

# MAZDA B series FE3 engine swap HOW \_ TO

## Intro

I will be installing an FE3 engine into my 1987 Mazda b2000. This is a guide on what I have found.

The information has been sourced primarily from the kia FE3.wiki site and online forums from members that have performed the swap on their B Series trucks. The purpose of this guide is to be as concise and clear and to have a decent swap without spending too much money or cutting corners. I am no expert and am always looking for advice/ knowledge and better ways of doing things. This guide is without using power steering or a/c connection

### Required (parts)

#### *NEEDED FROM B SERIES engine*

- Oil pan
- Oil Pick Up tube
- Transmission
- Engine mounts
- Lower coolant pipe
- Clutch from Mazda
- Oil dipstick and tube

#### *NEEDED from FE3*

- FE3 engine (Sourced from 1995 2002 Kia Sportage \* try to source from engine with the same transmission)
- Engine Wire harness (Source from a 1996+ to use OBD2 for better diagnosis) with fuse block
- Upper and lower O2 sensors
- OBD 2 port
- Chassis accelerometer
- Crankshaft position sensor
- Maf sensor
- IAT sensor
- Throttle cable
- Fuel pump
- Ecu (compatible ECUs as referenced from the FE3 wiki)
- Clutch and flywheel
- Exhaust manifold and Gasket

#### *Other parts needed*

- Header from 1.8 Miata may be used but holes need to be drilled larger
- 14 inch Electric Fan to attach to radiator

### Miscellaneous

- New belts
- Change oil and filter
- Coolant flush
- Engine hoist
- Socket wrenches / tools
- Caliper tool for measuring crank position sensor
- High pressure fuel lines and fuel pump
- 11/16" drill
- Epoxy and JB weld to mount crank position sensor
- Dremel tool and sanding drum
- Crank sensor (Beck ARNley 180-0325)
- If you have a manual transmission here are a list of compatible ECUs

#### From Tiburon

- 1997 RD 1.8 39150-23920
- 1997 RD 2.0 39110-23910
- 1998 RD 1.8 39150-23920
- 1998 RD 2.0 39110-23930
- 1999 RD2 2.0 39110-23931
- 2000 RD2 2.0 39110-23931
- 2001 RD2 2.0 39110-23956

ECU "39110-23930" was the one used in the first swap, But from what is known any of them should be fine.

#### From Elantra

- 96 J2 39110-23900
- 97 J2 39110-23920
- 98 J2 39110-23940
- 99 J2 39150-23956

### Resources (websites/guides/videos)

- a. Facebook groups that have been a huge help
  - FE3 MAZDA SWAP
  - Mazda B2000/B2200 builds 86-93
- b. Websites
  - <https://fe3.wiki/>
  - Much of this guide is a copy and paste of this page but my guide is a bit easier to read - [Silent dawns kia swap](#)
- c. YouTube Videos/channels
  - Imaginary Machines How to wire a b2000 - [video](#)
- d. List of car models the FE3 can be sourced from

### GETTING STARTED

1. REMOVE THESE FROM YOUR B – SERIES TRUCK
  - Engine and Transmission from truck
  - Oil Pan and Oil Pick up tube
  - Oil dipstick and tube?
  - Lower coolant pipe
  - Engine Mounts
2. Transferring Everything over to your FE3
  - Remove lower flywheel shield from FE3
  - Remove KIA engine mounts and transmission side braces
  - Install Oil Pick up tube and Oil Pan (oil level on the dipstick will be incorrect because of the shallower oil pan)
  - Install Lower coolant pipe (from B series)
  - Install Kia Manual fly wheel to engine
  - Install clutch from Mazda (other compatible clutches?)
3. Drill a precise hole for the Crank Position Sensor
  - On the Bell housing measure in 44mm from the mating flange



- From the center of the volt hole, measure up 36mm to intersect the first line



or..... Mark 36mm from the center of the bolt hole on the face and transfer it onto the bellhousing with a combo square







- Start with a smaller drill bit and go up and size but you'll ultimately need to drill a 0.700" hole for the VR Sensor. That is a 45/46" drill, or 11/16"

- Message it a bit with a Dremel sanding drum

Note: If you drill an 11/16" hole it is tight enough to press fit the vr sensor into the bellhousing hole and epoxy seal it in place.

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- The 4 cycle Bosch 60-2 trigger wheel is set up with the VR sensor at 115 degrees from tooth 1 at Top Dead Center.  $360/60(\text{teeth})$  is 6 degrees per tooth.

-  $114 \text{ degrees} / 6 \text{ degrees} = 19$ . Count 19 teeth between the VR sensor and + tooth 1. So tooth 20 is where the VR sensor will be at TDC.

- You can see at the bottom of the flywheel is a red tooth. The tooth 1. It's the first tooth after the two missing teeth. You count teeth clockwise.

- Once you see where tooth 20 sits when the crank is at TDC, mark that on the shield on the engine.

- I then measure from that mark to the center of the bolt hole to get 36mm.

- Then I measure from the center of the tooth to the shield to get 44mm.

