

TECHNICIAN INSTALLATION MANUAL

1999-2000 Mazda Miata

Standard TVS900 Supercharger Kit



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Scope and preparation

This manual covers removal of the stock intake components, installation of the current FFS Standard TVS900 supercharger kit, physical installation of the supplied EMS, and initial startup checks.



Figure 1. Stock 1999 engine-bay reference before disassembly.

Before starting

- Verify the vehicle is mechanically sound and filled with 91-octane or higher fuel.
- Verify receipt of all three kit boxes: supercharger assembly, cold-air intake, and remaining hardware/assemblies. Check contents against the supplied packing information.
- Disconnect the negative battery cable and relieve fuel-system pressure.
- FFS does not supply replacement vehicle gaskets. Have the intake-manifold, EGR crossover-tube flange, EGR valve and IAC Valve gaskets available before disassembly.
- Install the supercharger/manifold assembly as received. Do not loosen factory-assembled joints or preinstalled fittings.
- Retain the original fasteners and components identified for reuse.

Section 1. Remove the stock intake system and intake manifold

1. **Remove the strut-tower brace, if equipped.**
2. **Remove the IAT sensor and grommet from the stock airbox.** Disconnect the MAF sensor, then remove the intake crossover tube, MAF sensor and airbox.
3. **Disconnect the valve-cover breather hose and remove its support bracket.**
4. **Disconnect the IAC Valve, TPS, EGR, VICS solenoid, crankshaft-position and power-steering-pressure-switch electrical connectors.** Disconnect the three front engine-harness connectors and release the harness as required for intake-manifold removal.
5. **Disconnect the PCV, brake-booster, purge-control, boost-sensor and VICS vacuum hoses from the intake manifold.**
6. **Disconnect the throttle cable from the throttle body and intake manifold.**
7. **Remove the VICS control solenoid.**
8. **Disconnect the two throttle-body coolant hoses and remove the stock throttle body from the upper intake manifold.**
9. **Disconnect the fuel-rail support and intake-manifold ground harness.** Remove the short hose between the upper and lower intake manifolds.
10. **Remove the two 12 mm-head bolts from the front of the upper intake manifold and the six 12 mm-head bolts from its top, then remove the upper intake manifold.**
11. **Remove and retain the original TPS.**
12. **Remove and retain the original IAC valve and gasket.**
13. **Remove the EGR valve and EGR-tube support fastener.** Loosen the EGR-tube flare nut at the exhaust manifold, then disconnect the tube from the lower intake manifold. Retain the EGR valve.



A - 22 mm flare nut



B - EGR tube supported out of the way

Figure 2. EGR crossover-tube connections released during stock-manifold removal.

14. **Release the injector harness from the two fuel-rail clips, remove the harness cover, and unplug the four injector electrical connectors.**
15. **Raise and support the vehicle.** Remove the splash shield and the stock intake-manifold support brace.

16. **Remove the nine lower-intake-manifold nuts.** Remove the 10 mm-head bolts securing the wire-harness support and oil-line support beneath the manifold. Tilt the manifold upward, remove the 10 mm-head fuel-line-support bolt, then remove the lower intake manifold.

**A - Harness support****B - Oil-line support (same area)****C - Fuel-line support**

Figure 3. Factory attachments beneath the lower intake manifold that must be released before removal.

17. **Remove the stock fuel rail, injectors and fuel-feed hardware down to the chassis fuel-feed tube.** Cap the open tube until the FFS fuel connection is installed.
18. **Remove the oil filter to provide access to the lower manifold studs during installation.**

Section 2. Prepare the engine bay

1. **Clean the cylinder-head gasket face and intake-manifold studs.** Clean the FFS intake-manifold mating flange with the supplied alcohol prep pads.
2. **Join the two throttle-body coolant hoses with the supplied 5/16 in barb fitting and existing spring clamps.** Cut the hoses to finished length and secure them clear of both accessory and supercharger belts.
3. **Move the starter-side harness into the ledge along the firewall side of the engine bay.**



Figure 4. Starter-side harness repositioned into the engine-bay ledge.

