

PMO Throttle Body Installation Instructions

by Clewett Engineering

To install this system safely, first and most importantly, **DISCONNECT THE BATTERY** before starting this project!

When removing the original induction system and disconnecting fuel lines, fuel will drip and be a fire hazard. Use great care in cleaning up any fuel spills and properly disposing of soiled rags to prevent fire hazard and protect the environment. Check the complete fuel system for leaks before starting the engine.

We recommend extreme caution when working around open intake ports. Throughout this entire process be aware that if anything drops into an intake port and the engine, it will likely require engine disassembly to remove the object. If the engine is started or just turned over by hand with a foreign object in the port or combustion chamber, severe engine damage will be the result. Cover the engine with a towel whenever possible and take great care to keep foreign objects out of the engine.

There are many ways to harm yourself and your engine. Safety glasses should be worn when installing this system. If there is something you do not understand with any part of these instructions, contact a qualified automotive repair professional for assistance.

Getting started:

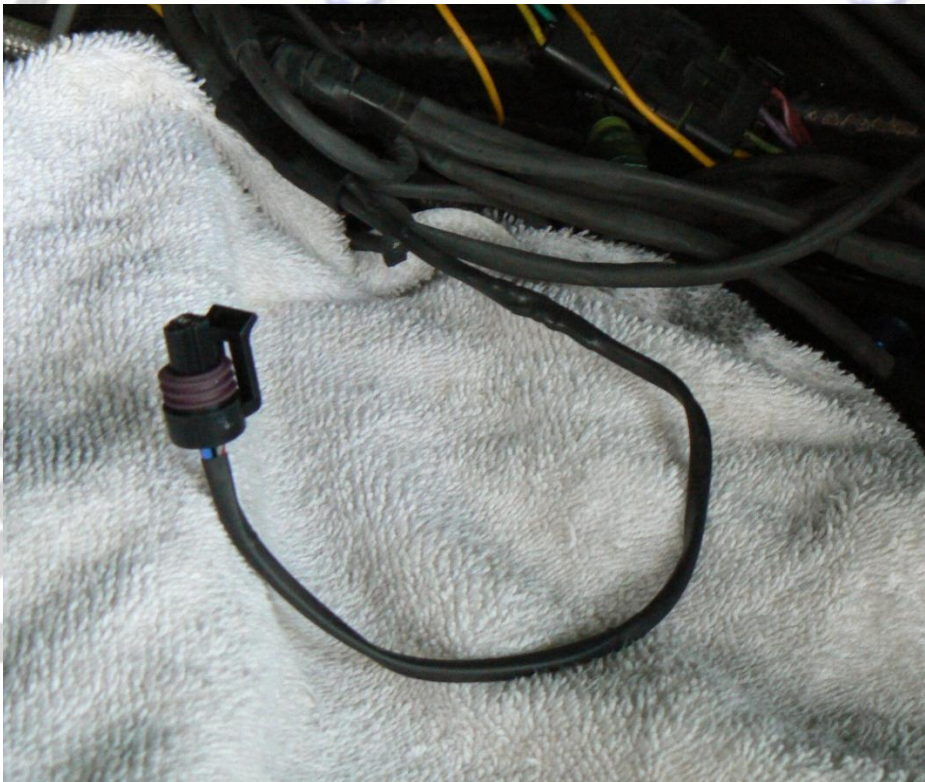
DISCONNECT THE BATTERY. Remove the existing induction system, wiring, and components that will not be required upon completion of the new system.



If installing a new engine management system with the ECU inside the car, this is the best opportunity for routing the wire harness through the firewall.



This is a good time to change the TPS connector if needed. The sensor will be located on the end of the throttle shaft over cylinder #6. Terminal 'A' - 5 volt, terminal 'B' - sensor ground, terminal 'C' - signal. This is a pull-to-seat connector, so insert the wires, crimp the terminals and then pull the terminal into the connector.



Installing the intake manifolds - 1. Verify that the mating surfaces on the head around the intake port are clean. Use a rag or tack cloth to keep particulate from entering the engine. Intake studs may need to be changed on earlier engines.



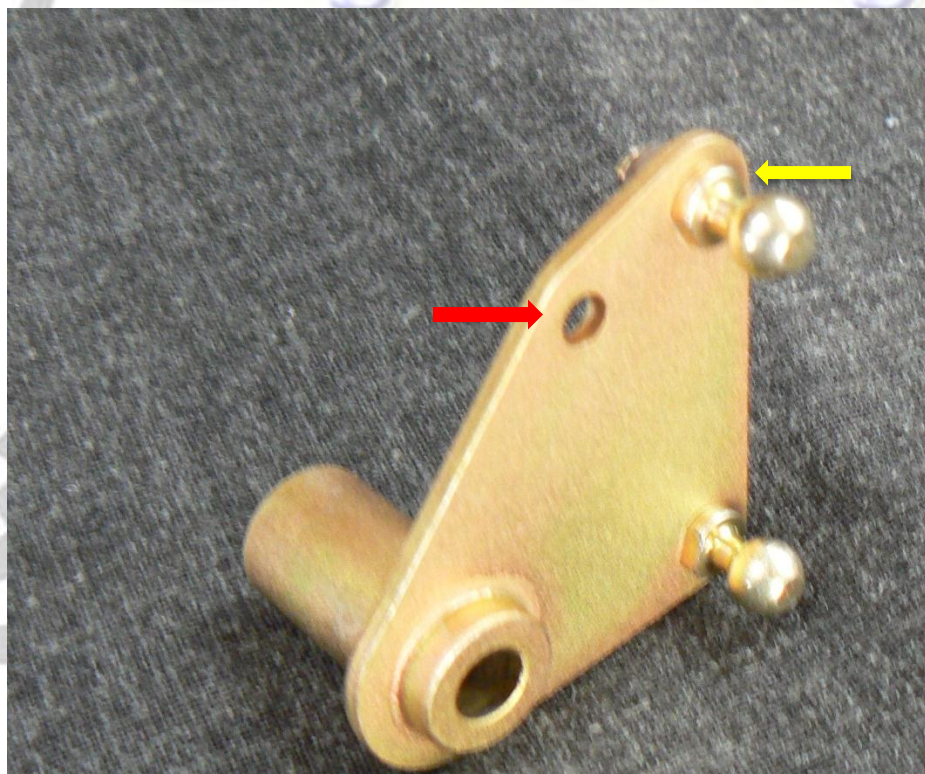
2. All 6 ports must have a matched set of top and bottom gaskets and insulators for the manifolds to seal properly and for the manifolds to remain straight after tightening. On each pair of intake manifold studs, place an intake gasket, insulator block and another intake manifold gasket, as shown in the photo below.



