International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

# Fabrication of Wear Testing Machine

**M. N Kaarthik[1], B. Rohit[2], Nayan N Baheti[3], Rohan M[4], A.Bhaskar[5]**

U.G Students

Asst. Professor (S.G), SRM Institue of Science and Technology, Ramapuram, Chennai, India

**Abstract:** ***The project was carried out to design and fabricate a circular pin disc wear tester with effective cost and efficient wear tester (pin on disc) used in the metallurgy research field. The purpose of the project is to study the application of the principle of friction on a pin into the circular disc, and calculate the pressure of two types of pin (copper and aluminum) towards the circular mild steel disc. The parameters that are going to be used to get the results are toque, moment, force applied, speed of rotation, duration of test and total revolution per minute disc rotation. The tachometer will be used to measure the revolution per minute of the disc surface. By doing that, we can accurately calculate the volume lost and the wear rate of the materials. The outside wear machines are costly, not often to be had and beyond the scope of the researchers. In the process with the want to produce a double reason effective system with one hundred% locally sourced substances and additives.***

**Keywords:** Three phase motor, Dial gauge, Pulley, Belt drive.

## 1. Introduction

The outside wear machines are costly, not often to be had and beyond the scope of the researchers. In the process with the want to produce a double reason effective system with one hundred% locally sourced substances and additives for you to be cheap and easily to be had to surface have a look at and could enhance productiveness, satisfactory manage, good production practice within the constructing material enterprise and additionally spur national economic boom, the design and fabrication of a put on trying out system is done. Pin on disc wear take a look at machines have been designed and constructed. Pin on disc wear tests are done by applying a constant regular load in the touch even as rotating the disc at constant pace. The weight reduction is constantly measured and saved to calculate the damage rate. The aim of this have a look at was to assess the impact of changing the weight at the charge of wear, via layout a tool to discover the fee of material eliminated under the effect of different loads.

## 2. Components Used

The components that are used in the project FABRICATION OF WEAR TESTING MACHINE are as follows:-

- Frame
- Motor
- Pulley
- Bearing
- Rim
- V-belt
- Washer
- Rope
- Pin Holder
- Pin
- Pin On Disc
- Weights

- FRAME: This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement.
- V-BELT: A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel.
- 4 D.C Motors (ROBO-2 JOHNSON Geared Motor 500 RPM, 12V , Torque Rating- 10 kg, Speed Rating- 500 RPM) are used for basically converting electrical energy to mechanical energy.
- Spur gears are used for the motor and the shaft.
- Railway Tracks of material Mild Steel (12 feet long) are used.
- Excide –Lead Acid Battery (Output Voltage 12V and Output Power 7Ampere Hour) is used.

## 3. Block Diagram

### 3.1 2D Block Diagram of the system:

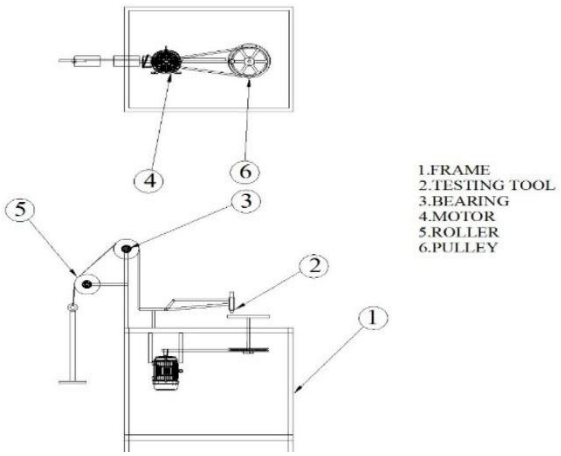



**Figure 1:** 2D Block Diagram of the System

1. Frame
2. Testing Tool
3. Bearing
4. Motor
5. Roller
6. Pulley

## 4. Working Principle

- The wear testing machine consists of the testing edge, pulleys, weight, measuring gauge, AC motor, and the table.
- The AC motor is mounted on the bottom side of the table which is used for achieving the rotating motion of the test piece.
- The test piece is loaded of the work table and is made to rotate with the help of the motor power supply.
- Initially the testing edge is allowed to touch on the test specimen and is made as the initial or the zero value in the gauge and the specimen is rotated with the work table which is integrated with the motor.
- Axial load is applied to the pin against the plane surface of the rotating disc.
- When the load is applied, the gauge readings are noted and the noted readings are the wear properties of the material.

