Spindle Resistance Survey and Conclusions, Version 1.1

By R. G. Sparber

Conclusions

1. By comparing the spindle to machine body electrical resistance before and after lubrication, it ***may*** be possible to determine when sufficient lubrication has penetrated the bearings.

2. My latest Electronic Edge Finder is compatible with 68% of the machines. By changing one resistor value, it works with 82% of the machines. If my Software Defined Electronic Edge Finder is used, all machines are compatible.

Background

Milling machines and lathes share a feature: a shaft, called a spindle, which rotates. The spindle experiences significant axial and radial forces, so it must be securely supported. Modern machines use ball bearings, while older machines use close-fitting solid metal bearings. A lubricant covers all internal surfaces to minimize friction and reduce wear.

All bearing lubricants I have encountered have high electrical resistance. When all internal bearing surfaces are coated adequately with lubricant, the electrical resistance between spindle and machine body is higher than when dry.

A common ohmmeter can measure the resistance between the spindle and machine body to assess how well the lubricant covers the bearings. If “large,” all is well. If “small,” we know there is a problem, but the exact location is unknown.

My primary motivation for this study was to learn how many machines can use my newest Electronic Edge Finder. As this study unfolded, I saw the potential as a diagnostic tool for bearings and lubrication.

Results

82% of the machines measured at least ½ ohm, while 68% measured at least 1 ohm.

Newer ball bearings tend to have a higher electrical resistance than older ones.

I have one case involving a lathe with solid metal bearings. It behaves the opposite of ball bearings.

The Testing Procedure

This procedure evolved as data was collected, so not all data sets are complete. However, all of the data has proven to be invaluable.

Common ohmmeters have two test probes. These probes have resistance which adds to the resistance under test. We can trust the reading if the resistance under test is much larger than the probe resistance. If not, we can first measure the probe resistance and subtract it from the subsequent test reading.

Equipment

The ohmmeter must be able to measure tenths of an ohm.

Procedure

1. Record the make and model of the machine.
2. Set the ohmmeter to the most sensitive scale.
3. Touch both probes to the machine's body and record this value.
4. Move one probe to the spindle, so the meter measures between the spindle and machine body.
5. Subtract the reading in step 2 from this reading and record the result.
6. By hand, rotate the spindle about 5 degrees.
7. Take a second measurement and subtract the reading in step 2 from this reading. Record the result.
8. Remove the probes and run the machine for a few seconds.
9. Repeat steps 1 – 4.

Data

Machine	First reading	After small rotation	Notes	source
Standard Modern 11” (Manual Lathe)	0.66 ohms	1.31 ohms		nova_robotics
Hardinge VMC600ii (CNC 3 axis mill)	0.97 ohms	80 ohms		nova_robotics
Chiron FZ 08 KS Magnum (CNC 5/7 axis VMC)	10k	over 300k		nova_robotics
Craftex CX600 (Small Manual Mill)	0.09	1.2 ohms		nova_robotics
Shark HD520 (CNC Router Table)	open circuit	open circuit		nova_robotics
Atlas 12” late 60’s to early 70’s WELL WORN had been in a production facility	.4 ohms	7.7 ohms	High and low readings were repeatable at the same places on the chuck after several revolutions.	odd one
Smithy Midas 1220XL probably less that 2 hours on machine	0.4 ohms	0.7 ohms		odd one
Lathe (AI, dutch brand, ca 1960)	0.5 ohms	no data		Carnel
drill-mill: (HBM, dutch version of Harbour Freight, ca 2000)	0.4 ohms	no data		Carnel
SB Heavy 10	0.5 ohms	0.4 Ohms	Uses tapered roller	brianr47
Myford ML7 with plain white metal bearing and unused for 5 days (**dry**)	6 ohms	3.3 Ohms		Hans Pearson
Myford ML7 with plain white metal bearing and unused for 5 days (**lubricated**)	2.5 ohms	no data		Hans Pearson
1952 Logan 920. It does have ball bearings.	0.9 ohms	0.9 ohms		DSTP
LaBlond 17 inch lathe (**dry**)	0.6 ohms	0.6 ohms		Frank S
LaBlond 17 inch lathe (**lubricated**)	8.2 ohms	no data		Frank S
Emco Unimat SL	29 ohms	35 ohms		Andre
Korean?? lathe	15 ohms	17 ohms		Andre
milling head for above lathe	40 ohms	7 ohms		Andre
Harrison L5A	3.8 ohms	1.8 ohms		Andre
Logan model 1957 11” lathe	0.3 ohms	no data		rebuilder1954
Washington RF-25 pattern mill/drill	.8 ohms	1.3 ohms		rebuilder1954
Grizzley X6320A bought about 1975	14.2 ohms	5.6 to 14.6 ohms		Gary

Comments

- I see a lot of variation between machines. A small range of resistances may indicate adequate lubrication for a given machine.
- The two CNC machines have very high resistance. They might be using ceramic ball bearings.
- The LaBlond 17 inch lathe was tested dry and lubricated with expected results. The Myford, which employs solid bearings, seems to behave opposite, but I can’t be sure because the second number is missing.

Acknowledgments
Thanks to Jon of homemadetools.net for promoting my request for data. I am indebted to all of the people listed in the data table. Most are from this site.

I welcome your comments and questions.

If you want me to contact you each time I publish an article, email me with "Subscribe" in the subject line. In the body of the email, please tell me if you are interested in metalworking, software plus electronics, kayaking, and/or the Lectric XP eBike so I can put you on the right distribution list.

If you are on a list and have had enough, email me "Unsubscribe" in the subject line. No hard feelings.

Rick Sparber
Rgsparber.ha@gmail.com
Rick.Sparber.org