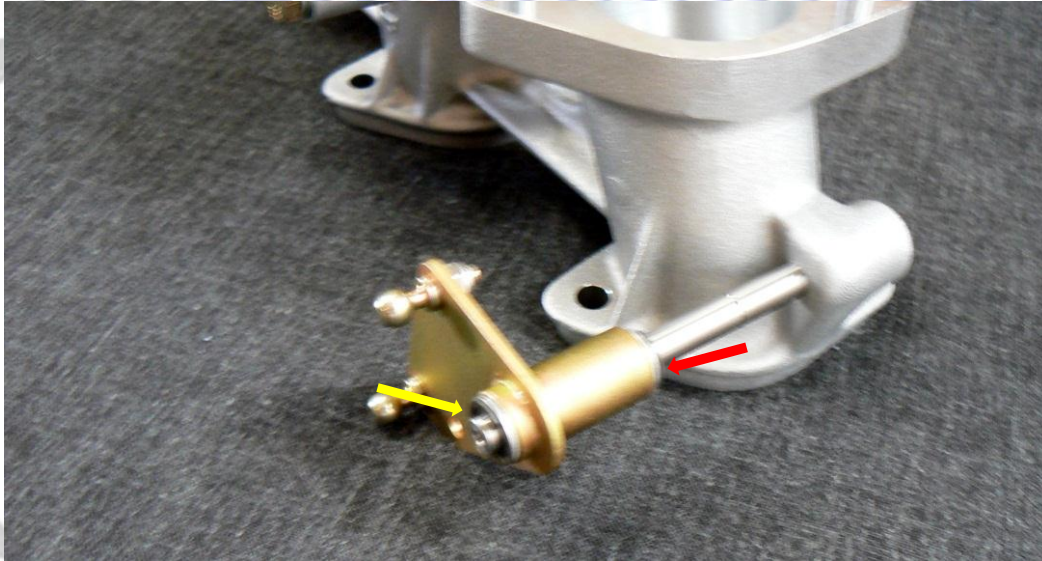
3. Install the six throttle body mounting studs into each manifold.



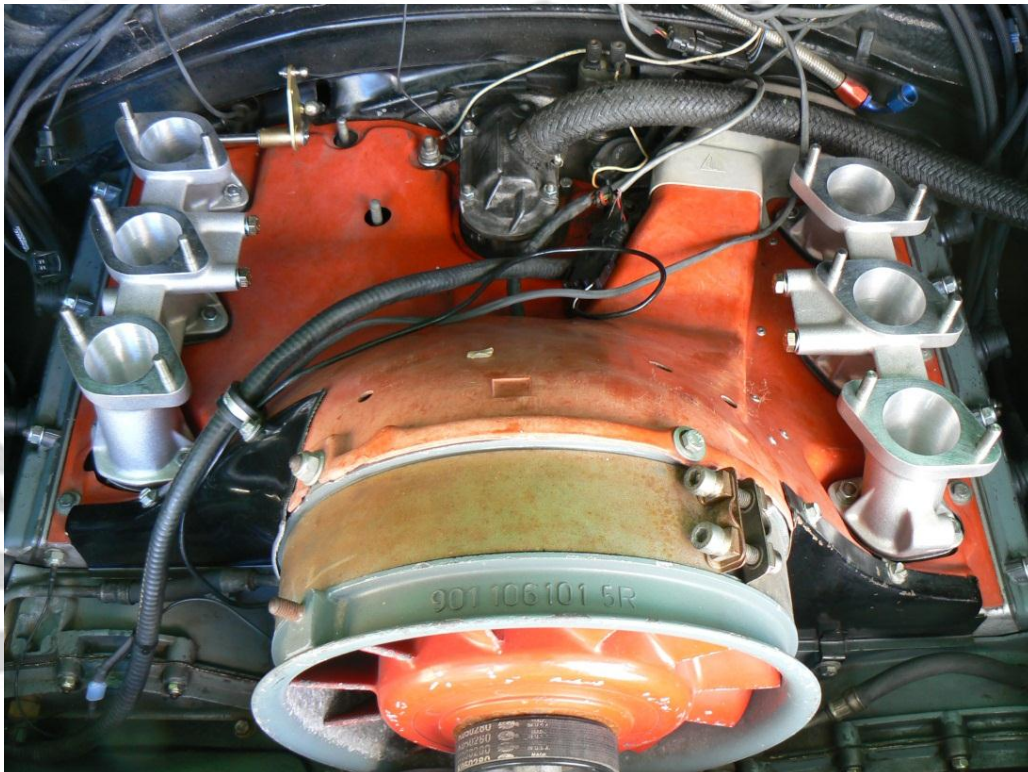
4. Remove the bell crank and 2 ball pins from the bag of throttle linkage components. Install 2 ball pins to the bell crank as shown. The yellow arrow position is for tall manifolds, red for short or regular height.