## 5. Future Scope

- By making some more corrections like selection of the perfect materials, and maintaining the working temperature it would be the successful analytical tool which can be used to measure the wear rate.
- By the addition of temperature sensor and a digital display device it can also help to evaluate the variations of temperature with wear &friction parameters.
- On making exact modifications/changes the wear resistance of bio made substances, costly coatings, bulky type of substances can be found out.
- The effect of dynamic loading can also be studied.
- Tests can be performed out with repeated continuous loading and unloading parameters.

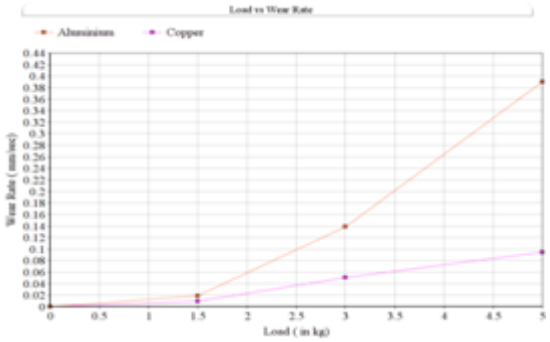
## 6. Existing System

The current machines take into account with modifying/ changing the current wear testing machine with the help of measuring instruments like thermistor & thermocouple and to vary the results by using various lining substances. The wear of all the substances are differentiated and results are formed on the data received. The change in wear with respect to time , various loads and lining substances are studied. The temperature changes in the substances under different parameters were observed and the obtained results are reported.

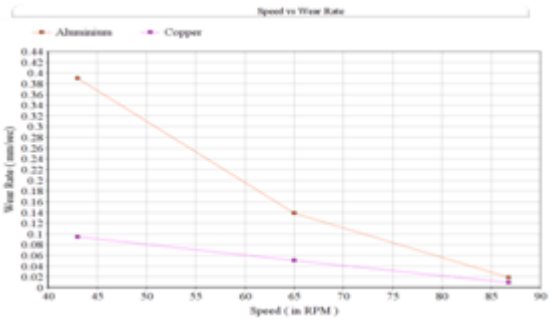
## 7. Proposed System

- This project proposes a model of low cost wear testing machine whose components are cheap and are easily available in the local markets.
- The proposed model is very easy to handle as there no complex mechanisms.
- The proposed wear testing machine can be operated by non skilled workers also. This reduces the labour cost.
- There is only one moving part in the proposed machine namely wheel.
- In the proposed wear testing machine model, there is an endurance that the wear rarate will be same for different atmospheric conditions.
- The proposed model uses a 3 Phase Induction motor. Thus only source of power consumption is by the motor alone.
- As there are few moving parts only, the maintenance becomes easy.
- In the proposed machine both Pin and the disc can be tested.
- On making proper modifications the wear resistance of bio materials, coatings, bulk materials and composites can be found out.
- Further modifications can be done to facilate experiments to study the effect of temperature and relative humidity by providing environmental chamber, when material is operating under dynamic loading condition.

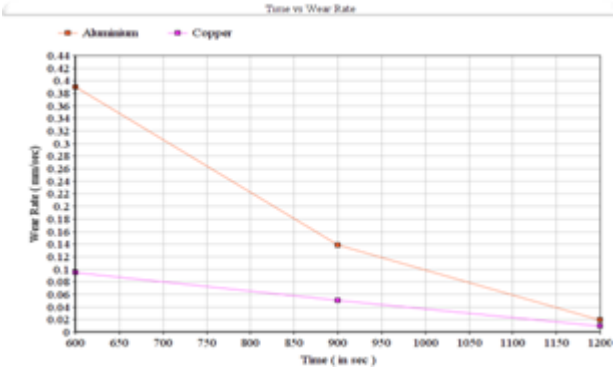
## 8. Graphs




**Graph 1:** Load vs Wear Rate




**Graph 2:** Speed vs Wear Rate




**Graph 3:** Time vs Wear Rate

## 9. Construction

- The bars are cut according to dimensions by the metal cutting operation.

- The bars are welded (arc welding) to form the main FRAME.
- The grinding operation is performed on the frame after the welding operation is completed.
- The sheet metal is cut according to the dimensions and placed on the top of the frame.
- The bearing cap is fixed and a long rod is inserted.
- Disc is fixed on the top of the rod with the help of nut and bolt.
- Pulley is fixed at the bottom of the rod. Bushings are also used.
- 3 Phase Induction motor is fixed on the bottom side of the frame by welding.

