

Installing a Replacement Z-Axis Motor

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TD10543: Z-axis Motor Replacement (0118A)

1.1 Purpose

This document gives instructions to replace the Z-axis motor in instances of a Z-axis **brake** failure.

Don't use this procedure if your Z-axis **motor** fails. Email support@tormach.com to contact Tormach Technical Support for guidance on how to proceed.

WARNING! Crash Hazard: You must support the spindle head as described in this document before you make any mechanical or electrical adjustments to the spindle head. (For example, loosening the set screws on the Z-axis motor coupler.) If you make adjustments without first supporting the spindle head, it could result in the spindle head crashing on the machine table.

Complete the replacement Z-axis motor procedure in the order listed.

NOTICE! Never cut and splice any wires when replacing the Z-axis motor. Cut or damaged wires may void your warranty replacement.

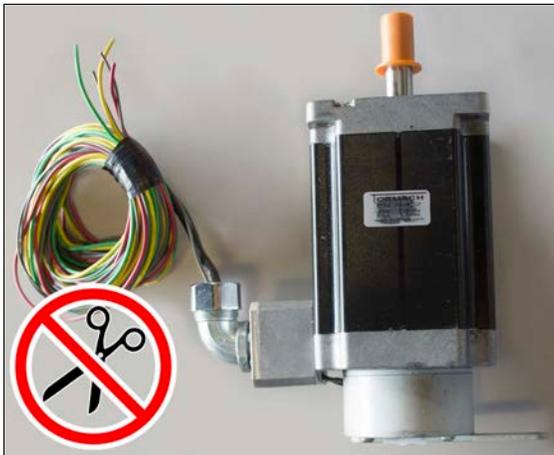


Figure 1-1: Example of a correctly returned motor with no wires cut.

1.2 Required Tools

Before you begin, make sure you have the following tools and items:

- 3/8-inch flat-blade screwdriver
- 1/2-inch flat-blade screwdriver
- #2 Phillips screwdriver
- 3 mm hex wrench
- 4 mm hex wrench
- Electrical tape (or similar)
- Needle-nose pliers
- Shipping block (or similar 3-inch block of wood)
- Spare wire (about 8 feet)

1.3 To Install the Replacement Z-Axis Motor

Installing the replacement Z-axis motor involves the following two steps. Complete them in the order listed:

- "Removing the Existing Z-Axis Motor" (below)
- "Installing the New Z-Axis Motor" (page 7)

1.3.1 Removing the Existing Z-Axis Motor

To remove the existing Z-axis motor, you must complete the following steps in the order listed:

- "Prepare the Machine" (below)
- "Disconnect the Z-Axis Motor and Brake Wires" (page 4)
- "Remove the Existing Z-Axis Motor" (page 5)

Prepare the Machine

1. If you have any tooling in the spindle:
 - a. Remove the tooling.
 - b. If your machine doesn't have a Power Drawbar installed, tighten the collet so that it's flush with the spindle nose.
2. Jog the machine table to the **left (-X)** and **forward (-Y)** to provide full access to the electrical cabinet.

- Put a shipping block (or similar 3-inch block of wood) on the machine table below the spindle nose. This prevents the spindle nose from dropping onto the machine table.

NOTE: If installed, a workholding device can safely hold the shipping block. Make sure the shipping block is securely held on a solid surface.



Figure 1-2: Example of a shipping block placed below the spindle nose.

- Locate the Z-axis motor mount cover plate below the Z-axis motor on the machine column.
- Use a #2 Philips screwdriver to remove the four screws securing the cover plate to the machine column, and set all aside.
- Use a #2 Philips screwdriver to remove the screw, washer, and nut securing the energy chain to the spindle motor cover, and set all aside.

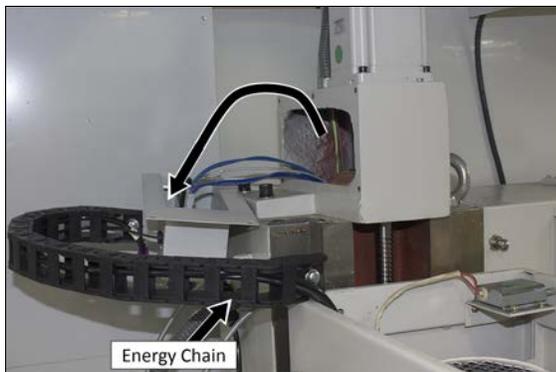


Figure 1-3: Z-axis motor mount below the Z-axis motor on the machine column.

