AeroInjector™ Owners Manual

$10.00

Rev F 03/21

AeroConVersions

A Product of Sonex Aircraft, LLC

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Disclaimer and Limited Warranty

Sonex Aircraft, LLC, makes every effort to assure that each AeroInjector meets high quality and durability standards, and warrants to the original purchaser that this product is free of defects in material and workmanship for the period of one year from the date of purchase. This warranty does not apply to damage due directly or indirectly to misuse, abuse, negligence or accidents, repairs or alteration out side our facilities or lack of maintenance. Due to the experimental nature of the AeroInjector, the end user is solely responsible for determining AeroInjector's suitability, installation and use. Sonex Aircraft, LLC, will in no event be liable for death, injuries to person or property, or incidental, contingent, special, or consequential damages arising from use of our product.

Important:

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This guide was written to help you achieve a dependable installation and outstanding performance from your AeroConversions AeroInjector. Properly installed and tuned, the AeroInjector has gained a reputation for increasing power and reducing fuel consumption on a broad range of aircraft and auto-conversion engines.

A Product Line of Sonex Aircraft, LLC.

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Overview of Features

The AeroInjector is precision machined from solid 6061 aluminum billets and premium Delrin. There are only two moving parts: a fuel/air "throttle slide" that moves with the cockpit throttle control and meters combustion air and fuel, and a tapered needle that moves with the cockpit mixture control to control in-flight mixture adjustments and serve as an idle cut-off valve.

The throttle slide carries within it an infinitely adjustable tapered fuel needle. Three (3) different needles are included with each AeroInjector, and others are available. Spigot or flange mounts easily adapt the AeroInjector to popular aircraft and auto engine conversions. A clamp for the mixture cable is built in to the body of the AeroInjector, and the throttle cable is attached directly to the throttle slide. The AeroInjector's intake design accepts air filters or carb heat ducts.

The AeroInjector works in up-draft, side-draft, and down-draft configurations. Gravity feed is recommended where possible. If a fuel pump is required, a fuel pressure regulator must also be used. By design, the AeroInjector is extremely resistant to icing.

Combined, these features make the AeroInjector one of the most versatile and adaptable injectors ever developed.

AeroInjector Size Recommendations

The following chart is a general guideline to injector sizing for a variety of popular engines. *Please call for recommendations for your particular engine.*

Engine:	Size:	Model:
VW (1900 - 2180cc)	32mm	ACV-C07
Jabiru 2200	32mm	ACV-C07
Jabiru 3300	35mm	ACV-C08
Cont. 65, 85, 90	32mm	ACV-C07
Cont. 0200	35mm	ACV-C08
Corvair O-164, O-190	35mm	ACV-C08

