KEMENTERIAN PENDIDIKAN TINGGI

JOJAPS

eISSN 2504-8457

POLITEKNIK MALAYSIA PORT DICKSON

Journal Online Jaringan Pengajian Seni Bina (JOJAPS)

Spring Compressor

Juliana binti Basiron, Muhammad Rozan bin Roslan, Saiha binti Ismail & Amirul Izzat bin Ismail

Centre Of Innovation, Kolej Vokasional Sultan Ahmad Shah, Jalan Endau-Rompin, Pahang, Malaysia.

Abstract

Absorber system is a knuckle-mounted device on a vehicle's wheel which functions to reduce and absorb the impact of a crash when a vehicle is moving on an uneven road or ground. There are two types of absorbers. They are hydraulic and gas compression. Gas compressor is more durable than the hydraulic type. The life expectancy of hydraulic type absorber system is shorter than gas compression and the conversion process would occur in the event of a malfunction. The techniques of installing spring absorber using spring clamp is a conventional method and is commonly used at workshops and Sultan Ahmad Shah Vocational College (KVSAS). The time taken to open and reinstall the spring in absorber is a problem faced by mechanics and automotive lecturers. In addition, the safety in using conventional method is very low and users of the device are at high risk of injury especially when the spring is compressed. To solve the problem, an idea was developed to design a better spring compressor. A detailed study was carried out through the reading of previous studies, three designs were produced by using sketches and the best design is selected through the matrix method. The materials used consist of product waste and the cost spent in assembling the spring compressor is RM57.00. The spring compressor is produced through metal fabrication processes such as cutting, drilling, welding and painting. To test the effectiveness of the spring compressor, two methods were implemented by using questionnaire and time comparison test between spring compressor and spring clamps. The questionnaire was produced by using Microsoft Word. The questionnaire was distributed to 58 respondents (32 males and 26 females) at 3 secondary schools at Kuala Rompin District and 17 automotive students at KVSAS. The questionnaires were analyzed by using Microsoft Excel. From the results, 100% of respondents agreed that using spring compressor saves time compared to spring clamps. 100% of respondents stated that using spring compressor is safer and more appropriate during teaching and learning process. 98.3% of respondents agreed that spring compressor should be used at KVSAS to assist lecturers in teaching absorber system. The result of the test comparison time is 9 minutes. The cost is reduced to RM32.00. In conclusion, spring compressor achieves the objectives of the study in term of time-saving, safety and usability at KVSAS.

© 2020 Published by JOJAPS Limited.
Key-word: - *Absorber, spring clamp, spring compressor, conventional method.*

1. Introduction

Absorber system is a knuckle-mounted device on a vehicle's wheel which functions to reduce and absorb the impact of a crash when a vehicle is moving on an uneven road or ground (Kumhar, 2016). There are two types of absorbers (Ganzi, 2011). They are hydraulic and gas compression (Jamaludin, 2012). Gas compressor is more durable than the hydraulic type (Najeeb, 2015). Muhammad et al. (2019) informed the life expectancy of hydraulic type absorber system is shorter than gas compression and the conversion process would occur in the event of a malfunction. The techniques of installing spring absorber using spring clamp is a conventional method and now is commonly used at workshops and KVSAS. The time taken to open and reinstall the spring in absorber is a problem faced by mechanics and automotive lecturers. In addition, the safety factor of using conventional method is very low and users of the device are at high risk of injury especially when the spring is compressed. To solve the problem, an idea was developed to design a better spring compressor. The main purpose of spring compressor was designed to save time when opening and reinstalling the spring to absorber. In addition, the utilization of spring compressor is safer than conventional methods. This product has a mass of 16.5kg (165N). Meanwhile, it is 96cm long x 58cm wide x 70cm high. The materials used were product waste and the cost spent in assembling the spring compressor is RM57.00. Compared to the original price of the spring clamp which is RM89.00, RM32.00 managed to be saved. The average time taken in opening and installing the spring on absorber by using spring compressor is 6 minutes.