- With the engine and trans bolted up again you can use a depth gauge and measure the depth between the outside surface of your transmission to the top of a tooth on the flywheel trigger wheel. You want an air gap of about .010" - .032". So subtract that from your measurement. You can get a bushing that allows the crank sensor to fit snugly into it and shave it down to get the proper depth so the sensor fit inside the transmission but with a .010" air gap to the flywheel teeth.

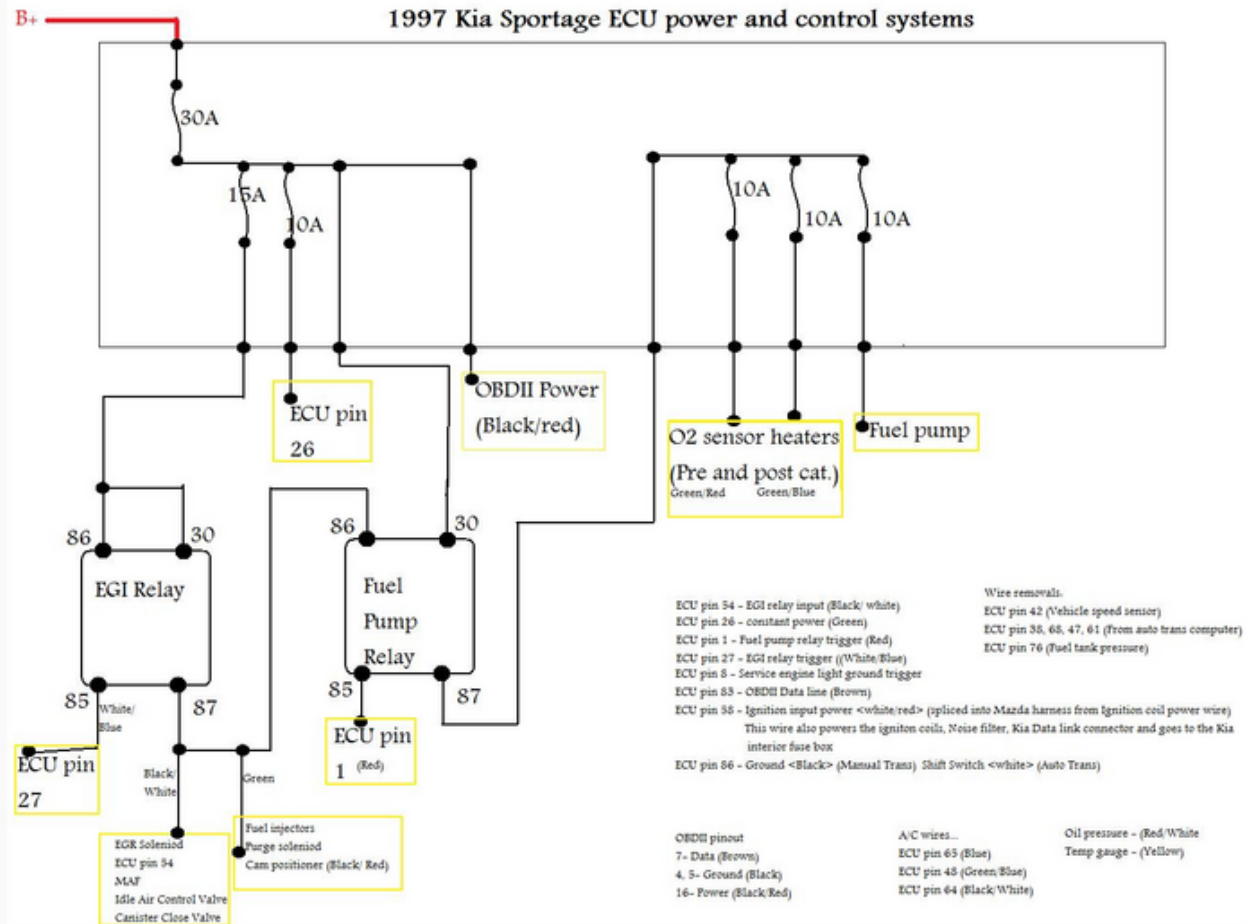
You can either use the bushing or press fit the sensor into the hole.

Shown here is the "trial fit" with JB weld. You can either do this with a bushing or leave the hole 11/16" and press fit the sensor into the hole instead of using a bushing to hold it.



4. Transmission and engine mating before engine install
  - a. Mount transmission to engine
  - b. Use engine hoist lower engine and transmission within engine bay.
5. Wiring with (wire harness)
  - a. Below is a wiring diagram Silent Dawn made for a 1997 KIA sportage.





(I'll try to host to a site with a full resolution photo)

Basically you come off the battery/alternator with a 30 amp fuse.

From that 30amp lead you run

- \*A 15 amp fuse to power the EGI relay.
- \*A 10 amp fuse for the green wire to ECU pin 26.
- \*A straight line to the Fuel pump relay pin 30.
- \*A straight wire to pin 16 on your OBD2 port.