4. **Support the loosened EGR tube above the intake-manifold opening.**



Figure 5. EGR crossover tube supported above the manifold opening.

5. Chase the unused M10 x 1.25 upper block thread for the underbrace lower bracket as required.

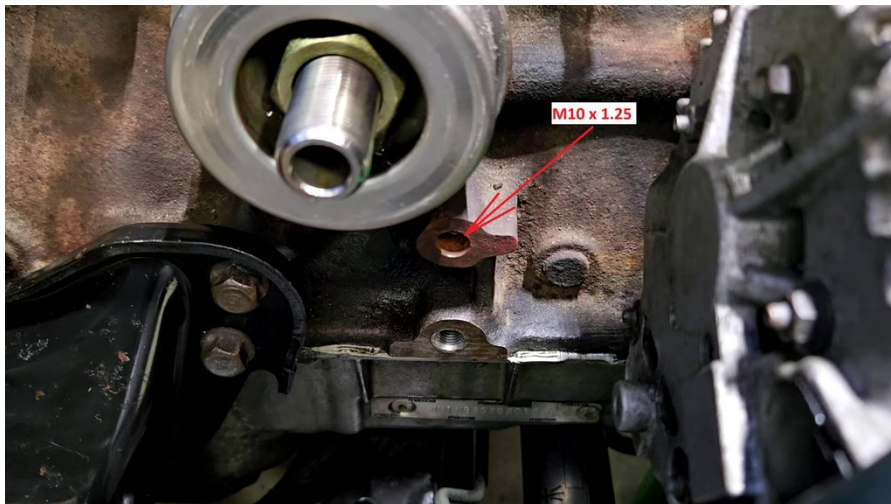


Figure 6. Unused M10 x 1.25 upper block thread for the underbrace lower bracket.

Section 3. Install the supercharger/manifold assembly

1. **Install the intake-manifold gasket.**
2. **Support the assembly at the supercharger pulley and throttle body.** Lower it into the engine bay at an angle, then roll it toward the cylinder head and onto the studs.
3. **Leave the assembly slightly away from the cylinder head while starting all five upper manifold nuts.** Close the flange gap after all five nuts are engaged.

**A - Lower into position****B - Start upper nuts**

Figure 7. Supercharger/manifold installation: engage all upper nuts before closing the flange gap.

4. **Install the four lower manifold nuts through the wheel-well/steering-rack opening using a 1/4 in-drive 12 mm socket, swivel and 6 in extension.** Tape may be used to stabilize the swivel and retain the nut.

