



DESIGN AND DEVELOPMENT OF PORTABLE HYDRAULIC VALVESPRING COMPRESSOR

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ABSTRACT

This study aims to design and develop a Portable Hydraulic Valve Spring Compressor, test and evaluate its performance in terms of easiness to use, time element for the process, the number of worker/student involve during the work and the quality of work. The study employed descriptive-comparative design, t-test as the statistical tool, questionnaires and observation guide to gather data. Based on the findings, the researcher disclosed that Portable Hydraulic Valve Spring Compressor is easy to use, less time element, less worker and has a quality of work.

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INTRODUCTION

Hydraulic tools are tools that are fluid power to do the work. It is the ability to apply force or torque multiplication independent of the distance between the input and output Meriam-Webster 1993. In normal cases, hydraulic tools were being combined with a mechanical force or torque for ideal machine designs Toboldt and Johnson 1983. For various reasons, it becomes advisable to replace or remove many components on internal combustion engines due to automobile wear out Marathe and Mohite 1983. The valve stem seals on the engine cylinder head are hard to remove. In removing or installing valve springs of internal combustion engines and in particular, to valve springs compressors, hydraulics are also used applied either the hand - operated lever or a pneumatic Orillos *et al.* 2011. One of the most crucial and tedious as well as perilous activities in the removal and installation of valves and valve springs is the compression of the strong valve springs. It is recognizable that if the spring is compressed manually, there are chances to accidentally release the spring and severe injury may result in Marathe and Mohite 1983. From a few observations done by Bryan and Bryan 1990, the worker had a hard time to remove and install the valves and valve springs using the mechanical valve spring compressor.

Sometimes, when the tension of the valve spring is high or high - performance spring, the jaws, especially when it is being worn tends to slip off to spring. They disclosed that using mechanical valve spring compressor in the removal and installation of valves and valve springs takes much time to perform its functions and needs more than one person to do the operation. The researcher aims to design and develop a Portable Hydraulic Valve Spring Compressor, test and evaluate its performance regarding easiness to use, time element for the process, the number of worker/student involve during the work and the quality of work.

Conceptual Framework

The conceptual paradigm showing the variables for the design and development of Portable Hydraulic Valve Spring Compressor which guided this study were being depicted below. The input includes the idea based on the four parameters. These also include the bill of materials and supplies and the development cost. The throughput of this study consists of the processes involved in the design and development of the project. These are planning and designing, constructing and assembling, testing, revising and evaluation. The output will be the completed project which is the portable hydraulic valve spring compressor.

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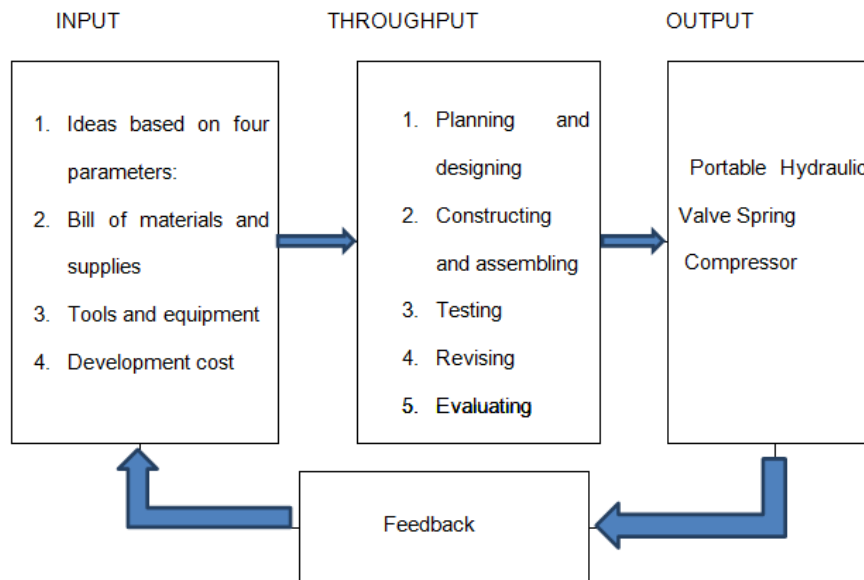