- Locate the four set screws on the Z-axis motor coupler inside the Z-axis motor mount, and make note of the direction to which they point. To easily access the set screws, they must point toward the left side of the machine once the Z-axis is lowered.

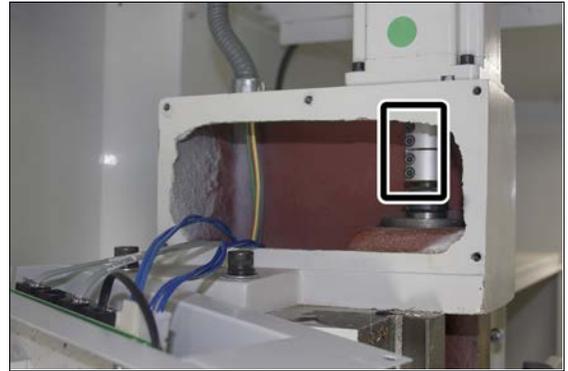


Figure 1-4: Z-axis motor secured to the Z-axis motor coupler with set screws pointing toward the left side of the machine.

- Jog the Z-axis **down (Z-)** until the spindle nose touches the top of the shipping block.
- Power off the machine and the PathPilot® controller.
 - Push in the **Emergency Stop** button on the **Operator Panel**, which disables movement of the axes and the spindle.
 - From the PathPilot® interface, click **EXIT**.
 - Turn the **Main Disconnect** switch to **Off** on the right side of the electrical cabinet.
 - Remove the power plug(s) from the wall outlet. If your system is hardwired, isolate the circuit breaker(s).
 - Follow correct lockout/tagout procedures.

10. Examine the four set screws on the Z-axis motor coupler that you located in Step 7. Make sure they're still pointing toward the left side of the machine.
Depending on the direction in which the set screws are pointing, do one of the following:
 - a. If the set screws are pointing toward the left side of the machine: You have finished preparing the machine. Go to "Disconnect the Z-Axis Motor and Brake Wires" (below).
 - b. If the set screws are not pointing toward the left side of the machine: This indicates that the shipping block is too short for your specific machine. Remove the shipping block and repeat Steps 3 through 9 with a different block of wood. When finished, go to "Disconnect the Z-Axis Motor and Brake Wires" (below).

Disconnect the Z-Axis Motor and Brake Wires

1. Open the electrical cabinet door.

WARNING! Electrocutation Hazard: When servicing the machine from inside the electrical cabinet, always use caution. Points in the electrical cabinet have high voltages that can electrocute or shock you. Even after you've powered off the machine, electronic devices in the electrical cabinet may retain dangerous electrical voltages. Only qualified electrical machinery technicians should perform maintenance or troubleshooting procedures inside the electrical cabinet while power is still on.