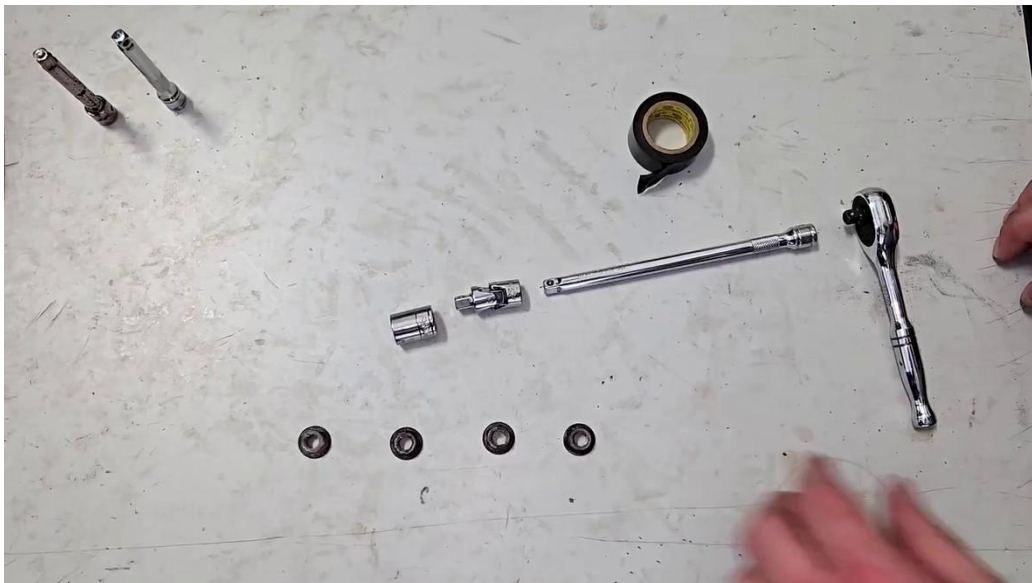


Figure 8. Lower manifold-nut access uses a 1/4 in-drive socket, swivel and extension.

5. **Tighten the four lower manifold nuts first, followed by the five upper nuts, to 14-19 ft-lb (19-26 N·m).**

Section 4. Install the intake-manifold underbrace

1. **Position the upper bracket on the underside of the manifold with its flat face toward the front of the vehicle.** Install the two M8 x 20 fasteners finger-tight.
2. **Position the lower bracket with its flat face forward.** Install the M10 x 25 bolt in the upper block hole and the M10 x 20 bolt in the lower hole. Leave both bolts loose.
3. **Attach the hole end of the underbrace to the lower bracket and the slotted end to the upper bracket using the two 3/8 x 1.25 in fastener sets.** Leave both joints loose.
4. **Adjust the brackets within their slots so the brace fits without preload.**

5. Tighten the lower bracket-to-block bolts to 32-35 ft-lb (43-47 N·m), followed by the upper bracket-to-manifold bolts to 18 ft-lb (24 N·m), then tighten the two pinch fasteners to 23-25 ft-lb (31-34 N·m).



Figure 9. Completed underbrace installation viewed from below.

Section 5. Connect the EGR crossover tube

1. Rotate the freed EGR crossover-tube support bracket out of the way; the bracket and original support bolt are not reused.
2. Remove the temporary support from the crossover tube. Position the EGR gasket between the tube flange and FFS bracket, then install the supplied EGR tube fasteners. Use the loosened exhaust-manifold flare nut to align the tube without preload.
3. Tighten the EGR tube flange bolts to 10-13 ft-lb (14-18 N·m), then tighten the 22 mm EGR-tube flare nut at the exhaust manifold.



Figure 10. EGR crossover-tube connection at the FFS manifold bracket.

Section 6. Install the crank pulley

1. **Remove the four original crank-pulley fasteners.** Clean corrosion and debris from the harmonic-damper centering hub.
2. Identify the harmonic damper:



A - Cast and stamped dampers



B - Stamped-damper spacer

Figure 11. Damper identification and spacer orientation.

- **Cast damper:** Install the FFS crank pulley without the supplied spacer.
 - **Stamped-steel damper:** Install the supplied spacer with the **INSTALLED CORRECTLY** marking facing outward and legible.
 - **ATI damper:** Use the separate FFS pulley configuration specified for the ATI damper.
3. **Align the pulley with the damper locating pin and centering register.** If the pulley does not install easily, continue cleaning the centering hub until the pulley fits over the hub. Install the four supplied M6 x 35 socket-head bolts with blue threadlocker and tighten to 13 ft-lb (18 N·m).

Section 7. Reroute the engine harness and install the TPS

1. **Remove the original intake-manifold harness retainers that are no longer used.**
2. **Open the main harness wrapping far enough to pull the MAF and IAT leads back to the main branch point.** Route those two leads toward the passenger-side airbox location; retain the crankshaft-position and power-steering-pressure-switch leads on the driver side.