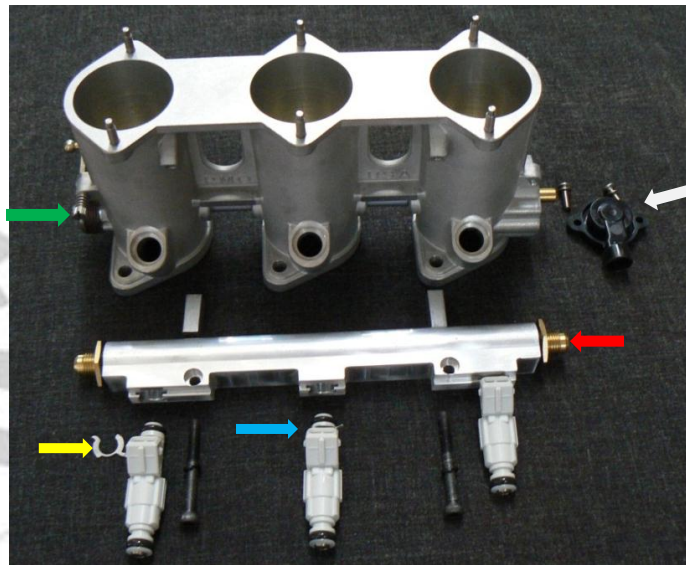
5. One of the intake manifolds is supplied with a bell crank pivot rod, which is the 1-3 intake manifold. Verify that the 'E' clip closest to the manifold (red arrow) is in the proper position and slide on a washer. Apply a small amount of assembly lube to the pivot shaft and inside the bell crank. Install the bell crank as shown with a washer and 'E' clip (Yellow arrow).



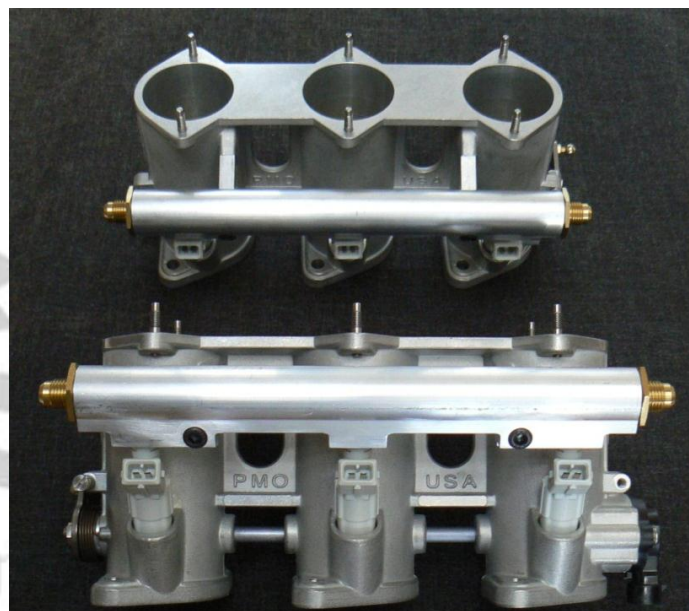
6. Install the intake manifolds as shown below. We recommend using M8X1.25 nuts with a 12mm hex and wave washer for attaching the manifold.



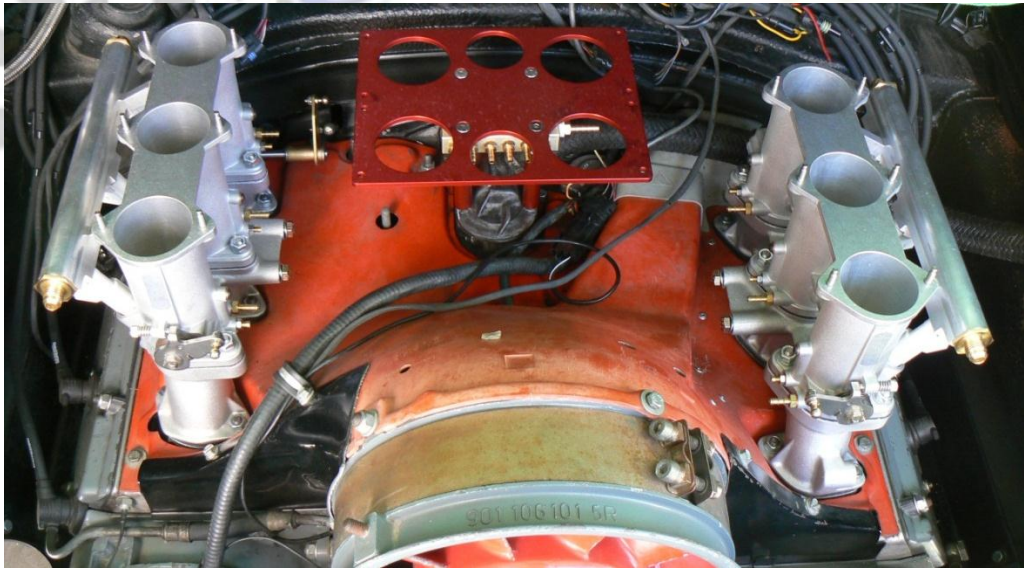
Assembling the throttles - 1. Install the 'C' (yellow arrow) retainer on each in the full circular groove (blue arrow) on the injector. 2. Apply oil to injector O-ring and insert the injector into the fuel rail as shown. Rotate the 'C' injector retainer 90 degrees to lock the injector in place. Repeat this procedure for all 6 injectors on both fuel rails. 3. Apply oil to the bottom injector O-rings and insert the fuel rail/injector assembly into the throttle body. 4. Insert the M6 socket head screw through the fuel rail, through the rectangular spacer and tighten the screw in two places, attaching the fuel rail to the throttle body. 5. Oil and install the O-rings on the fuel rail AN adapters (red arrow) and thread them into each end of the fuel rail. Tighten to the shoulder. 6. Align and slide the TPS sensor (white arrow) onto the brass adapter on the end of the fuel rail. When the sensor is close to the throttle body, rotate the sensor with the TPS connector pointing down. 7. Insert screws and tighten. Verify that the throttle shaft rotates freely from closed to wide open throttles. 8. As a starting point, adjust the throttle stop screw (green arrow) in 3/4 turn after making contact with the throttle arm on both throttles.



