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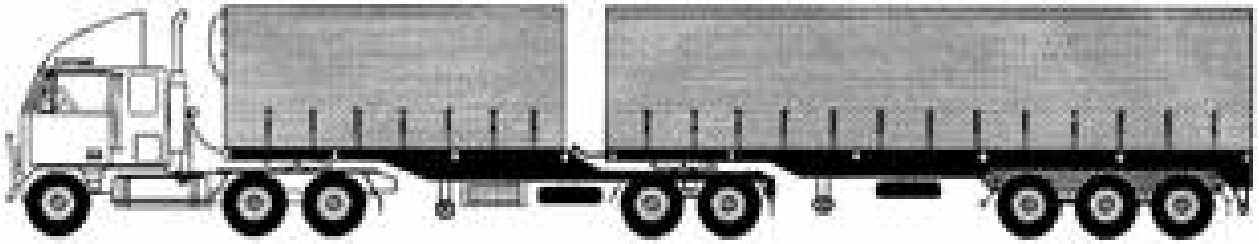
Engineering



Heavy Vehicle Brake System

By Krishna, Erjan & Kenny

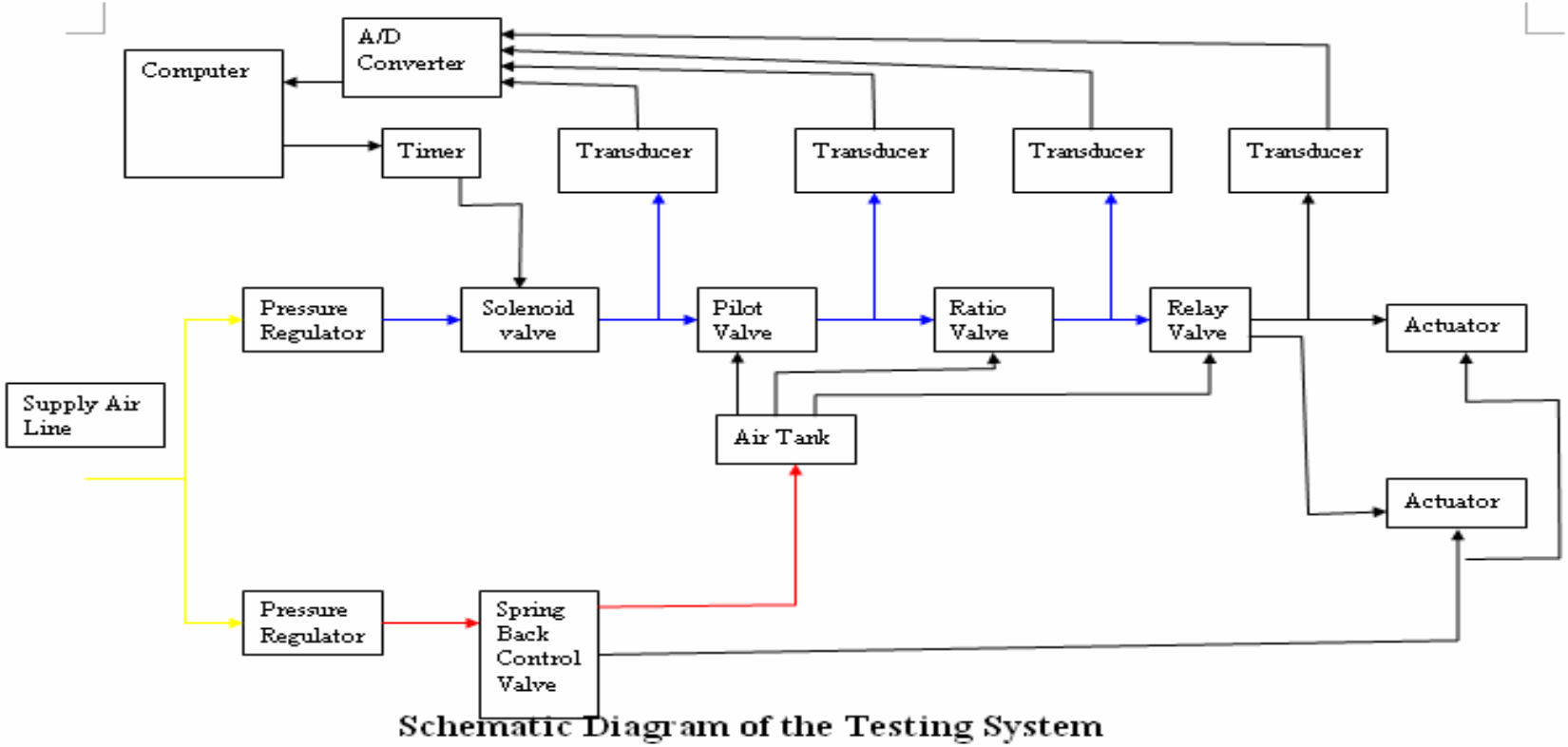
Introduction

- **This project is done in collaboration with the Australian Road Transport Suppliers Association (ARTSA).**
- **The project is carried out by 3 Monash University students.**
- **The objective of this project**

Investigate and measure the typical components within the heavy vehicle brake system by:

  - determining the repeatability of performance
  - characterize these components in the low pressure region.
  - Determining the response and delay times
  - Develop an analytical model that will predict the response of an individual component or overall system when a certain pressure is applied.