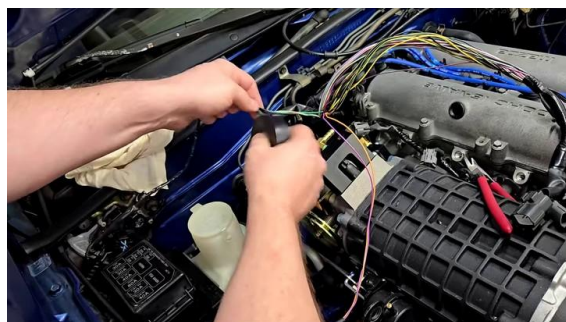
A - Open main harness



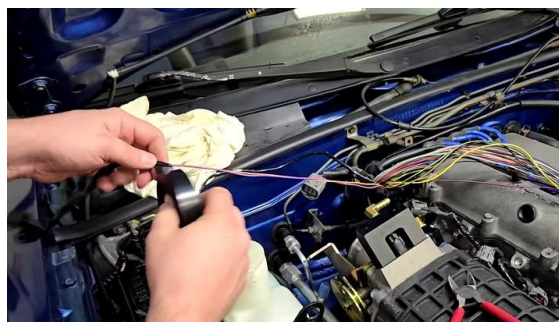
B - Separate MAF/IAT leads

Figure 12. Open the main harness and separate the MAF and IAT leads.

3. Open the forward harness wrapping and pull the TPS and IAC leads back toward the rear of the engine.



A - Identify TPS/IAC leads



B - Isolate the branch

Figure 13. Separate the TPS and IAC leads for rearward routing.

4. Rewrap each separated branch and junction with the supplied electrical tape. Route the harness above the supercharger/manifold assembly as shown.



A - MAF/IAT branch



B - TPS/IAC branch



C - Main junction

Figure 14. Rewrap the MAF/IAT branch, TPS/IAC branch and main junction.



Figure 15. Completed engine-harness routing above the supercharger/manifold assembly.

5. Release the original clamp at the front harness bracket, shift the harness rearward for connector slack, then close the clamp.



Figure 16. Front harness clamp shifted rearward for connector slack.

6. **Install the supplied 1999-2000 TPS shaft extension in the preassembled throttle-body adapter.** Install the original TPS with its connector facing the front of the vehicle, away from the EGR hardware, using the supplied M4 x 20 flange-head bolts. Tighten the bolts snug; do not overtighten.



A - Extension installed



B - TPS installed

Figure 17. TPS shaft extension installed in the adapter and completed TPS installation.

7. **Connect the TPS, crankshaft-position and power-steering-pressure-switch connectors.**
8. **Secure the TPS and IAC Valve wiring well away from the hot EGR valve, crossover tube and manifold to prevent heat damage.** Secure the unused VICS connector out of the way and reconnect the engine-harness grounds at the valve-cover bolt.

Section 8. Install the FFS fuel rail

1. **Install the original injectors and lower seals in the cylinder head.** Replacement of the lower injector seals is highly recommended; disturbed used seals are a common source of vacuum leaks. Connect the injector harness before installing the rail; rotate the cylinder 3 connector as shown for clearance at the manifold vacuum block.

**A - Injector connectors****B - FFS fuel rail***Figure 18. Injector orientation and completed fuel-rail installation.*

2. **Lubricate the injector upper O-rings with clean engine oil.**
3. **Position the three fuel-rail spacers at the mounting bosses.** Install the preassembled FFS rail over the four injectors, confirming that each O-ring enters the rail without displacement.
4. **Install the three M8 x 35 socket-head bolts and tighten the rail evenly to 25 ft-lb (34 N·m).** Orient the injector connectors clear of the manifold vacuum block and EGR crossover tube.

Section 9. Install the EGR valve

1. **Remove the four screws from the top of the original EGR valve.** Rotate the upper solenoid section 90 degrees from its stock position so the electrical connector faces forward as shown below, then reinstall the four screws.
2. **Install the EGR valve and gasket on the preassembled FFS EGR bracket using the new fasteners supplied in the kit.** Tighten the EGR valve bolts to 18-20 ft-lb (24-27 N·m). Connect the EGR electrical connector and control hose.

