

Lab Activity

Field: Industrial Maintenance

Task: Disassemble and Reassemble an Electric Motor

Overview: This is a hands-on lab activity intended to demonstrate some of the day-to-day job tasks which would be performed by an Industrial Maintenance Mechanic. Electric motors are by far and away the most common machines in the world, and repairing them is a perfect example of industrial maintenance work.

To complete the activity, students will:

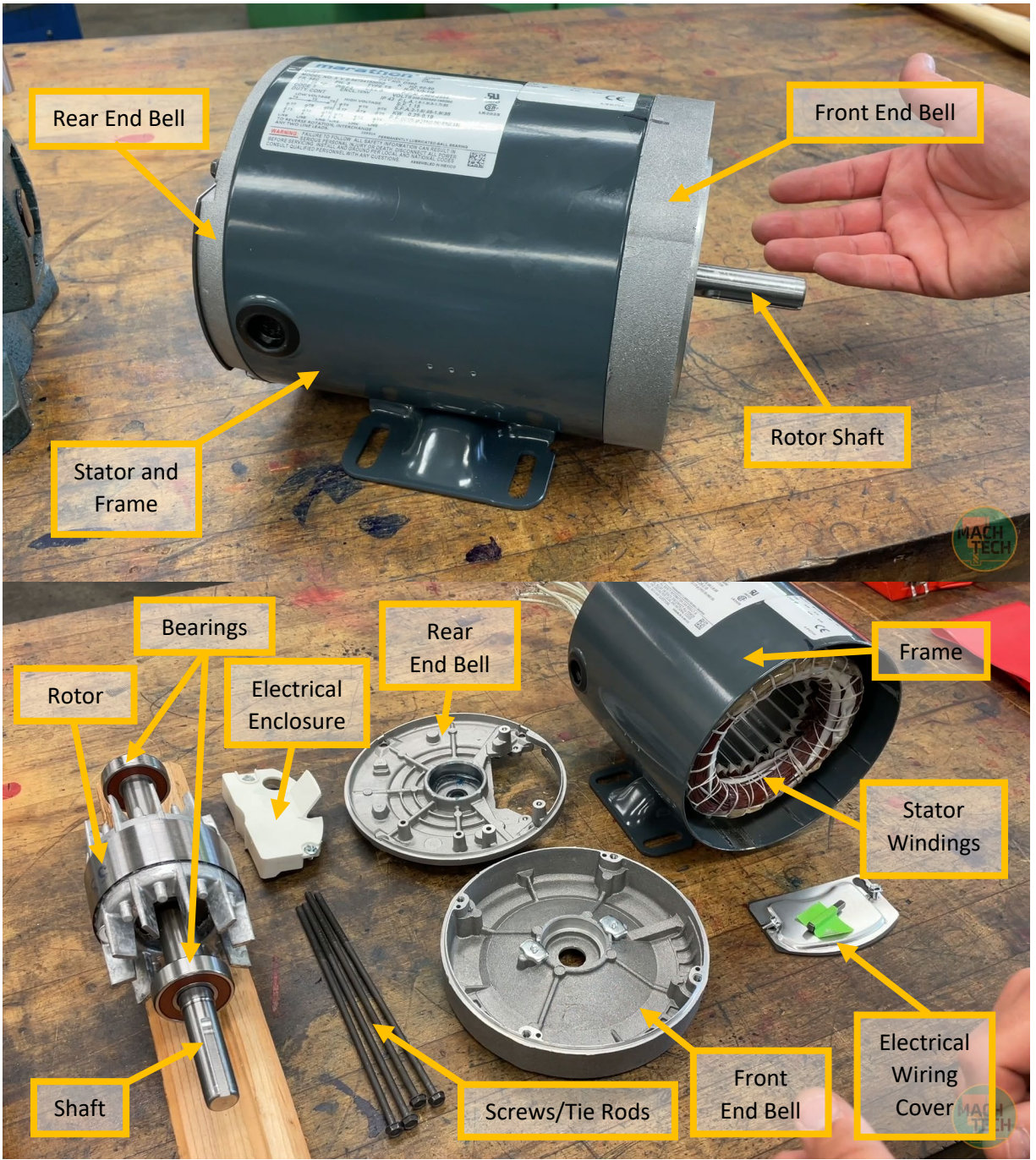
- 1) watch the detailed step-by-step video walkthrough on YouTube:
https://youtu.be/9fM3_XXlfc4
- 2) read the written instructions in this lab activity sheet
- 3) disassemble and reassemble an identical electric motor, using the video walkthrough and written instructions

Students with no prior knowledge should be able to complete this activity during a three hour session. All tools and equipment will be supplied by the instructor. The motor used in the activity is a Marathon Electric Model D390 1/3 HP Three Phase AC Induction Motor.