Flowchart of Test Setup



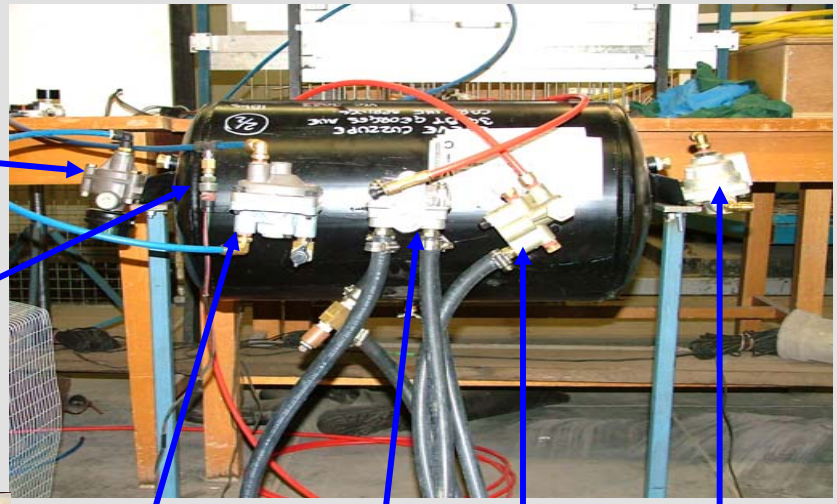
Schematic Diagram of the Testing System

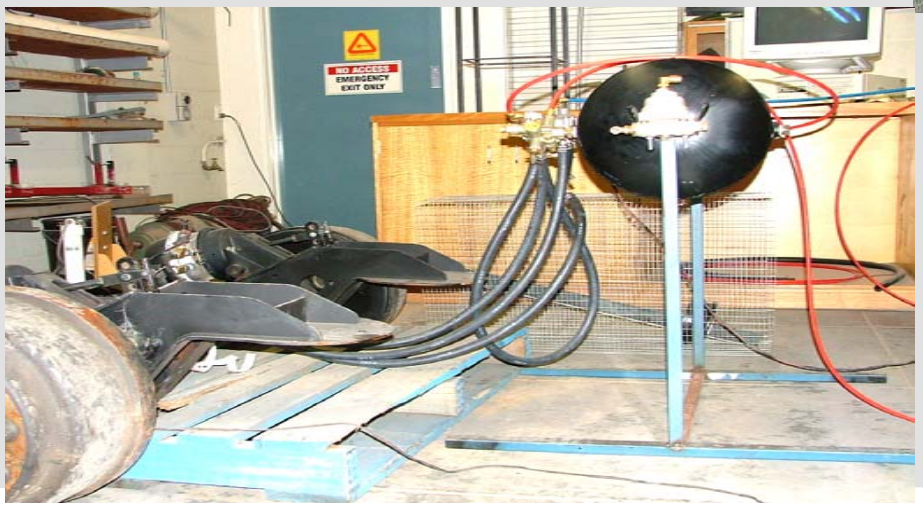
Equipment Layout

Compressed Air supply to the brake system via pressure regulators and a solenoid valve that simulates the parking brake and foot pedal

Overall system is connected with the maximum possible length of signal and air lines that will allow the system to meet the ADR.