*Figure 19. EGR valve installed with the upper solenoid rotated for fuel-rail clearance.*

Section 10. Install the IAC Valve bracket assembly

1. Mount the supplied preassembled IAC bracket assembly to the firewall at the location shown using the two supplied #8 x 1.5 in self-tapping screws.

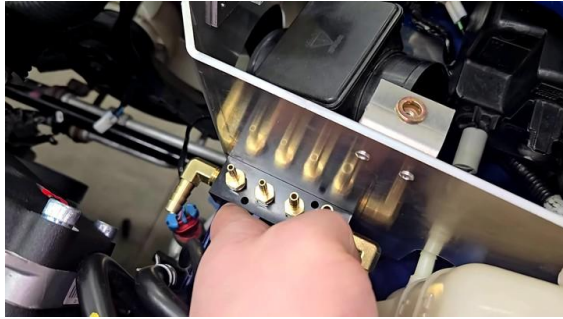


Figure 20. IAC Valve and supplied bracket installed on the driver-side firewall.

2. Trim the external tab of the original IAC gasket where required for bracket clearance.
3. Install the original IAC gasket and valve on the bracket assembly with the supplied fasteners and blue threadlocker. Tighten the IAC Valve bolts to 10 ft-lb (14 N·m). Connect the IAC electrical connector and secure its lead away from the EGR hardware.

Section 11. Install the cold-air intake and vacuum distribution block

1. Remove the plastic A/C-line supports that click into the frame. Shift the A/C lines toward the chassis as required for airbox clearance and secure the lines with a supplied zip tie.
2. Transfer the IAT-sensor grommet, IAT sensor and MAF sensor from the original airbox to the FFS airbox/MAF bracket. Retain the original MAF fasteners.
3. Move the floor-mounted harness and coolant-reservoir hose clear of the airbox mounting area.
4. Test-fit the airbox and confirm the five mounting locations. Remove the airbox and place two supplied washers/spacers at each location.
5. Mount the preassembled vacuum distribution block to the airbox panel at the location shown using the two M3 x 35 socket-head bolts and flange nuts.
6. Install the five supplied airbox fasteners. One fastener threads into the body; install nuts below the remaining four fasteners.

**A - Vacuum distribution block****B - Airbox fasteners***Figure 21. Vacuum distribution block and five airbox mounting locations.*

7. **Remove the yellow secondary lock from the MAF connector so the connector will pass into the airbox.** Route the separated MAF and IAT leads into the airbox. Loosen the washer reservoir as required for connector access, then secure it. Reconnect the auxiliary A/C fan.

*Figure 22. Yellow MAF-connector secondary lock removed for connector passage into the airbox.*

8. **Install the 135-degree silicone bend on the throttle body, followed by the aluminum tube.**

**A - Throttle-body end****B - Tube below manifold***Figure 23. Cold-air-intake aluminum tube location beneath the intake manifold.*

9. **Install the MAF silicone bend, straight coupler and remaining silicone bend between the MAF and aluminum tube.** With all pieces in place, rotate the silicone couplers and adjust the insertion depth at each joint as required for alternator, cooling-fan and chassis clearance. Rotate the MAF within its slotted mounting holes as required, then tighten the MAF fasteners and all clamps.



Figure 24. MAF-side silicone coupler adjusted for alternator, fan and chassis clearance.

10. **Connect the MAF and IAT sensors.**
11. **Install the filter adapter and air filter.** Position the filter low enough for airbox-lid clearance, tighten it, then install the airbox lid and tighten the lid bolts to 6 ft-lb (8 N·m).
12. **Reconnect the coolant-reservoir hose and top off the reservoir.**

Section 12. Install the tensioner and supercharger belt

1. **Remove any shipping fasteners from the tensioner mounting holes.**
2. **Position the four supplied spacers between the preassembled tensioner bracket and the supercharger.** Install the M8 x 75 bolt in the upper-left location and the three M8 x 70 bolts in the remaining locations. Apply blue threadlocker to all four bolts; threadlocker is required to seal the fastener threads that enter the supercharger case. Tighten the four tensioner-bracket bolts to 16-18 ft-lb (22-24 N·m).
3. **Install the automatic tensioner with the M10 x 80 flange-head bolt through the front of the bracket.** Engage the tensioner's locating pin in the bracket and install the flange nut at the rear. Tighten the automatic-tensioner bolt to 36-42 ft-lb (49-57 N·m).