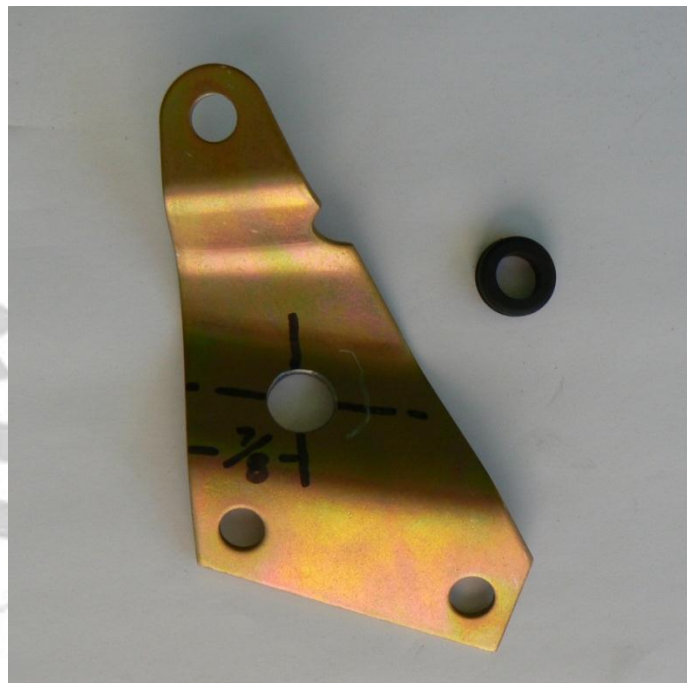
Completed assembly



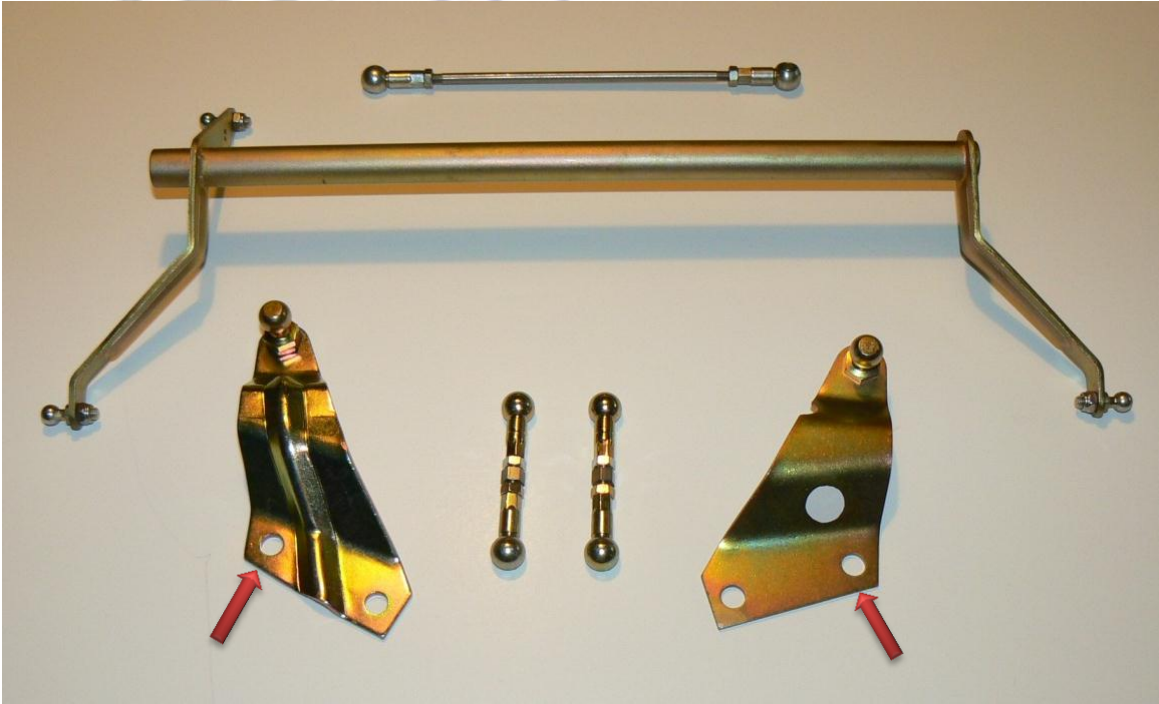
Installing the throttles – 1. Place matched set of 6 throttle body base gaskets over the studs on the intake manifold and install the throttle body. Use wave washers and M8 nuts with 12mm hex. 2. Snug all nuts tensioning the wave washer. 3. Finish tightening to 18 ft/lb (or uniform tightness) from the center out to the ends. 4. Verify that the throttle shaft rotates freely upon completion.