Figure 1. The Conceptual Paradigm of the Study

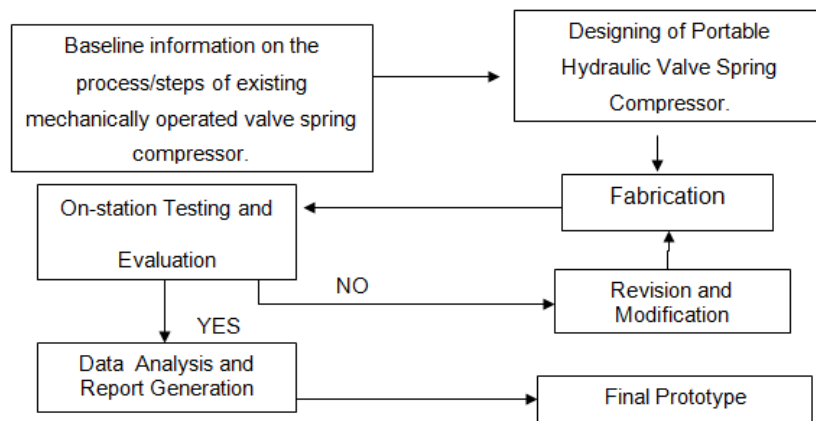


Figure 2. Flowchart of the design and development of portable hydraulic valve spring compressor

MATERIALS AND METHODS

To achieve the objectives mentioned above, the following activities/procedures have been done or undertaken:

- Baseline information on existing manufactured mechanically operated valve spring compressor. Detailed process/steps of compressing valve spring using manufactured mechanically operated valve spring compressor was being documented including the timeframe for the process/steps, the number of students removing and installing the valves and valve springs and the quality of work. Relevant information acquired from the activities served as a basis for the design and development of portable hydraulic valve spring compressor.
- Design, Develop, Test and Revision
Working design was being based on the existing manufactured mechanically operated valve spring compressor. Reverse design and proper modification was being made for the compressor to actually apply to the work. Fabrication was being done in Automotive Workshop of SLSU, Main Campus Sogod, Southern

Leyte, after which initial testing was done/conducted. The necessary revision was made to make the portable hydraulic valve spring compressor workable.

- Preparation of Materials, Tools, and Equipment

Welding Machine	Steel Square	Sand Paper
Welding Rod	Pull-push Rule	Paint
Portable Grinder	Portable Hydraulic Jack	Angular Ba
Electric Drill	Vise Grip	G.I. Pipe
Hacksaw 1 set	Open Wrench	Ply Board ½" thick

- Assembly Phase

The angular bars, round bars G.I. pipe, and ply board were being cut according to the specifications of the design. Rough welded joints and surfaces was being ground, filed and sandpapered. The ply board was being laid on the base as the flooring, and it was being painted. When it dried, the portable hydraulic jack was being installed.

Testing was being conducted at the Automotive Workshop of SLSU, Main Campus, Sogod, Southern Leyte. Further revision



Figure 3. Shows the assembly phase

and modification of the portable hydraulic valve spring compressor were conducted considering its quality performance before subjecting it to final evaluation. The instructors, professors and the 3rd year students served as the evaluators with fixed parameters namely; easy to handle by any users, time element of the process/steps, the number of worker/students doing the work and the quality of work. Comparison with the existing manufactured mechanically operated valve spring compressor considering the parameters were conducted using the appropriate statistical tools. Data in efficiency rating were subjected to T-test to determine the significant differences on the results.