2. Inside the electrical cabinet, remove all wire trough covers and set all aside.

3. Use the following image to locate the Z-axis motor driver, the Machine Control Board, and the DC-BUS board.

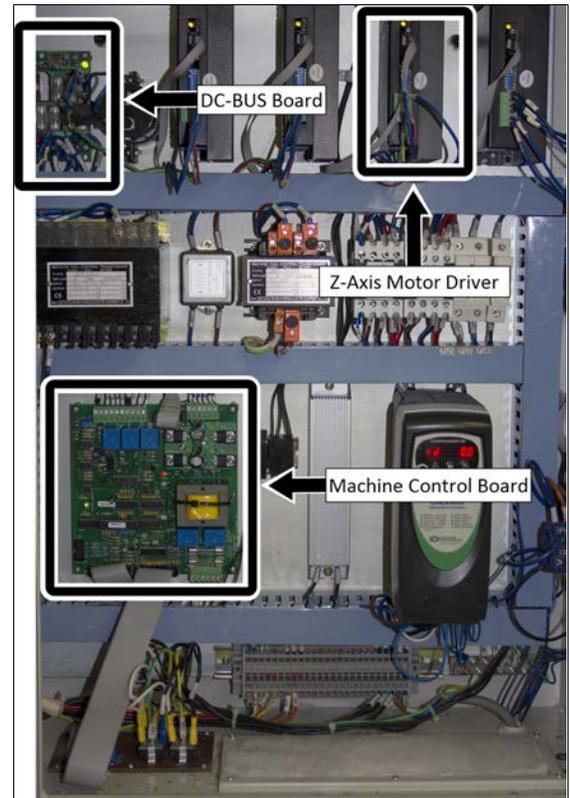


Figure 1-5: Inside of the electrical cabinet.

4. Remove the wire connector from the Z-axis motor driver.



Figure 1-6: Z-axis motor wires on the Z-axis motor driver.

5. Use a 1/8-inch flat-blade screwdriver to remove wires 316, 317, and 318, and set aside the connector.

6. Use needle nose pliers to pull the gray brake wire connector from the DC-BUS board.



Figure 1-7: Brake wire on the DC-BUS board.

7. Use a 1/8-inch flat-blade screwdriver to loosen the set screw below wire J1-7 on the Machine Control Board.

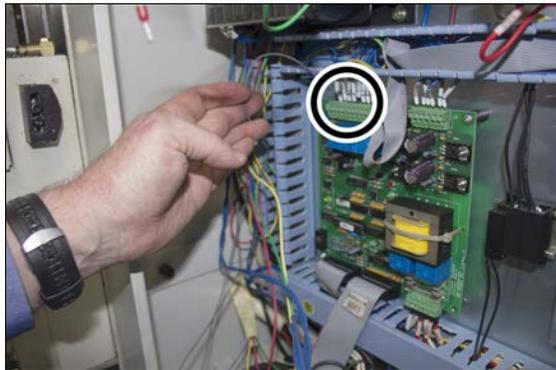


Figure 1-8: Brake wire on the Machine Control Board.

8. Use a needle nose pliers to remove the gray brake wire. You have disconnected all Z-axis motor and brake wires.
9. Go to "Remove the Existing Z-Axis Motor" (below).

Remove the Existing Z-Axis Motor

To replace the Z-axis motor, you must move all five Z-axis motor and brake wires from the electrical cabinet, through the machine column, and out of the Z-axis motor mount.

NOTICE! Never cut and splice any wires when replacing the Z-axis motor. Cut or damaged wires may void your warranty replacement.

1. Group together the Z-axis motor and brake wires that you disconnected in "Disconnect the Z-Axis Motor and Brake

Wires" (on the previous page).

2. Shape the wires into a loop, then insert the spare wire into the loop.

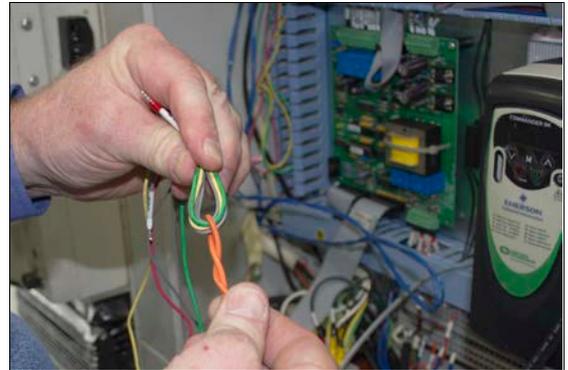


Figure 1-9: Example of a spare wire grouped together with the Z-axis motor and brake wires.

3. Put electrical tape around both the loop and the spare wire to secure all wires together.

NOTE: Make sure that the group is thin enough to be pulled out through the electrical cabinet's access hole.

4. Locate the Z-axis motor cable connector on the machine column, and unscrew the cable connector by hand. All five Z-axis motor and brake wires are inside of the Z-axis motor cable connector.



Figure 1-10: Z-axis motor cable connector.

