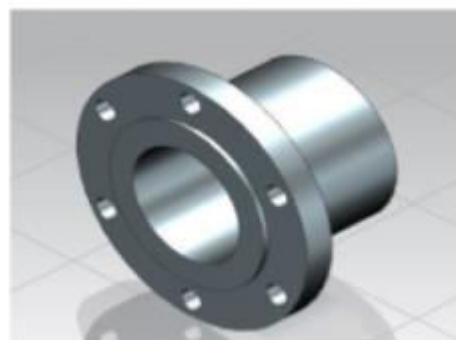


(h)Static Total Deformation

3)DESIGN OF WHEEL HUB:



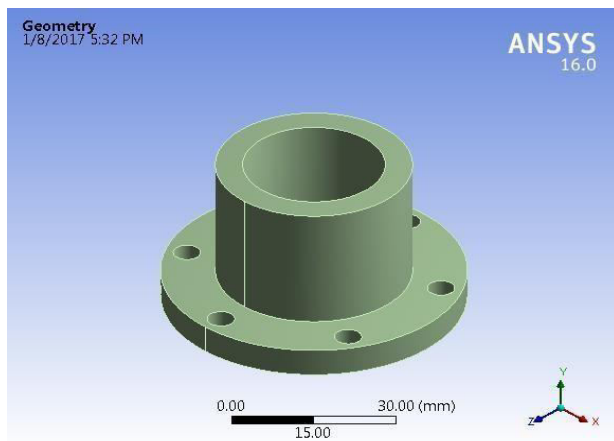
(a)Wheel Hub



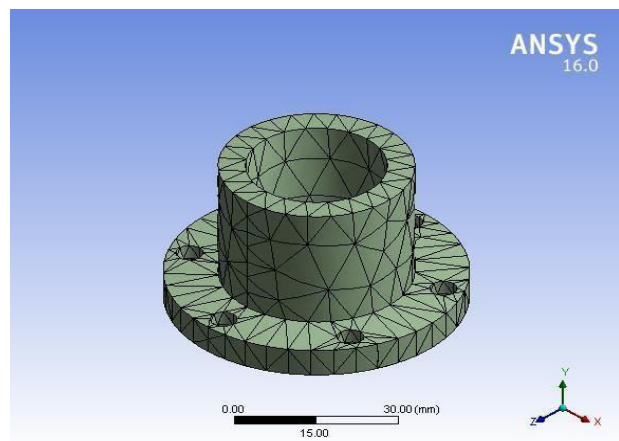
(b) Solid Model

DESIGNATIO N	ULTIMATE TENSILE STRENGTH N/mm ²	YEILD STRENGTH N/mm ²
EN8	520	360

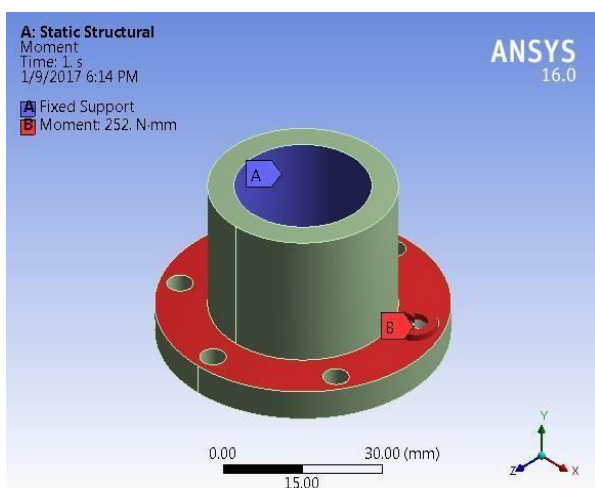
(c) Strength table of wheel hub



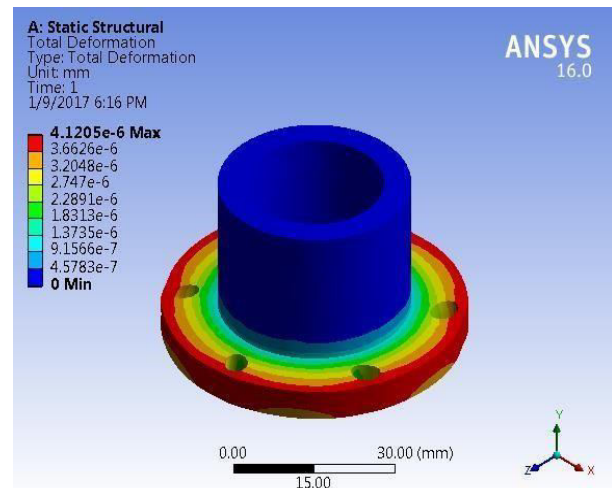
((d) Geometry of Wheel Hub



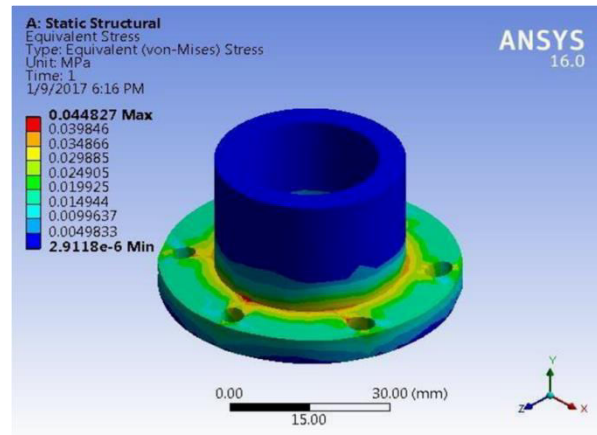
(e) Meshing of Wheel Hub



(f) Static Structural Moment

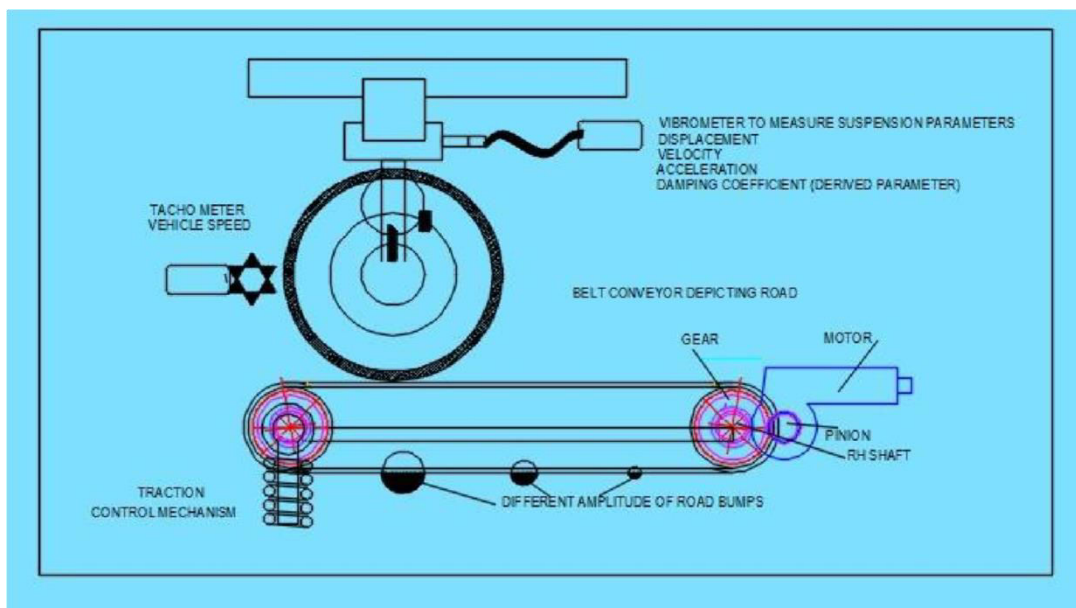


(g) Total Deformation



(h) Von Misses Stress

IV. EXPERIMENTAL SETUP AND RESULTS



(a) Experimental Setup

Process variable:

1. Vehicle speed
2. Traction
3. Amplitude of bumps

Measured Parameters :

- I. Tyre Pressure (electronic tyre pressure gage)
- II. Vibration (damping parameters owing to tyre pressure):
 - i. Displacement

- ii. Velocity
- iii. Acceleration
- III. Tractive load

Total volume of tyre @32 psi = 16674.858 cc

Assuming that pressure drops to 28 psi --to activate the system

Percentage change in volume = percentage change in pressure

Percentage change in pressure = (initial pressure- drop pressure / initial pressure) * 100

% pressure drop = 12.5 %

Target volume drop = $12.5 \times 16674.859 \times 12.5 / 100 = 2084$ cc ----

So to recover tyre pressure from 28 psi to 32 psi volume to be refilled is 2084 cc.

Assuming vehicle speed to be 20 to 25 kmph (reference ---towing speed)

Distance covered by the vehicle in one minute = 333.33 m

Considering vehicle tyre diameter to be 22 inch

Distance covered in one rotation = 1.6m

