

## A Review on Spring Stiffness Testing Machine

Pathan Mosin Aouraze<sup>1</sup>, Patel Soyal Dastagir<sup>2</sup>, Pawar Santosh Balu<sup>3</sup>, Labade Suyog Bajirao<sup>4</sup>

<sup>1</sup>Student, Dept. of Mechanical Engineering, Shri Chhatrapati Shivaji College of Engineering, Maharashtra, India

<sup>2</sup>Student, Dept. of Mechanical Engineering, Shri Chhatrapati Shivaji College of Engineering, Maharashtra, India

<sup>3</sup>Student, Dept. of Mechanical Engineering, Shri Chhatrapati Shivaji College of Engineering, Maharashtra, India

<sup>4</sup>Student, Dept. of Mechanical Engineering, Shri Chhatrapati Shivaji College of Engineering, Maharashtra, India

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**Abstract-** Spring are vital to vehicle because they support the weight of your car and allow it to remain stable even in rough driving condition. They have the ability to expand when you hit dips on the road and compress when you encounter bumps or cut into hard corners .A spring can also keep your trunk off of the ground and determine ride height, which in turn influences steering and suspension. If ride height of vehicle has decreased excessively or spring coil has broken it is necessary to replace the spring. For finding performance of the spring it is necessary to know stiffness of the spring. In this paper we see how the stiffness is measure. For this we use spring stiffness testing machine. In this machine we compress the spring and measure the corresponding load and deflection of spring. With the help of load and deflection reading we can easily calculate the stiffness of spring.

**Key Words:** Spring, Ride height, Spring coil, Stiffness, Spring testing machine, Load, Deflection.

### 1. INTRODUCTION

A spring is an elastic body used to store mechanical energy. When a spring is compressed or stretched from its mean position, it exerts an opposing force approximately proportional to its change in length. Spring is used in hydraulic valves, ball point pens, in a round hole or anywhere a pushing or compressing force needs to be applied. It is also used in brakes, clutches, spring balance, shock absorber, toys and watches etc.

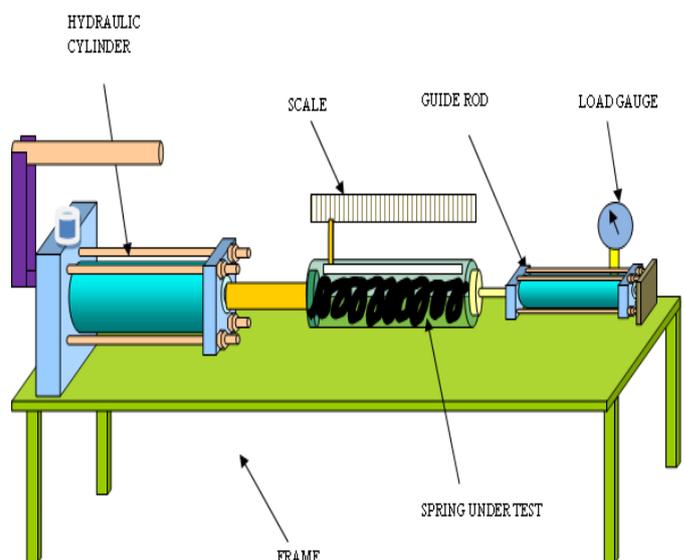
The most common application of spring is in vehicle suspension. Main reason for replacement of spring is physical damage. Spring stiffness must be checked before replacement. This spring test machine will give the force applied on spring. With the help of force and deflection produced, we can calculate stiffness of spring. By varying the force, we can obtain corresponding deflections. If load plotted along the Y-axis and deformation plotted along the X-axis, the spring stiffness is determined as the slope of the straight line. The unit of stiffness of extension or compression spring is  $N/m$ . Whereas Torsion springs unit is  $N \cdot m/rad$ . The inverse of stiffness is compliance that is: if a spring has a stiffness of  $10 N/mm$ , it has compliance of  $0.1 mm/N$ . The stiffness of springs in parallel is additive, as is the compliance of springs in series. Springs are specifically designed to be resilient, even when going through vigorous deflections. A key component to this resiliency is in the

spring material. The choice of material is based on numerous factors ranging from fatigue strength, cost and availability, corrosion resistance, magnetic permeability and even electrical conductivity.

### 2. PROBLEM DEFINITION

Springs are used in machines for different purpose. Automatic lever return after removing the load, automatic hydraulic cylinder return, spring are used in die cushioning, In pressure relief valve, in shock absorbers, in between railway wagons, Automobile Industry various shapes and sizes of springs are used. In Industries they purchase the springs for their machines. But they are facing the problem of checking the spring stiffness. Understanding the Industry people problems this simple machine is designed. Machine operation is simple. Only knowing the two readings, load and deflection we can calculate spring stiffness.

### 3. SPRING STIFFNESS TESTING MACHINE



**Fig-1:** Conceptual view of spring stiffness testing machine  
Fig- 1 shows the conceptual view of spring stiffness testing machine, following are the main element of this machine:

#### 1. Large cylinder

It is used to apply the load on spring. Load is applied by hydraulically operated piston and cylinder.

#### 2. Small cylinder with load gauge

Load applied by large cylinder is act on small cylinder through spring which is to be tested. Load gauge is fixed on this small cylinder which shows load or pressure applied on spring.

#### 3. Scale

Scale is used to measure deflection of spring.

#### 4. Frame

Frame is used for providing base to all components.

### 3.1 Working of Spring Stiffness Testing Machine

The force is applied from large cylinder to small cylinder by application of lever. The force applied from large cylinder by lever is multiplied to many times. This multiplied force acts on piston. Due to this force piston rod moves outward and presses the spring which is to be tested. From the spring force is transmitted to small cylinder. Since the load gauge is connected to small cylinder. Therefore load gauge measure the pressure acting on it with the help of bourdon tube. After this measure the deflection of spring with the help of scale. As we have reading of load applied on spring and deflection of spring we can easily calculate the stiffness.

### 4. ADVANTAGES, DISADVANTAGES AND APPLICATION

#### 4.1 Advantages

- Different diameter spring can be easily checked.
- Machine is non-destructive type that is spring does not damage during test.
- Skilled operator is not required for operating this machine.
- For testing the spring one man is enough.
- The testing is done in less time, so production rate is high.
- The system is portable, noiseless and self lubricating.

#### 4.2 Disadvantages

- Below 40mm and above 70mm spring wire diameter cannot be checked.
- As hydraulic cylinders are used, leakage problems occur.

#### 4.3 Application

- The spring stiffness testing machine is used for measuring stiffness of helical and spiral spring in between 40mm to 70mm wire diameter.
- Spring testing machine used in spring manufacturing industries in quality control department.
- It is used in educational institute to compare the theoretical design and practical spring stiffness.
- Spring testing machine is used in garages also for checking suspension of various automobile.

### 5. CONCLUSION

For a spring the most important characteristic is stiffness under load. In spring testing machine we can find stiffness of spring having diameter ranges from 40mm to 70mm. The result obtained from this machine is verified with standard value. This machine is able to making testing of spring stiffness easier and affordable by automobile industries.

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