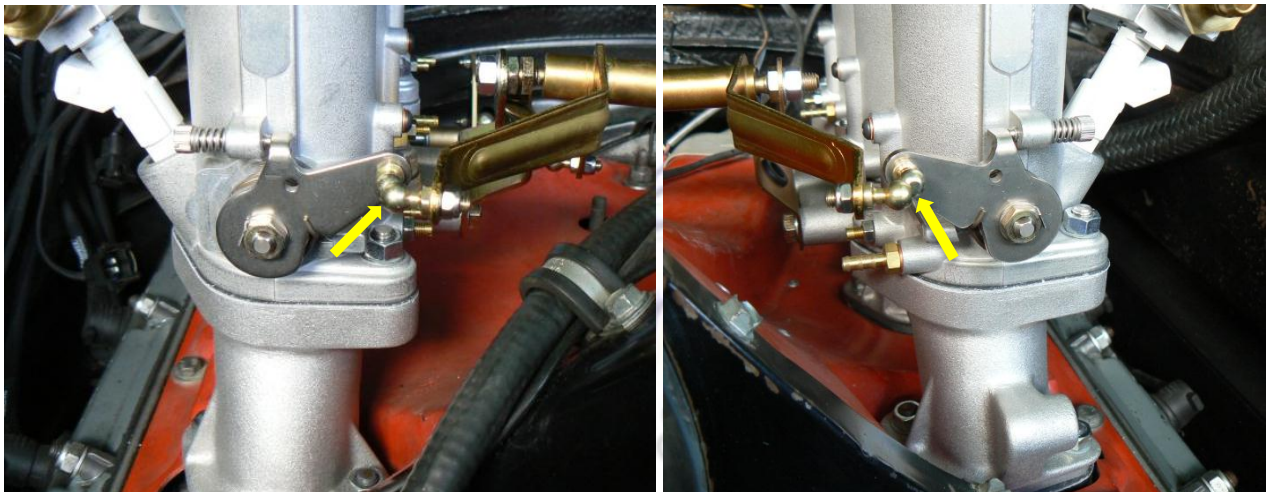
Throttle linkage preparation – Each intake runner of the throttle body has a vacuum nipple. To use this vacuum port on the right side center runner, a hole needs to be added to the right side cross bar support bracket. 1. In the linkage package find the right side support bracket pictured below. 2. Drill a $\frac{1}{2}$ " (13mm) diameter hole $\frac{7}{8}$ " (22mm) from the edge of the bracket through the center of the flat portion as shown in the picture below. 3. Remove any burrs and insert a $\frac{3}{8}$ " (10mm) grommet. 4. Replace the pivot ball pin and tighten.



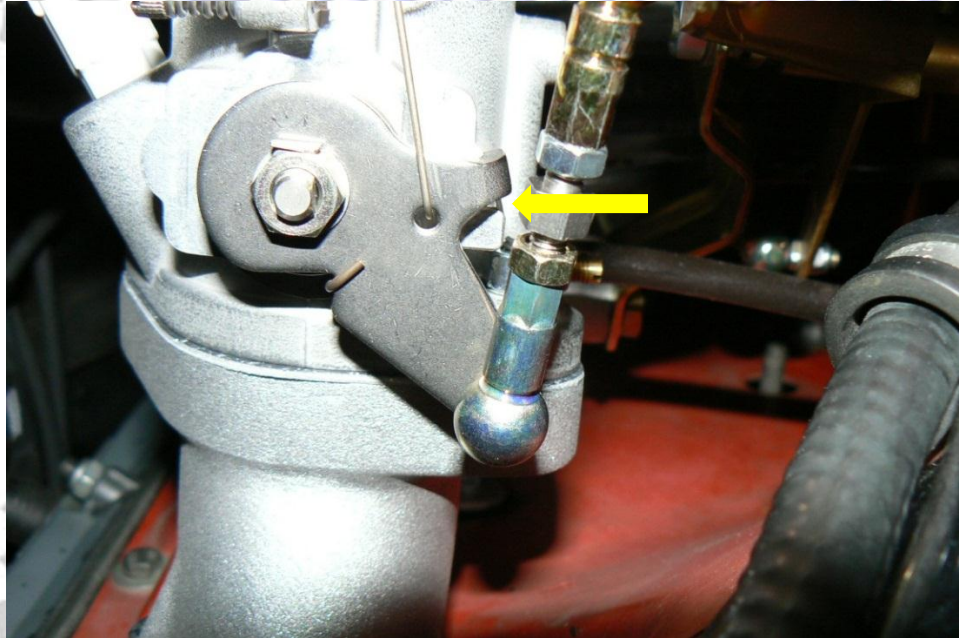
5. Install the ball pins on the cross bar as shown. Adjust the press rods to their shortest length.