Total rotations per minute of tyre = number strokes for single valve system
= $333.3 / 1.6 = 208$ strokes

No of strokes available for refill = 208

Pump piston diameter = 12mm

Pump stroke = 15 mm

Assuming that 80 % stroke is effective.

So, Volume of air pumped per stroke = 1.35 cc

So, Volume pumped per stroke = 1.35 cc

Volume pumped by single unit system to replenish the dropped pressure

= $208 \times 1.35 = 280.8$ cc

So total time required for a single unit to replenish dropped pressure

= total volume to be replenished / volume replenished per minute

= $2084 / 280.8 = 7.42$ minute



V. CONCLUSION

So maximum time required for a single unit valve system to restore pressure from 28 psi to 32 psi considering only 805 efficiency of system = 7.5 min

REFERENCES

- [1] Sagar Adakmol, Tushar Shende, Dikshit Poriya, Sanjot Fotedar & S.P.Shinde. Central Tyre Air Inflation System, ISSN (online): 2321-0613
- [2] A.V.Wadmare, P.S.Pandure, Automatic Tire Pressure Controlling and Self Inflating System, ISSN: 22781684, pISSN: 2320-334X
- [3] Shreyansh Kumar Purwar, Automatic Tire Inflation System, e-ISSN: 2395 -0056, p-ISSN: 2395-0072.
- [4] Indrajeet Burase, Suyash Kamble, Amol Patil, Avinash Kharat, A Survey on Automatic Air Inflating System for Automobile, ISSN(Online) : 2319-8753, ISSN (Print) : 2347-6710.
- [5] Vishnuram.K, Dinesh.R, Suresh Krishna.N, Deepan Kumar.S & Tamil Chazhiyan, Self Inflating Tyres. ISSN (online): 2395-3500.
- [6] Ajas.M.A, Aiswarya.T.G, Adersh Vinayak, Surya Balakrishnan, Janahanlal P.S, Tire Pressure Monitoring and Automatic Air Filling System. ISSN: 2320 – 8791.



**Impact Factor:
7.569**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details