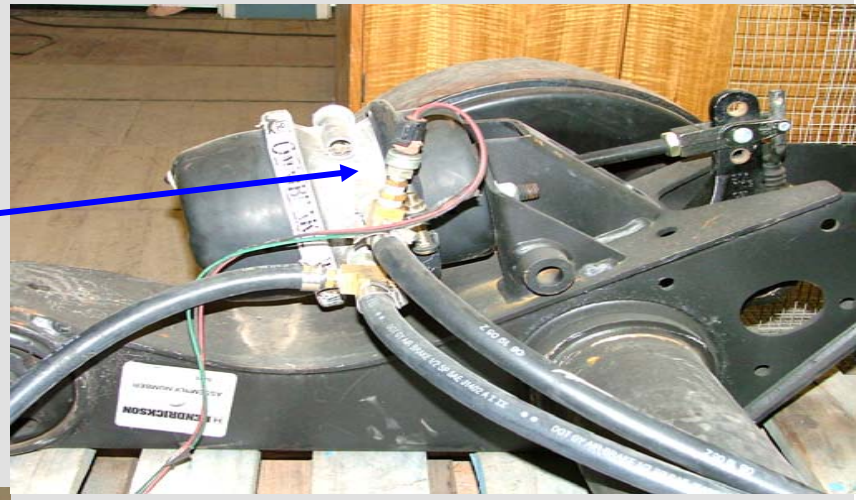
Equipment Setup – Air Tank Mounting

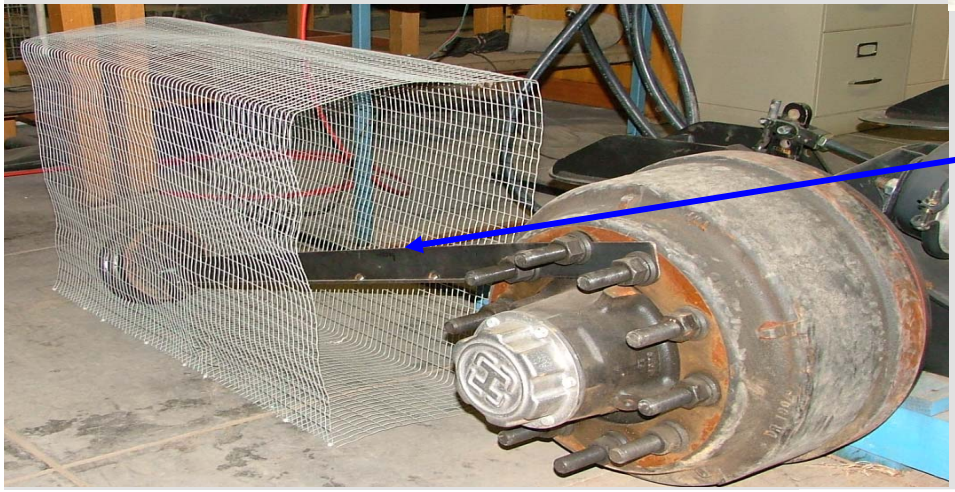




Equipment Setup – Threshold Test

Pressure Transducer at the actuator that reads the output pressure of the overall system





Meter long steel flat is attached to the brake drum with weights attached at the end. This will be used to determine the brake threshold pressure.

The Completed Tests

- **The Characteristic of the components in Low pressure**

  --Investigate the difference of the performance of the components between low pressure and high Pressure

  --The obtained data can determine the hysterisis and the pressure drop across the system.

- **Steady State Response with a Step Input**

  --determine the elapsed time, pressure rising rate, pressure falling rate and settling time of each components and the system

  --to create the analytical model to simulate the system

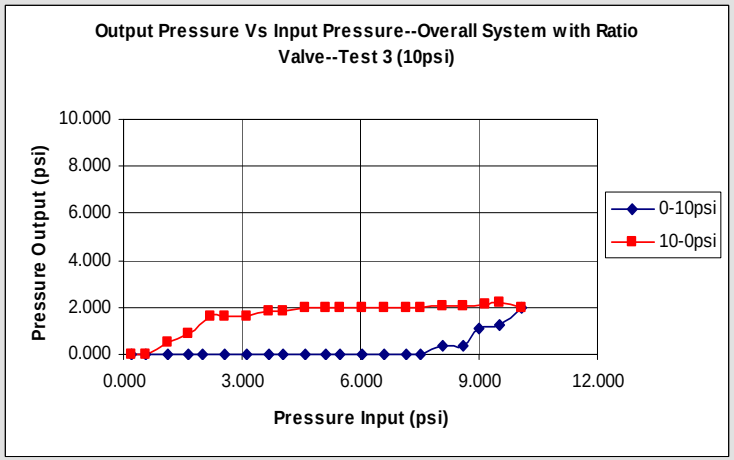
Test Procedure - Low Pressure Characterise

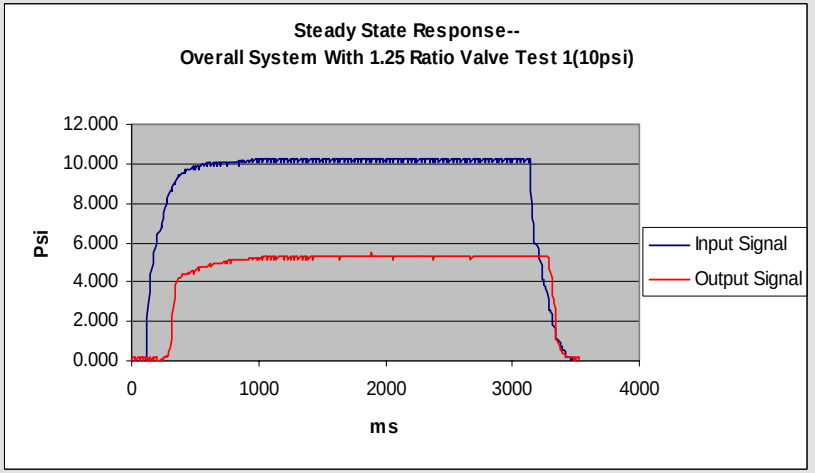
- **The pressure range from 0-5,0-10,0-20 & 0-100psi have been completed.**
- **Air supply pressure was increased between 0.5 or 1psi intervals with regulator until the maximum test pressure was reached.**
- **The pressure was then reduced from the max test pressure at 0.5 or 1 psi intervals back to 0psi.**
- **The output pressure was plotted against the input pressure.**