Throttle linkage installation - 1. Attach the bracket to the right side manifold with 2 bolts and wave washers finger tight. 2. Attach the left side cross bar bracket with with one bolt and wave washer, finger tight, so the bracket can rotate into position. 3. Lubricate the right and left cross bar pivot balls with assembly lube. Place the cross bar on both pivot balls and rotate the left side bracket into position. Insert the second bolt and washer, finger tight. 4. Adjust the cross bar position by rotating the cross bar down to meet the ball pins on the throttle arms. Rock the cross bar brackets until cross bar ball pins align with the throttle arm ball pins (yellow arrows). When the ball pins on both sides match the throttle shaft ball pins, tighten the cross bar support bracket bolts. 5. Adjust the jam nut on the left cross bar bracket to center the cross bar side to side. **Note:** on 964 and 993 engines it may be necessary to slot the holes with red arrows (above photo) for the cross bar to clear the fan shroud.



6. Attach the press rod to the left side throttle and cross bar. 7. From the shortest position, lengthen the press rod 2 full turns and tighten the jam nuts. 8. Adjust the pull rod from the bell crank to the cross bar, so that when the gas pedal is depressed to the stop, there is approximately 1/16" (1.5mm) between the throttle arm stop and the throttle body casting (yellow arrow).

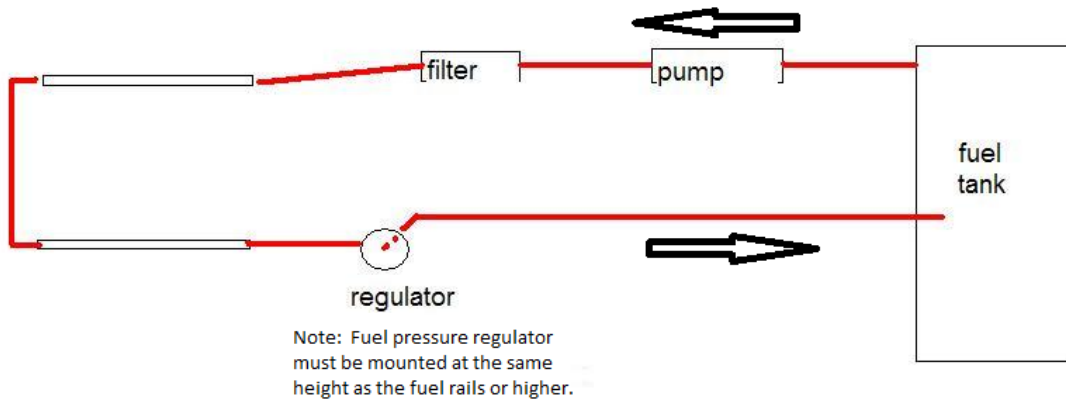


9. Attach the second press rod and adjust it, so the left side throttle arm remains on the stop screw.

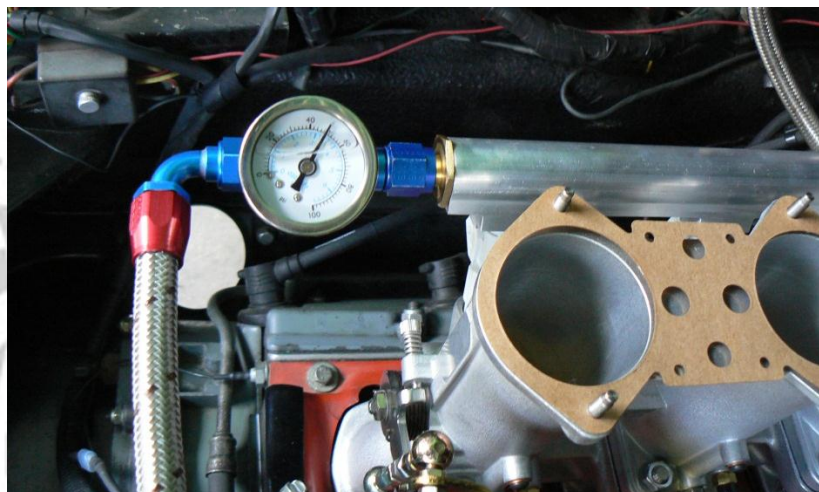


Installing the fuel lines - Fuel lines must be rated for high pressure, minimum 250 PSI working pressure for fuel injection systems. The recommended fuel pressure for this system is 45 PSI (3 bar), and may be run as high as 74 PSI (5 bar). The fuel rails have -8 AN port fittings on each end. The adapters installed in the earlier step adapt to -6 AN fittings. The fuel pressure regulator is also -6 AN. **Do not use slip on hose fittings and hose clamps for high pressure fuel systems!** A fuel pressure gauge can be installed permanently on the regulator or in line. A temporary gauge can be installed in the fuel line to set the fuel pressure and then be removed.