- b. Once engine is mounted it's time to dig into wiring
- c. Install harness to engine
- d. Run a wire with a 30 AMP fuse from the battery/alternator
- e. From the 30AMP lead you will then;
  - i. Run a 15amp fuse to power the EGI relay
  - ii. A 10-amp fuse for the green wire to the ECU pin 26
  - iii. A straight line to the fuel pump relay pin 30
  - iv. A straight wire to pin 16 on your OBD2 port
- f. The EGI relay
  - i. PIN 86 and 30 get power from 15A fuse
  - ii. Pin 85 is the trigger wire from the ECU pin 27 (white/blue located in the KIA 6 pin fuse box connector)
  - iii. Pin 87 powers (Black/white wire in Kia's 6 pin fuse box connector)
    - EGR solenoid
    - ECU pin 54
    - MAF

- Idle air control valve
  - Canister Close Valve
  - To pin 86 on the fuel pump relay
- g. Fuel Pump Relay
- i. Pin 86 gets Power from pin 87 on the EGI relay (green wire going to the 6 pin connector)
    - Fuel injectors
    - Purge Solenoid
    - Cam sensor
  - ii. Pin 85 gets signal from ECU pin 1. (Red wire from the 6-pin fuse box connector)
  - iii. Pin 30 gets power from the 30A fuse
  - iv. Pin 87 powers:
    - 3 x 10-amp fuses:
      - Fuel pump
      - O2 sensors heaters (Green/red wires inside the main engine harness, going to a white connector near the ECU)
- h. Run a another 20amp fuse for the radiator fan relay
- i. Splice in the ignition on power to the white/red wire that goes to pin 58 on the ecu. This wire is located at the 6 pin connector that comes from the kias engine bay fuse box.

Things to consider:

- The ECU will fit in the kick panel where the old MAZDA ECU was located.
- The KIA engine harness will fit through the hole where the Mazda harness used to go.
- The KIA engine harness grommet is the same size as the old Mazda grommet
- Keep the KIA's engine bay fuse block and the 6 pin connector between the fuse block and engine.
- You can use the KIAS engine fuse block and add 2x10amp fuses for O2 sensor heaters. And just supply power to the KIAS fuse block from a spare relay on the Mazda fuse block.

**OR**

You can modify how the Kia's fuse block is wired inside and make it so the Mazda's fuses are removed and you use the Kia's fuse block for everything

All you do next is splice on the following to power:

- Oil pressure switch
- Coolant temp
- Alternator warning light
- Tach
- Ignition (run ignition power to the Mazda's coil power wire)

You also can add:

OBD2 diagnostic port and check engine light

On the alternator:

You only need to wire up the battery warning light. You can leave the Mazda's positive field trigger wire disconnected, because Kia's harness already has the alternator field wire spliced to power inside it's own harness

Things you can remove:

- Wiring for the speed sensors
- Kia's diagnostic port (the square one by the MAF sensor)
- The fuel tank Pressure sensor
- Air condition,
- Chassis acceleration sensor
- Any automatic transmission wiring

#### WIRING METHOD 2

- a. Connect neutral control safety switch to (if pulled from an automatic transmission the wire needs to be live / if you pulled from manual transmission needs to be grounded)
- b. Jump the wire harness fuse box 12v power from the Mazda fuse box
- c. The white and red wire pin #58 run it fused to the black and white positive side of ignition harness
- d. Run the red wire from inside the Mazda fuse box that is pin #26 to a constant 12v source

#### WIRING METHOD 3 – USING BETA 1 SWAP

- Swapping a Hyundai Tiburon or Elantra Beta 1 Ecu onto your Kia Fe3.

Please note if you do not have a 55 pin ecu, you will need to find the 88 pin plug and wire it in from scratch. From what is known only 1998-2002 kia Sportage came with this ecu.

Wiring the ecu is easy, and because 95% of the wires are the same as your current 88 pin ecu its very straightforward. Do note however the Beta 1 ecu is physically bigger than the stock Sportage ecu.

Pin # 86 is to be cut as it was grounded on the Sportage, now it needs to be spliced onto pin #58 to take a 12v feed. It is recommended to do so with a 10-amp inline fuse. It has been said that if this pin is not provided 12v, it can cause overcharging of the battery?

See above for compatible ecu part numbers

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#### 6. Fuel Delivery System

- a. Install fuel lines with clips from auto parts store
- b. Install fuel pump inside the fuel cell (you can cut off the kia mount from the pump and mount it to the fuel pump lid of the Mazda b series fuel sending unit

- c. Install electric fan to radiator (List of fans you can use?) install on a 12v accessory switch?
7. Last thing to check before first start
- a. Coolant hoses
  - b. Fuel lines
  - c. Headers installed
  - d. Ecu wired
  - e. Oxygen sensors
  - f. Oil plug and filter
    - i. Note: from step #3 Install Oil Pick up tube and Oil Pan (oil level on the dipstick will be incorrect because of the shallower oil pan)
    - ii. Fill engine with 5 qts. take oil , take a new reading and engrave/mark a new "FULL" fill line.
  - g. Coolant replenished
  - h. Coil packs
  - i. Fire her up and everything should work