2. Problem Statement

The techniques of installing spring absorber using spring clamp is a conventional method and now is commonly used at workshops and KVSAS. Figure 1 shows that the spring clamp is still used at workshops and also at KVSAS as a learning aid. The time taken to open and reinstall the spring in absorber is a problem faced by mechanics and automotive lecturers. In addition, using conventional method is quite risky as users of the device are at high risk of injury especially when the spring is compressed. To solve the problem, an idea was developed to design a better spring compressor. Figure 2 shows the spring compressor which was produced at KVSAS.

Figure 1 Spring Clamps

Figure 2 Spring Compressor

3. Methodology

Based on the reading of previous studies, three designs were proposed by using sketches and the best design was selected through the matrix method. The materials used consist of product waste and the cost spent in assembling the spring compressor is RM57.00. Table 1 shows the specification of materials used to produce spring compressor. Meanwhile, the cost spent to buy new materials for reassembling the spring compressor is represented in Table 2.

Table 1 Materials Specification of Spring Compressor

Item	Number of Unit	Type of Material
Square rubber cap	10	Rubber
Pillar	2	Holo square
Plate	1	Plate Iron
Site	4	Holo square
Bolt and nut	2	Alloy Fastener

Table 2 Cost of New Materials

Item	Number of Unit	Cost (RM)	Total (RM)
Square rubber cap	10	1.00	10.00
Spray	3	8.00	24.00
Iron of hollo square	1	23.00	23.00
Total			57.00

The spring compressor is produced through metal fabrication processes such as cutting, drilling, welding and painting. To test the effectiveness of the spring compressor, two methods were implemented by using questionnaire and time comparison test between spring compressor and spring clamps. The questionnaire was created by using Microsoft Word. The questionnaire was distributed to 58 respondents (32 males and 26 females) at 3 secondary schools at Kuala Rompin District and 17 automotive students at KVSAS. Figure 3 shows the distribution of questionnaire to the respondents. The questionnaire was analysed by using Microsoft Excel.

Figure 3 Distribution of Questionnaires to The Respondents

4. Result and Analysis

To test the effectiveness of the spring compressor, two methods were implemented by using questionnaire and time comparison test between spring compressor and spring clamps.

4.1 Questionnaire

The questionnaire was distributed to 58 respondents (32 males and 26 females) at 3 secondary schools at Kuala Rompin and 17 automotive students at KVSAS. There are 10 questions in the questionnaire. Questions number 4 and 7 focused on the objectives of the study. While question number 10 is to determine the feasibility of using spring compressor at KVSAS. Figure 4 shows the analysis for question number 7 (Does spring compressor save time?), while analysis for question number 4 (Is this innovation tool safe to be used?) is shown in Figure 5. Figure 6 shows the analysis of question number 10 (Do you agree that spring compressor can be used at KVSAS?). Based on the analysis, the respondents agreed that Spring Compressor can be used at KVSAS. Based on the analysis, 100% of respondents agreed that using spring compressor saves time compared to spring clamps. 100% of respondents also agreed that using spring compressor is safer and more appropriate during teaching and learning process. 98.3% of respondents agreed that spring compressor is useful in assisting the lecturers in teaching absorber system.