- Two small pulleys for the purpose of counter weights are constructed on one side of the frame at the top.
- Steel rope is fixed by using interlocks.
- Counterweight rod is connected with the rope.
- Switch is provided on the one side of the frame.
- All the electrical wirings is done fixing the motor and the switch.
- Meanwhile the wheel disc, pins, and column holding the pins is fabricated according to the required dimensions on the Lathe machine

## 10. Observations

| Material | Load (in kg) | Speed (in RPM) | Weight of the Pin | | Time (in sec) | Wear Rate (in mm/sec) |
|---|---|---|---|---|---|---|
| | | | Before (in g) | After (in g) | | |
| Aluminium | 1.5 | 86.8 | 105 | 102 | 1200 | 0.019 |
| | 3 | 65 | 102 | 90 | 900 | 0.1386 |
| | 5 | 43 | 90 | 75 | 600 | 0.39 |
| | 1.5 | 86.8 | 276 | 272 | 1200 | 0.00947 |
| Copper | 3 | 65 | 272 | 260 | 900 | 0.0505 |
| | 5 | 43 | 260 | 250 | 600 | 0.0947 |

## 11. Calculations

**For Aluminium:**

$$\text{Wear Rate} = \frac{3}{0.0027 * 2000 * 1200 * 23.74}$$

$= 0.019$ mm/sec

**For Copper:**

$$\text{Wear Rate} = \frac{4}{0.00896 * 2 * 1200 * 19.63}$$

$= 0.00947$ mm/sec

## 12. Advantages and Disadvantages

**Advantages**

- Wear on multiple places can be tested,
- Easy in handling,
- No trained operators are required.

**Disadvantages**

- Initial cost is high.
- More number of moving parts.

## 13. Conclusion

- Thus, the average wear rate of Aluminium$= \frac{0.019 + 0.1386 + 0.39}{3}$

  $= 0.1825$ mm/sec
- Thus, the average wear rate of Copper $= \frac{0.00947 + 0.0505 + 0.0947}{3}$

  $= 0.0515$ mm/sec
- We can conclude that Aluminium has a greater wear rate than Copper.
- Thus Aluminium wears more in comparison with Copper.
- As the loads were gradually being increased, the speed was decreasing and thus the Wear Rate was increasing.
- For different loads, different durations of time are used i.e., 1200 sec, 900 sec and 600 sec.
- More the wear rate , more the material wears and gets damaged faster.
- Thus we can come to a conclusion that as Aluminium wears faster than Copper, it will wear faster and be damaged earlier than Copper.
- Copper should be preferred over Aluminium as the wear rate is lesser than Aluminium and thus the copper material will wear slower than Aluminium.
- The weight of the specimen pin was taken before and after the testing on weighing machine. And then only the weight loss was calculated.
- The Dial Gauge reading is set to ZERO before the testing. After the testing is done dial gauge reading is checked to know the deflection.

## References

[1] Hareesha M and Jeevan T. P. (October 2014) "*Modification of Abrasive Wear Testing Machine and Testing of Materials*"- International Journal of Science and Research (IJSR), Volume 3, Issue 10

[2] Sumit Sharma and Ajay Sharma (January 2015) "Investigation of Wear Characteristics of Aluminum Disc with Pin on Disc Tribometer"-International Journal of Scientific & Engineering Research (IJSER), Volume 6, Issue 1

[3] Mr.KiranDeore, Ms.LalitaAage and Prof.ManojHajare ( February 2015)"*Testing of Wear Rate Frictional Force and Coefficient of Friction Computationally Using Pin On Disk*"- International Journal of Engineering Trends and Technology (IJETT)Volume 20,Number 5

[4] T R HemanthKumar,R P Swamy and T K Chandrashekhar (August 2013)"*An experimental investigation on wear test parameters of metal matrix composites using Taguchi technique*"-Indian Journal of Engineering and Materials Sciences(IJEMS),Volume 20

[5] Deepak Shinde and Ganesh Gaitonde (May 2000) "*Standard Test Method for Wear Testing with a Pin-on-Disk Apparatus*"- ASTM Committee on Standards

[6] Gab-Su Choi Young-SikPyun, Jun-Hyoung Kim, Hak-Doo Kim, Yasutoshi Tominaga and ShirmendagwaDarisuren(January 2012) "*A development of multi purpose testing machine for friction, wear and*

*rolling contact fatigue*"- International Journal of Modern Physics: Conference Series ,Vol. 6

[7] AmalEbrahim NASSAR and EmanEbrahim NASSAR(December 2011) "*Design and Fabrication of a Wear Testing Machine*"- Leonardo Electronic Journal of Practices and Technologies , Issue 19

[8] Oris L Watson andCleveland & David L(October 2015) *"Design of wear testing machine*"- International Journal of Scientific & Engineering Research (IJSER), Volume 10, Issue 6