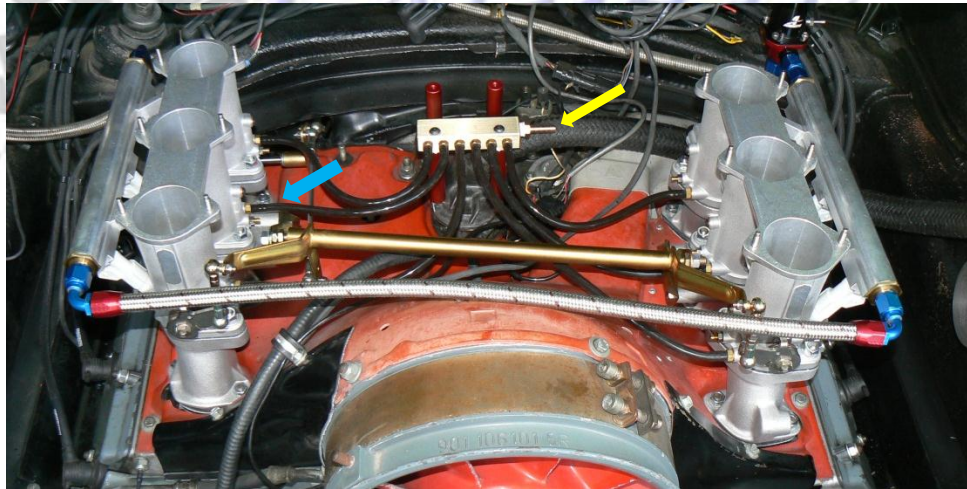
Fuel Line Routing



Upon completion of installing all the fuel lines, gauge and setting the fuel pressure, it's time to put fuel in the tank and connect the battery. 1. Turn on the fuel pump and check for fuel leaks around all fuel fittings and injectors. If the smell of fuel is present, chances are good that there is a leak. If a leak is detected, immediately turn off the pump and correct the problem. 2. Adjust the fuel pressure to 45 PSI. The picture below is shown with a temporary pressure gauge. If removing a temporary gauge or loosening any fuel line, always use caution and cover the fitting with a rag before loosening. Fuel systems will have residual pressure in the lines which will spray fuel out of the fittings when loosened. To protect yourself, wrap the fittings with a rag when loosening or removing fuel fittings that have been pressurized. Never tighten or loosen fuel line fittings with the fuel pump running! Verify that the fuel lines do not interfere with the throttle linkage.



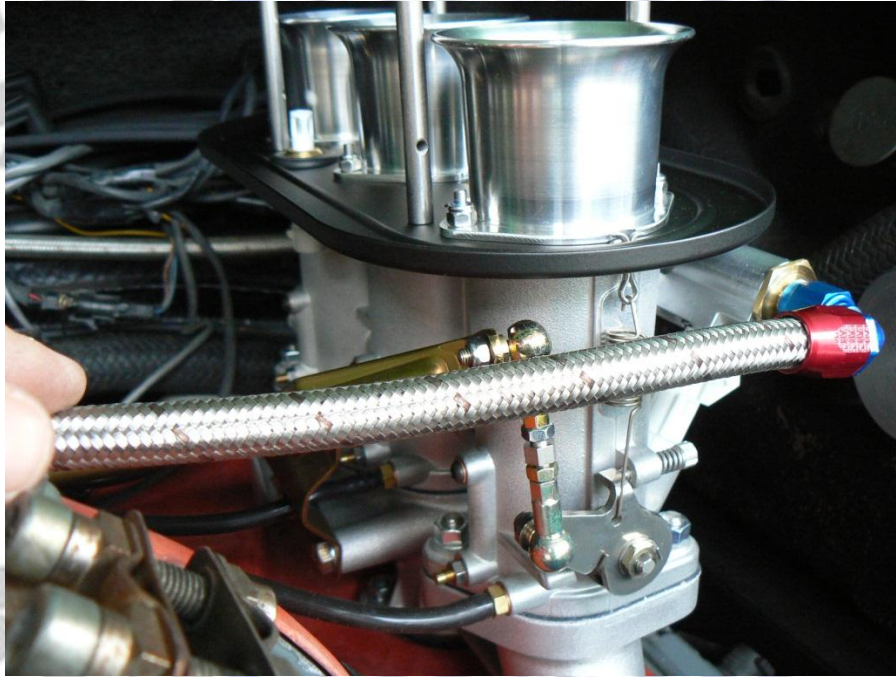
MAP sensor vacuum lines - Attach a vacuum line from each intake runner nipple (blue arrow) to the vacuum manifold. The large nipple (yellow arrow) on the end is connected to the MAP sensor. This installation is receiving a coil mounting plate which has been removed for clarity.



Air filter base plate preparation - 1. If using a manifold air temperature sensor (MAT) on one of the air filter bases, choose a location that will clear the throttle body. 2. Drill a 7/8" (22mm) diameter hole as close to the air filter inner bead as possible. 3. Insert a 5/8" (16mm) diameter grommet and screw the sensor into the grommet. 4. To install a second throttle return spring, on both air filter bases drill a 1/8" (3mm) diameter hole on one end on the centerline shown by the red arrow. Position the hole as close to the bead as possible. 5. On a 1/8" (3mm) cotter pin, measuring from the top of the loop, mark a line 3/4" (19mm) along the shaft of the pin. 6. Insert the cotter pin into the hole from the bottom side. As soon as the line is exposed, bend over each leg of the pin and trim to approximately 1/8" (3mm). The cotter pin loop is the eyelet for the return spring. 7. Assemble the air filter support rods as shown.