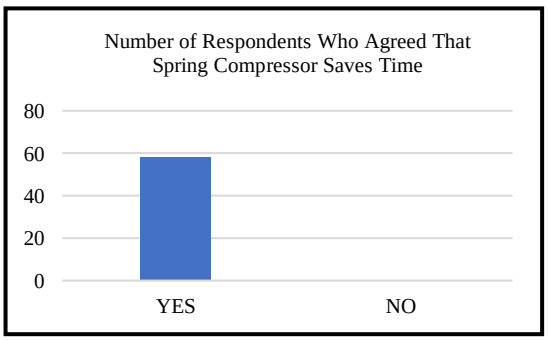

Figure 4 Number of Respondents Who Agree That Spring Compressor Saves Time

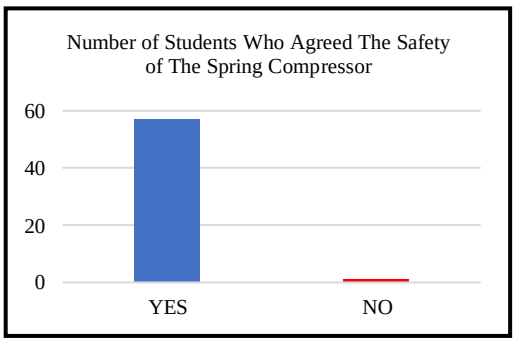

Figure 5 Number of Respondents Who Agreed The Safety of The Spring Compressor

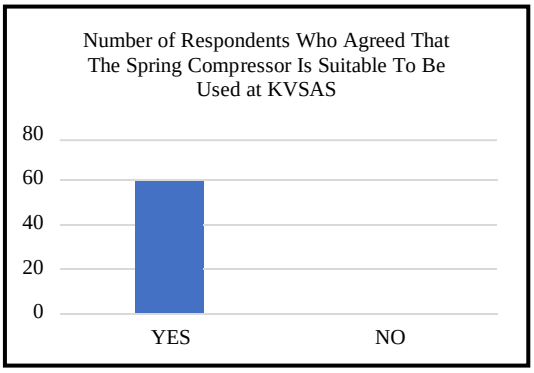

Figure 6 Number of Respondents Who Agreed That The Spring Compressor Is Suitable To Be Used at KVSAS

4.2 Time Comparison Test between Spring Compressor and Spring Clamps

The time taken to open and reinstall the spring on vehicle absorber by using the spring clamp is 15 minutes. Meanwhile, by using spring compressor it took only 6 minutes to open and reinstall the spring on vehicle absorber. Figure 7 represents the method for opening and installing using spring clamp and spring compressor. There is a difference of 9 minutes when using both of the equipment in which spring compressor saved more time. Table 3 shows the results of the time comparison test recorded between spring clamp and spring compressor. In conclusion, spring compressor saves more time compared to spring clamp.

Figure 7 Opening and Installing Spring on Absorber by Using Spring Clamp and Spring Compressor

Table 3 Result of Test Comparison Time Using Spring Clamps and Spring Absorber

	Conventional Method-Spring Clamp (minute)	Innovation Product-Spring Absorber (minute)	Time Difference (minute)
Test Comparison Time	15	6	9

5. Conclusion

From the results, 100% of respondents agreed that spring compressor saves more time compared to spring clamps. 100% of respondents agreed that using spring compressor is safer and more appropriate during teaching and learning process. 98.3% of respondents agreed that spring compressor should be used at KVSAS to assist lecturers in teaching absorber system. The result of the test comparison time is 9 minutes. Compared to the original price of the spring clamp which is RM89.00, the production cost is reduced to RM32.00. In conclusion, spring compressor achieves the objectives of the study in term of time-saving, safety and usability at KVSAS.

References

Suresh, G. (2013). Design Optimization of A Wishbone Suspension of A Passenger Car. Tech, Product Design Jawaharlal Nehru Technological University Ananthapuram, 1-7.
Kumhar, V. (2016). Analisis Struktur Kejatuhan Spring Penyerapan Menggunakan Analisis Elemen Finite. VSRD Jurnal Kejuruteraan Mekanikal, Awam, Automobil dan Pengeluaran, 5, 1-8.
Jamaludin, M.S. (2012). Kajian Punca Masalah Lantunan Daripada Penyerap Hentakan. Tesis. Fakulti Kejuruteraan Pembuatan Universiti Malaysia Pahang. Malaysia.
Muhammad Yousaf Iqbal, Wu, Z., Xu, G., Syed Arslan Bukhari (2019). Study of External Characteristics of Hydraulic Electromagnetic Regenerative Shock Absorber. World Journal of Engineering and Technology,7, 520-535.
Najeeb, N. S. (2015). Kolej Vokasional Balik Pulau Hidraulik. Retrieved from https://www.slideshare.net/lobakmerahjambu/hidraulik.