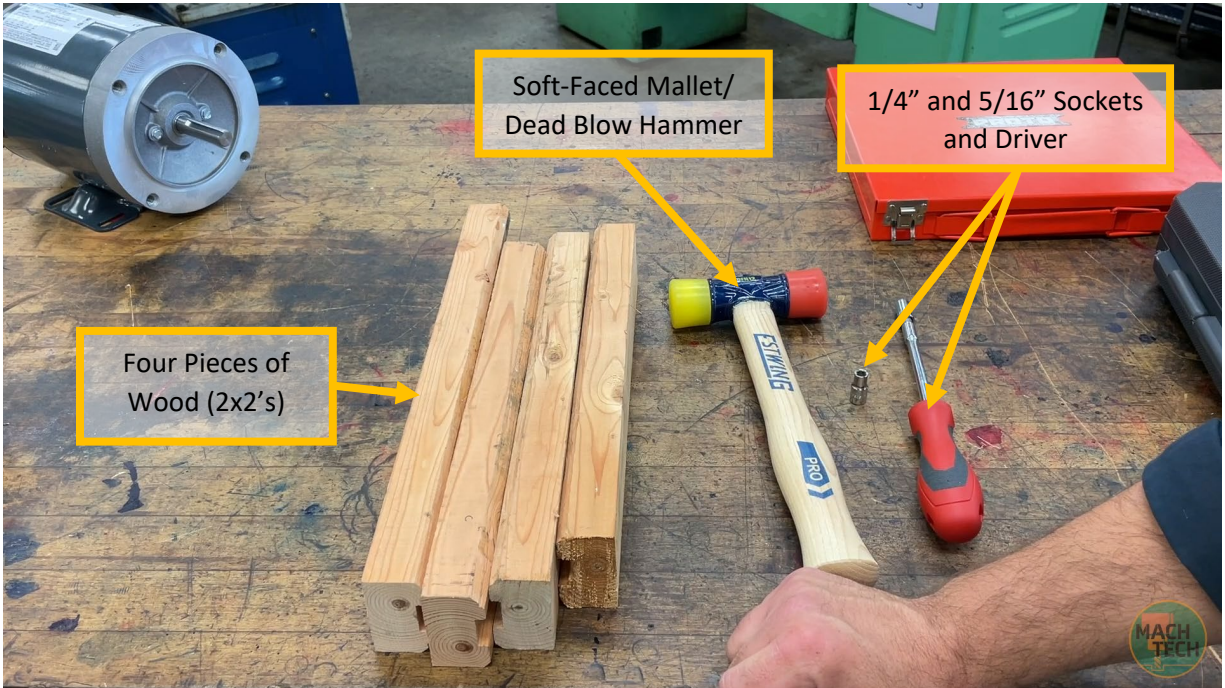
Outcomes: At the end of the activity, students will be able to:

- 1) describe the basic construction of an electric motor
- 2) name the key components of an electric motor
- 3) identify some common hand tools used in assembly work
- 4) disassemble and reassemble a typical industrial electric motor
- 5) remove and install ball bearings (with a hydraulic press)
- 6) follow best practices for successful disassembly and reassembly of machines

Parts of an Electric Motor:



Tools Required:



Disassembly:

Step 1 (Video Timestamp 3:33):

Remove the electrical wiring cover using a 1/4" socket and driver.

Step 2 (Video Timestamp 6:29):

Remove the long screws – sometimes called “tie rods” – which clamp the end bells together using a 5/16" socket and driver.

Step 3 (Video Timestamp 7:57):

Back off the bearing retaining clips in the front end bell using a 5/16" socket and driver. These don't need to be completely unscrewed. They only need to be backed off a turn or two to rotate the clips out of the way.

Step 4 (Video Timestamp 8:32):

Remove the rotor shaft and rear end bell as one piece through the rear of the motor.

Step 5 (Video Timestamp 8:56):

To separate the rear end bell from the shaft, block up the rotor on the pieces of wood and gently tap the rear end bell with a soft-faced mallet or dead blow hammer, rotating between taps, until the rear end bell comes loose.

Step 6 (Video Timestamp 9:17):

Remove the plastic electrical enclosure using a 1/4" socket and driver.

Step 7 (Video Timestamp 10:37):

Remove the wavy washer/disc spring for the rear bearing.

Step 8 (Video Timestamp 11:35):

Remove the front end bell from the stator frame using a drive pin punch.

***The following steps require use of a hydraulic press. Hydraulic presses store large amounts of energy and are dangerous if used inappropriately. Do NOT attempt to operate the hydraulic press with instructor supervision.**

Step 9 (Video Timestamp 14:23):

Remove the rear bearing from the shaft with a hydraulic press. Block up underneath the bearing with some steel bars. Use a short piece of brass to push on the shaft directly.

Step 10 (Video Timestamp 16:59):

Remove the front bearing in the same manner as the rear bearing was removed in the last step. The brass piece is not required because the end of the shaft is accessible.

Reassembly:

Step 1 (Video Timestamp 18:32):

Reinstall the bearings. This is essentially the reverse of the procedure used to remove them. The bearings are pressed onto the shaft. Use a short piece of pipe to push on the inner ring of the bearing. Once the bearing is fully seated against the shaft, stop applying pressure. Do not overload the shaft or you will cause damage.

NOTE: I forgot to turn on the camera when reinstalling the rear bearing. So only the front bearing is shown being reinstalled. The methods are substantially the same.

Step 2 (Video Timestamp 20:28):

With the front end bell sitting on two pieces of wood, assemble the rotor shaft in the front end bell in the vertical orientation.

Step 3 (Video Timestamp 20:59):

Assemble the stator frame over the rotor shaft and on the front end bell.

Step 4 (Video Timestamp 21:28):

Install the plastic electrical enclosure on the rear end bell using a 1/4" socket and driver. Make sure the wavy washer/disc spring is in the bearing pocket in the rear end bell. The grease in the pocket should keep it in place. Assemble the rear end bell on the stator frame. Make sure to pull the wires through the large hole in the plastic electrical enclosure.

Step 5 (Video Timestamp 22:56):

Insert the long screws/tie rods through the holes in the rear end bell and into the threaded holes in the front end bell. Tighten them using a 5/16" socket and driver. Make sure the screws are actually in the threaded holes. If they won't tighten, then they're not in the holes. Be patient.

Step 6 (Video Timestamp 24:40):

Install the electrical wiring cover on the rear end bell using a 1/4" socket and driver.

Step 7 (Video Timestamp 25:08):

Tighten the bearing retaining clips in the front end bell using a 5/16" socket and driver.