Figure 25. Tensioner bracket bolt locations.

4. **Remove the original plastic mounting clips from the three front harness connectors.** Connect the harness, route the connectors behind the tensioner and above the alternator, and secure the bundle to the alternator bracket with supplied zip ties, clear of the supercharger belt.



A - Remove connector clip



B - Route connectors



C - Secure for clearance

Figure 26. Remove the connector clips, then route and secure the front harness clear of the belt.

5. **Route the belt over the crank pulley and supercharger pulley, leaving the belt behind the tensioner pulley.**
6. **Rotate the tensioner with the supplied low-profile 3/8 in-drive tool, move the belt in front of the tensioner pulley, then release the tensioner.** Confirm that all belt ribs are seated in both drive pulleys.



Figure 27. Completed supercharger belt routing.

Section 13. Connect the fuel hoses

1. **Route the supplied 5/16 in SAE J30R9 hose from the forward rail fitting to the chassis fuel-feed tube.** Press the supplied quick-connect-to-barb fitting fully into the chassis end of the hose and secure both hose ends with clamps. Press the quick-connect fitting onto the chassis fuel-feed tube until the latch clicks.



A - Connect hose to rail



B - Press fitting into hose

Figure 28. Chassis fuel-supply hose connections.

2. **Connect the E-Cool Fuel Rail Fitting at the center of the rail to the E-Cool injector with the supplied 5/16 in SAE J30R9 hose and two clamps.** Follow the hose's natural curve and route it as shown.

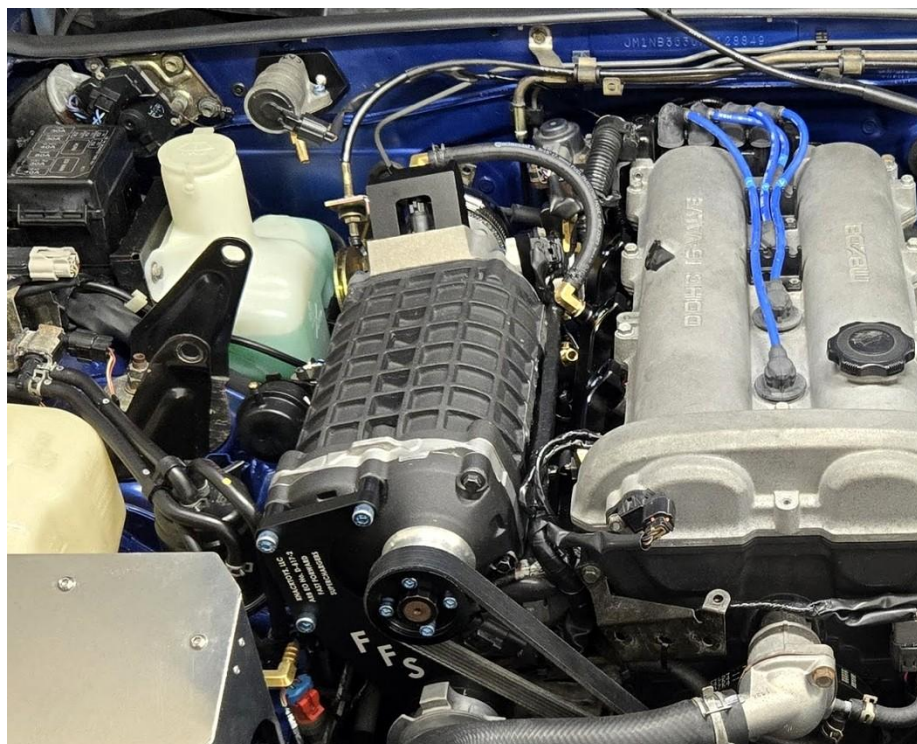


Figure 29. Completed E-Cool fuel-hose route from the center rail fitting to the E-Cool injector.