RESULTS AND DISCUSSION

The designed portable hydraulic valve spring compressor has the following developments: it has one leg supported by braces

to increase strength and stability; it has spring seat bracket with two jaws that could remove and install two valves and valve springs in one operation; it uses hydraulic jack (3 tons) to compress the valve springs which will give less stress to the operator; the construction was small table type wherein the cylinder head was securely positioned; the base of the design where the workplace was being secured was made of plyboard, thus, it will protect the cylinder head from wear out; it has a pivoted lever that transfers the force from the hydraulic jack to compress the valve spring, the valve locks/valve spring seats; and it has a box to secure the valve spring seat bracket and the handles of the hydraulic jack. It is portable that it can be carried easily and can be transferred from one place to another. The basis for designing and developing a new portable hydraulic valve spring compressor, a survey was employed to 46 respondents including students and faculty of BSIT major in Automotive to rate the existing mechanically

Table 1. Paired sample statistics of the mechanically operated valve spring compressor versus design and develop portable hydraulic valve spring compressor

Parameters	MEAN	N	Standard Deviation	Std. Error Mean
Part 1. MOVSC is easy to use/handle by any user	3.22	46	0.85	0.13
PHVSC is easy to use/handle by any user	4.82	46	0.39	0.05
Part 2. MOVSC time element for the process is short	3.00	46	0.89	0.13
PHVSC time element for the process is short	4.65	46	0.53	0.08
Part 3. MOVSC less number of worker/students Involve during the work.	3.0	46	1.11	0.16
PHVSC less number worker/students Involve during the process	4.70	46	0.51	0.08
Part 4. MOVSC quality of work	3.50	46	1.00	0.15
PHVSC quality of work	4.37	46	0.93	0.14

Table 2. Average responses of the respondents to mechanically operated valve spring compressor and to the design and develop portable hydraulic valve spring compressor

VALVE SPRING COMPRESSORS	PARAMETERS							
	Easiness to Use/Handle		Lesser Number of Person Involve		Shorter Time for the Process		Quality of Work	
	Mean	Remarks	Mean	Remarks	Mean	Remarks	Mean	Remarks
Mechanical Type	3.22	Uncertain/Undecided	3.00	Uncertain/Undecided	3.00	Uncertain/Undecided	3.50	Agree
Design Portable Hydraulic Type	4.82	Strongly Agree	4.70	Strongly Agree	4.65	Strongly Agree	4.37	Agree

operated valve spring compressor considering the four parameters. If the compressor is easy to use / handle by any users, the time element for the process/step is low, if the number of student involve during the work is less and the quality of work. Table 1. Shows paired sample test. Table 1. Displays the descriptive statistics used to compare the mechanically operated valve spring compressor and the design and develop portable hydraulic valve spring compressor regarding of the easiness to use / handle by any users, that the time element for the process is short and less number for person involve during the work and the quality of work. Comparison of each parameter were being based on the mean. The results revealed that the design and develop portable hydraulic valve spring compressor is easier to use / handle by any users the time element for the process is shorter, the number of people involve during the work is lesser and the quality of work yield similar to the mechanically operated valve spring compressor. These results were disclosed by Orillos et al. 2011,during the results and findings of their study. Table 2. Shows respondents’ to the two valve spring compressor.

Legend

Scale Interpretation

- 5 Strongly Agree
- 4 Agree
- 3 Uncertain/ / Undecided
- 2 Disagree
- 1 Strongly Disagree

Table 2. shows the result of the information gathered. The weighted mean was used to measure the average responses. It revealed that on average, the respondents were uncertain/undecided that the mechanically operated valve spring compressor is easy to use/handle by any users, that it requires less time for the process and that there is less number of workers. Students involve in using it. On the other hand, the respondents strongly agree that the design and develop portable hydraulic valve spring compressor is easy to use/handle by any users, there is a short time needed for the

process/steps and these compressor requires less number of person involve during the work. The respondents agree that the two compressor yield quality of work. Orillos et al. 2011, stated that the results may have been attributed to the combination of the hydraulic principle and simple machine construction and that it could perform better in all four specific parameters than with the mechanical device.

Conclusion

The design and develop Portable Hydraulic Valve Spring Compressor performs better than the Mechanical Valve Spring Compressor in terms of the four parameters namely: easiness to use/handle, time element for the process/steps, number of students involved in the work and the quality of work, thus, it improves the performance and functionality of the mechanical device.

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