5. Pull the wires from the Z-axis motor cable connector through the hole in the top of the Z-axis motor mount.



Figure 1-11: Z-axis motor and brake wires inside of the Z-axis motor cable connector.

6. Continue to pull the wires up and out of the top of the Z-axis motor mount from the electrical cabinet until the loose end — with the spare wire — is visible within the side opening of the motor mount.

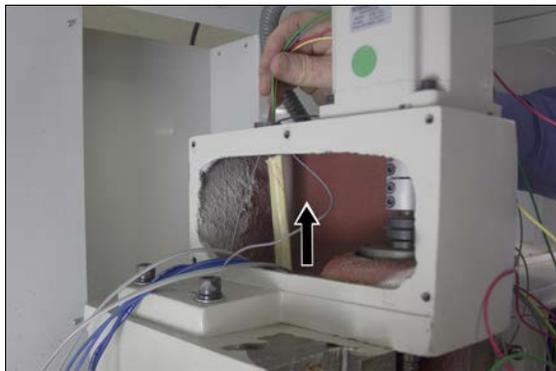


Figure 1-12: Side opening of the Z-axis motor mount.

7. Pull the wires through the side opening of the Z-axis motor mount to access the loop that you made in Step 2.
8. Separate the spare wire and set it aside. Make sure the spare wire remains threaded inside the machine column, since it's required to rewire the replacement Z-axis motor.
9. Pull the Z-axis motor and brake wires out the top of the Z-axis motor mount.

10. Use a 3 mm hex wrench to loosen the top two set screws on the Z-axis motor coupler in the Z-axis motor mount. To keep the Z-axis motor coupler from falling, make sure the bottom two set screws remain securely connected.

NOTICE! If you loosen all four set screws, the coupler could disconnect from the ball screw shaft and fall to the bottom of the Z column.



Figure 1-13: Z-axis motor coupler set screws.

11. Use a 4 mm hex wrench to remove four screws securing the Z-axis motor to the top of the machine column. Set aside all screws.
12. Use a 3/8-inch flat-blade screwdriver to pry up the Z-axis motor while slowly moving the Z-axis motor side to side until it releases.



Figure 1-14: Z-axis motor on the Z-axis motor mount.

13. Pull the Z-axis motor straight up and out of the motor mount.
You have finished removing your existing Z-axis motor.
14. Go to "Installing the New Z-Axis Motor" (on the next page).

I.3.2 Installing the New Z-Axis Motor

To install the new Z-axis motor, you must complete the following steps in the order listed:

- "Install the Replacement Z-Axis Motor" (below)
- "Connect the Replacement Z-Axis Motor and Brake Wires" (on the next page)
- "Reassemble the Machine" (on the next page)

Install the Replacement Z-Axis Motor

1. Make sure there are no chips or dirt on the mounting surfaces for the Z-axis motor. If needed, clean the surfaces. Take care to keep any chips or dirt from falling into the machine column.
2. Examine the four set screws on the Z-axis motor coupler to make sure they're still pointing toward the left side of the machine.
3. Insert the Z-axis motor shaft straight down into the Z-axis motor coupler while slowly moving the Z-axis motor side to side until it's against the motor mount.

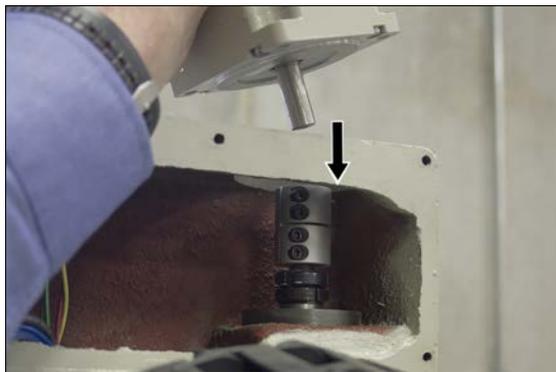


Figure 1-15: Example of a Z-axis motor installation into a Z-axis motor coupler.