Section 14. Route the vacuum and crankcase-ventilation hoses

Route all hoses as shown in the 1999-2000 vacuum diagram.

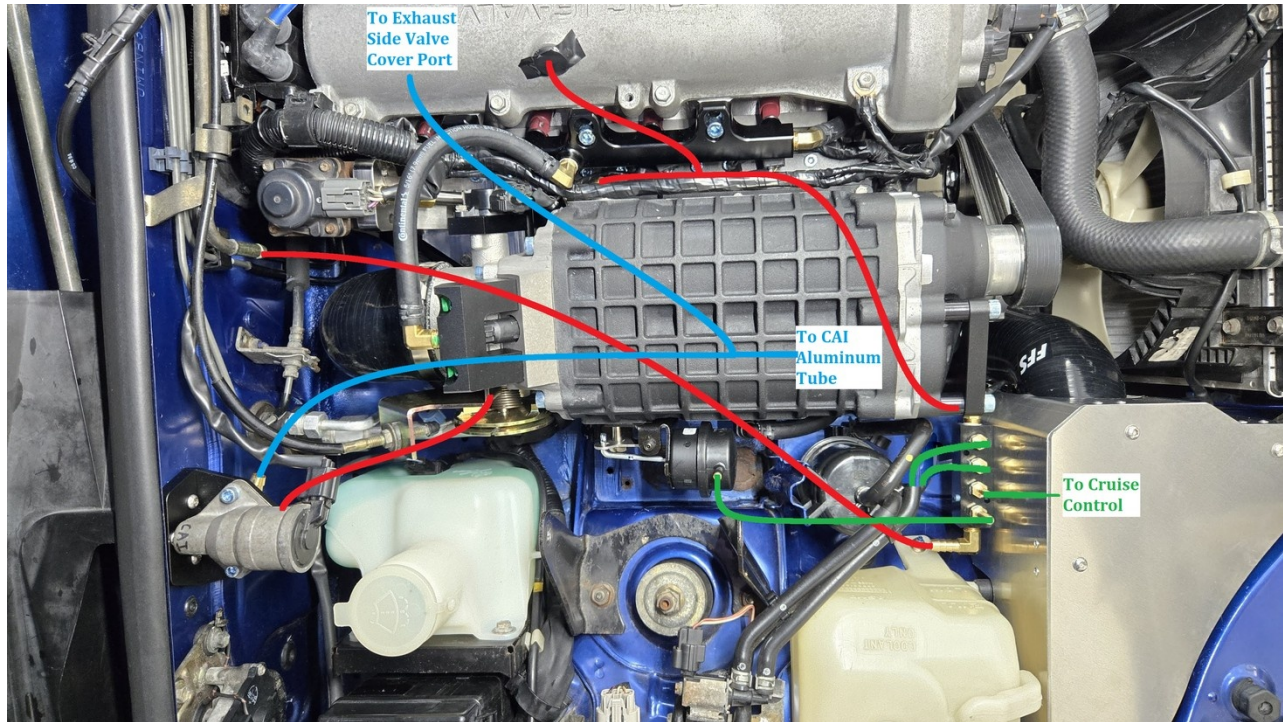


Figure 30. 1999-2000 vacuum and crankcase-ventilation routing.