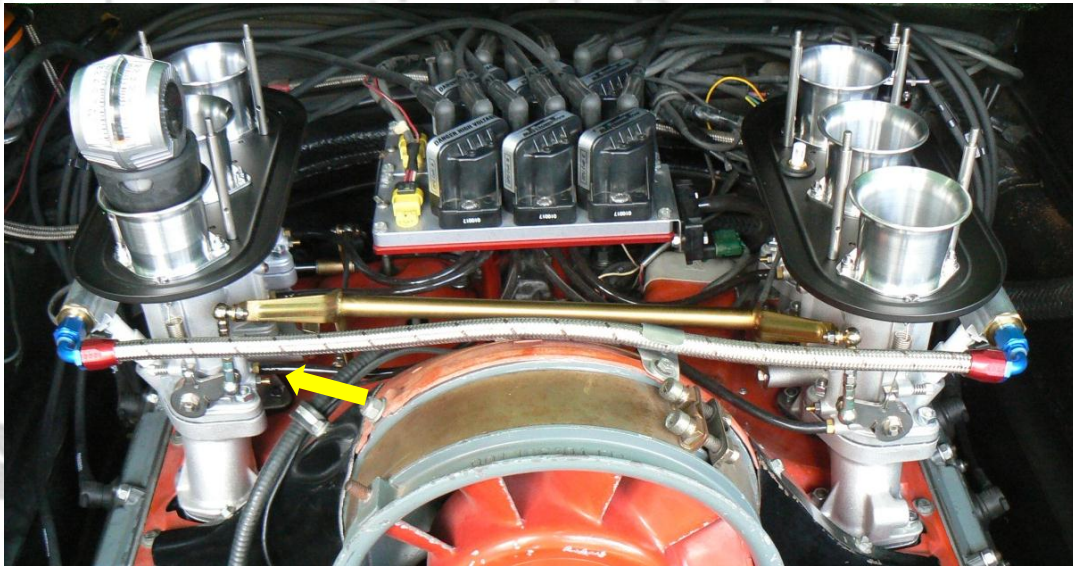
Air filter base installation - Install the air filter base baskets, base plates and 3 air horns on each throttle before installing nuts. Install the throttle return spring as shown.



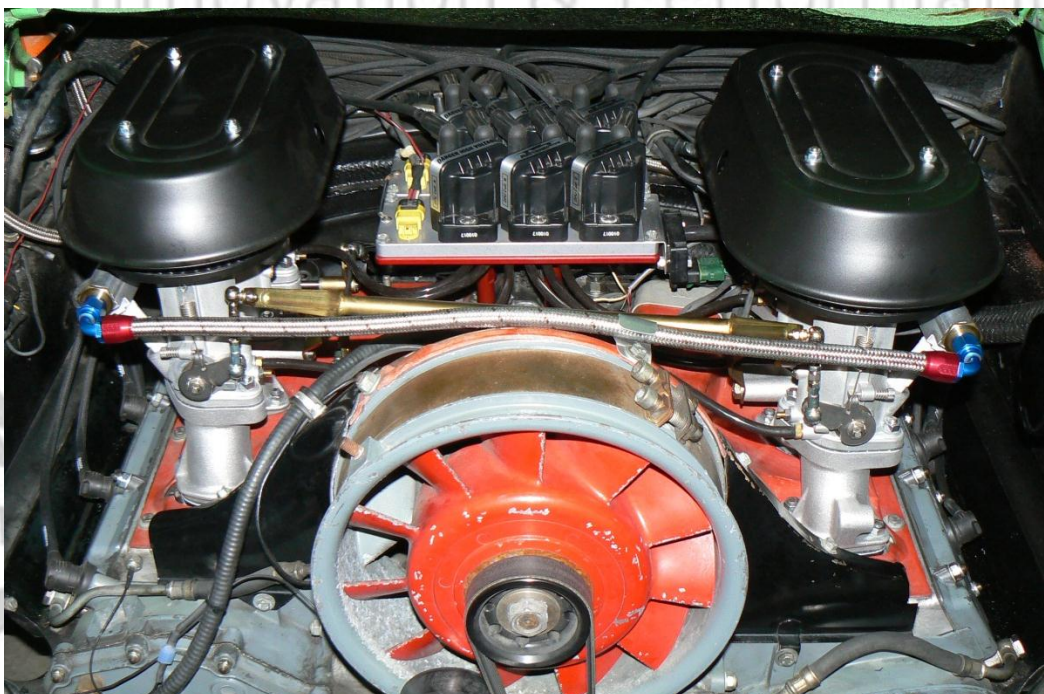
It's now time to check the installation.

- Manifolds, throttles and linkage are tight.
- Fuel lines are tight and fuel pressure set to 45 PSI and no fuel leaks.
- Throttle linkage is rough balanced and the throttle opening stops just short of the stop on the throttle castings.
- Fuel lines clear throttle linkage and are supported as needed.
- All air horns are tight and return springs are in place.
- MAP signal vacuum lines are in place.
- Engine management system wires connected to the injectors, MAT and TPS sensor.
- Verify that the engine has oil.
- Final fuel line leak check is OK.
- Tie up any loose wires
- Address anything else that may be a concern.

First start up and balance the throttle bodies – 1. Start the engine and adjust mixture if needed. 2. Once the engine is running and stable, remove the right side press rod so that the throttles work independently. 3. Using a syncrometer or monometer, adjust the throttle stop screws balancing the idle air flow and idle speed. 4. Next check the balance of each throttle body runner. If adjustment is necessary open the air bypass screw (yellow arrow) on the low flowing runners to match the highest flowing runner. 5. Reattach right side press rod and bring the engine RPM up to 2500-3000 RPM using the crossbar to activate the throttles. Using the right side press rod adjust, adjust the balance left to right and tighten the jam nuts. 6. It may be necessary to readjust the idle speed once the engine is up to full operating temperature.



7. Install the air filters and now the throttle body installation is complete. It's time to start tuning.



We appreciate any comments on this installation manual. If there is something we missed or you see that we can improve the procedure to help others, please let us know.

Visit our YouTube video to see a live balancing procedure at:

<http://www.youtube.com/watch?v=LGjN3wrGi0g&feature=youtu.be>