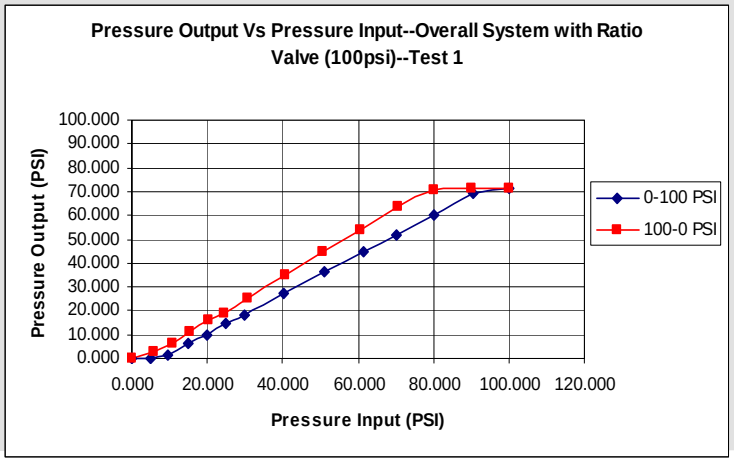
Test Procedure – Steady State Response

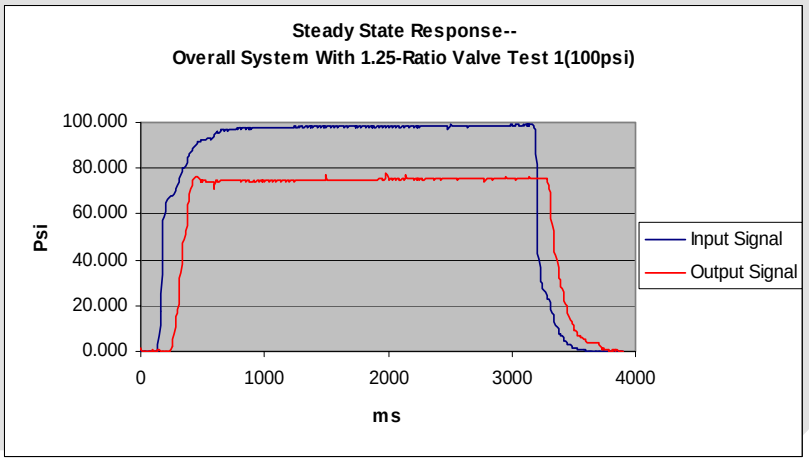
- **The Steady State Response for pressure of 5,10,15,20,40,60,80 & 100psi have been completed.**
- **Pressure regulator that simulates the foot pedal is adjusted to the desired pressure.**
- **A solenoid valve that is controlled by a timer is attached to the service brake signal line after the regulator.**
- **The solenoid valve is then actuated by the timer that closes the valve after 3000ms.**
- **From the recorded data, the rise time, settling time and time delay can be determined.**

Results


Output Pressure Vs Input Pressure--Overall System with Ratio Valve--Test 3 (10psi)
Pressure Output (psi)
10.000
8.000
6.000
4.000
2.000
0.000
0.000
3.000
6.000
9.000
12.000
Pressure Input (psi)
0-10psi
10-0psi


Steady State Response--
Overall System With 1.25 Ratio Valve Test 1(10psi)
Psi
12.000
10.000
8.000
6.000
4.000
2.000
0.000
0
1000
2000
3000
4000
ms
Input Signal
Output Signal


Pressure Output Vs Pressure Input--Overall System with Ratio Valve (100psi)--Test 1
Pressure Output (PSI)
100.000
90.000
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
0.000
20.000
40.000
60.000
80.000
100.000
120.000
Pressure Input (PSI)
0-100 PSI
100-0 PSI


Steady State Response--
Overall System With 1.25-Ratio Valve Test 1(100psi)
Psi
100.000
80.000
60.000
40.000
20.000
0.000
0
1000
2000
3000
4000
ms
Input Signal
Output Signal

Flow Diagram of Proposed Analytical Model