4. Use a 3 mm hex wrench to loosen the bottom two set screws on the Z-axis motor coupler in the Z-axis motor mount. This removes tension from the motor shaft.
5. Locate the four Z-axis motor screws that you set aside in "Removing the Existing Z-Axis Motor" (page 2).
6. Insert the four screws into the Z-axis motor, then, use a 4 mm hex wrench to tighten the screws and install the replacement Z-axis motor. Make sure that there is no gap between the Z-axis motor and the machine column.

7. On the Z-axis motor coupler, use a 3 mm hex wrench to tighten the set screws, then make one additional quarter turn.



NOTE: To avoid lost steps during machining, you must make sure all set screws are fully tightened.

8. Put the Z-axis motor and brake wires through the top of the Z-axis motor mount and out of the side opening.

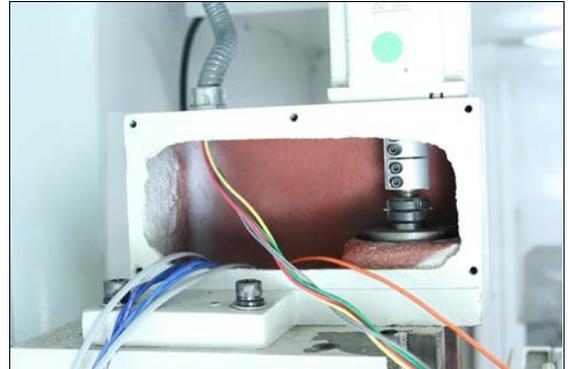


Figure 1-16: Side opening of the Z-axis motor mount.

9. Tighten the Z-axis motor cable connector by hand.
 10. Group together the Z-axis motor and brake wires, and shape them into a loop.
 11. Insert the spare wire into the loop of Z-axis motor and brake wires.
 12. Put electrical tape around both the loop and the spare wire to secure all wires together.
- NOTE:** Make sure that the group is thin enough to be pulled through the electrical cabinet's access hole.
13. Put the wire sheath over the Z-axis motor and brake wires.
 14. Use the spare wire — which is still threaded through the machine column — to pull the replacement Z-axis motor and brake wires into the electrical cabinet.
 15. Once you can access the wires in the electrical cabinet, remove the spare wire.
 16. Go to "Connect the Replacement Z-Axis Motor and Brake Wires" (on the next page).

Connect the Replacement Z-Axis Motor and Brake Wires

1. Locate the wire troughs in the electrical cabinet.
2. Put the Z-axis motor and brake wires into the wire troughs, and into the following locations:
 - Wires **316**, **317**, and **318**: Insert into to the Z-axis motor driver.
 - Gray brake wire with spade connector: Insert into the DC-BUS board.
 - Gray brake wire without spade connector: Insert into **J1-8** on the Machine Control Board.
3. Make all necessary electrical connections in the order in which you removed them.
4. Install the wire trough covers.
5. Close the electrical cabinet door.
6. Go to "Reassemble the Machine" (below).

Reassemble the Machine

1. Locate the four set screws that you set aside in "Prepare the Machine" (page 2).
2. Use a #2 Phillips screwdriver to attach the Z-axis motor mount cover plate to the machine column.
3. Locate the set screw, washer, and nut that you set aside in "Prepare the Machine" (page 2).
4. Use a #2 Phillips screwdriver to attach the energy chain to the spindle motor cover.
5. Power on the machine and the PathPilot® controller.
 - a. Turn the **Main Disconnect** switch to **On** on the right side of the electrical cabinet.
 - b. Twist out the **Emergency Stop** button on the **Operator Panel**, which enables movement to the machine axes and the spindle.
 - c. Press the **Start** button on the **Operator Panel**.
 - d. Bring the machine out of reset and reference it.
6. Make sure the Z-axis replacement motor works:
 - a. Do a test of Z-axis movement: Jog the Z-axis **up (+Z)** and make sure the Z-axis does not make any unfamiliar noises.
 - b. Do a test of Z-axis brake: Push in the **Emergency Stop** button and make sure the spindle head does not move.If the tests are successful: You have finished installing your replacement Z-axis motor. Remove the shipping block and keep it for future use.
If the tests are not successful: We can help. Email support@tormach.com to contact Tormach Technical Support for guidance on how to proceed.