1. **Connect the brake-booster hard line to the large vacuum distribution block port shown.**
2. **Connect the original purge-control and boost-sensor hoses to their assigned small vacuum distribution block ports.** Connect the cruise-control hose to its assigned port, routing it below the airbox; install the supplied block-off plug on vehicles without cruise control.
3. **Connect the bypass-valve actuator to the remaining vacuum distribution block port with 7/32 in hose.**
4. **Connect the throttle-body-adapter manifold barb and PCV valve to two branches of a 3/8 in tee beneath the supercharger.** Connect the common leg to the vacuum distribution block as shown.
5. **Connect the CAI aluminum-tube barb to a second 3/8 in tee.** Connect the remaining branches to the IAC inlet and the exhaust-side valve-cover port. Install the supplied restrictor in the valve-cover branch before connecting the hose.
6. **Connect the IAC outlet directly to the vacuum port adjacent to the throttle body.**
7. **Connect the supplied nylon tube to the push-to-connect fitting on the intake manifold.** Route it through the driver-side firewall grommet when the tuning cards will be mounted near the factory ECU, or through the passenger-side firewall grommet when the tuning cards will be mounted in the glove box. If a boost gauge is installed, use the supplied Y-connector to branch this signal to the gauge.
8. **Secure the hoses and tube clear of the throttle linkage, supercharger belt and EGR hardware.**

Section 15. Install and adjust the throttle cable

1. Install the throttle cable barrel into the throttle pulley, wrapping around the pulley, and press the cable into the cable bracket.
2. Adjust the housing nuts for slight cable slack at closed throttle.



Figure 31. Throttle-cable routing at the guide pulley and throttle arm.

3. Verify full pedal travel and adjust cable slack as required so the accelerator pedal reaches its stop before the throttle arm reaches its wide-open-throttle stop.
4. Verify smooth operation and positive return to the closed stop.

Section 16. Install the spark plugs

1. Remove the original spark plugs.
2. Gap the four supplied BKR7EIX spark plugs to 0.028 in, install them, and tighten to 11-16 ft-lb (15-22 N·m).
3. Reinstall the ignition leads in their original cylinder positions.

Section 17. Install the EMS assembly

1. Remove the driver-side lower dash trim and expose the factory ECU.
2. Disconnect the three vehicle-harness connectors from the ECU. Connect them to the corresponding female connectors on the FFS EMS harness, then connect the three male FFS harness connectors to the ECU.
3. Route the nylon pressure tube and two E-Cool leads into the cabin through the driver-side firewall grommet near the brake booster and steering column when mounting the tuning cards near the factory ECU. When mounting the tuning cards in the glove box, use the passenger-side firewall grommet. Form a passage through the selected grommet and cabin-side insulation, then reinstall and seal the grommet.

4. **Connect the routed pressure tube to the EMS pressure sensor.**
5. **Connect the two E-Cool leads using the supplied quick connectors.** The injector connection is not polarity-sensitive.
6. **Secure the EMS assembly and harness adjacent to the ECU, clear of the steering column, pedals and trim-panel attachment points.** Reinstall the lower dash trim.

Section 18. Final assembly and startup

1. **Install the oil filter and verify the engine-oil level.** Reinstall the splash shield and strut-tower brace, then reconnect the negative battery cable.
2. **Confirm that the throttle returns to the closed stop and that full pedal travel does not load the throttle-cable bracket.**
3. **Prime the fuel system by jumpering GND to F/P at the underhood diagnostic connector with the ignition in RUN.** Check the rail, injectors, E-Cool hose and chassis-feed connection for leakage before starting the engine.
4. **At key-on, verify power indication on each EMS module.** Start the engine and verify the EMS running/injector-signal indication.
5. **Check fuel, oil, coolant and vacuum connections.** Verify that the supercharger belt tracks correctly and that the belt, hoses and harnesses remain clear throughout engine movement.
6. **If idle adjustment is required, warm the engine to normal operating temperature.** Place the transmission in Neutral (manual) or Park (automatic), switch off all electrical loads, and wait for the cooling fan to stop. Unplug the IAC Valve, jumper TEN to GND in the underhood diagnostic connector, and adjust the throttle-body idle screw to 800 rpm (approximately 850 rpm indicated on the factory tachometer). Remove the jumper, reconnect the IAC Valve, disconnect the negative battery terminal for 30 seconds to reset the ECU, reconnect the battery, and verify normal idle operation.