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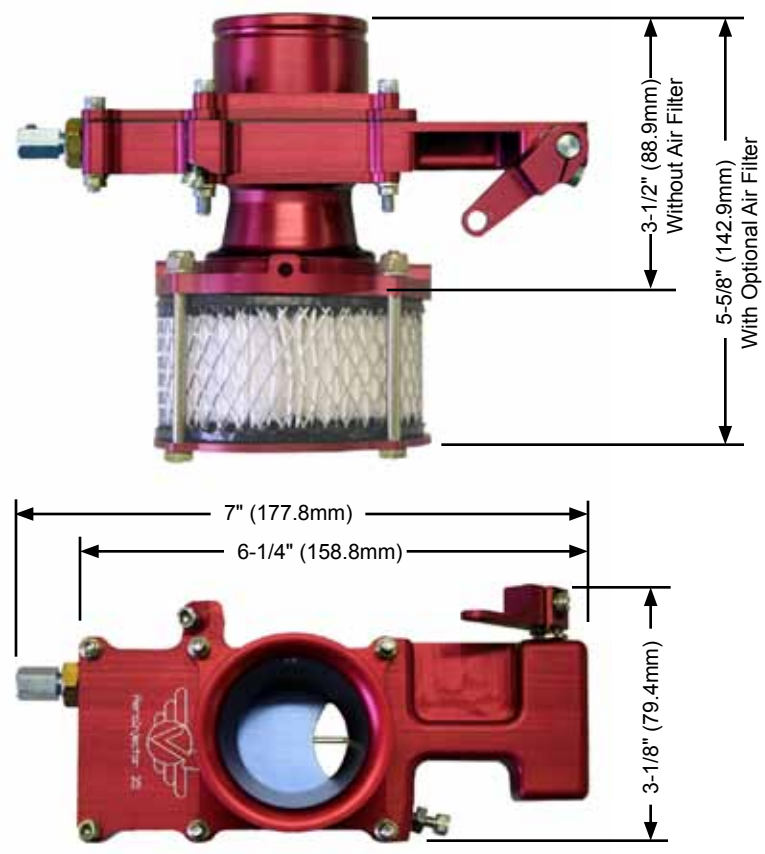
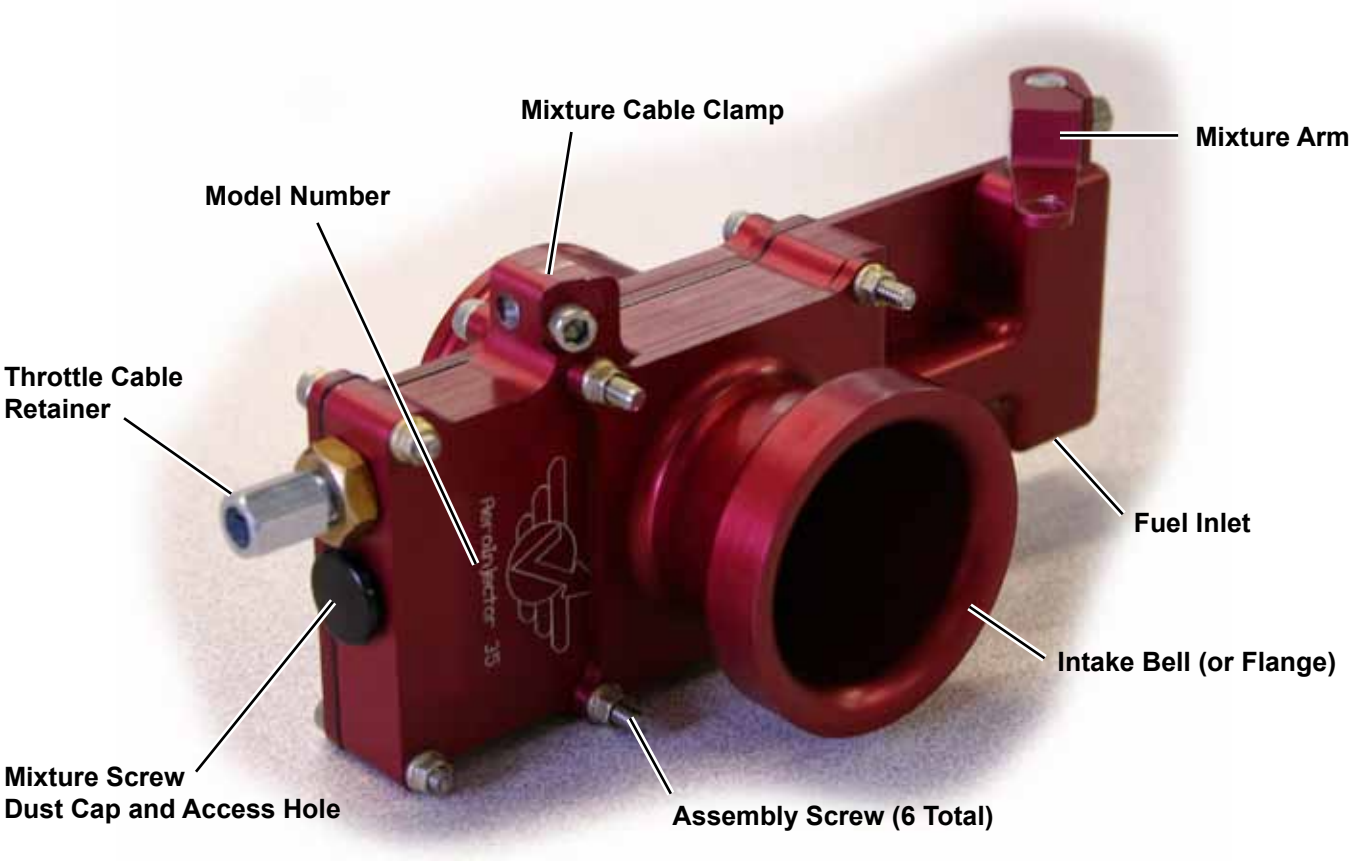


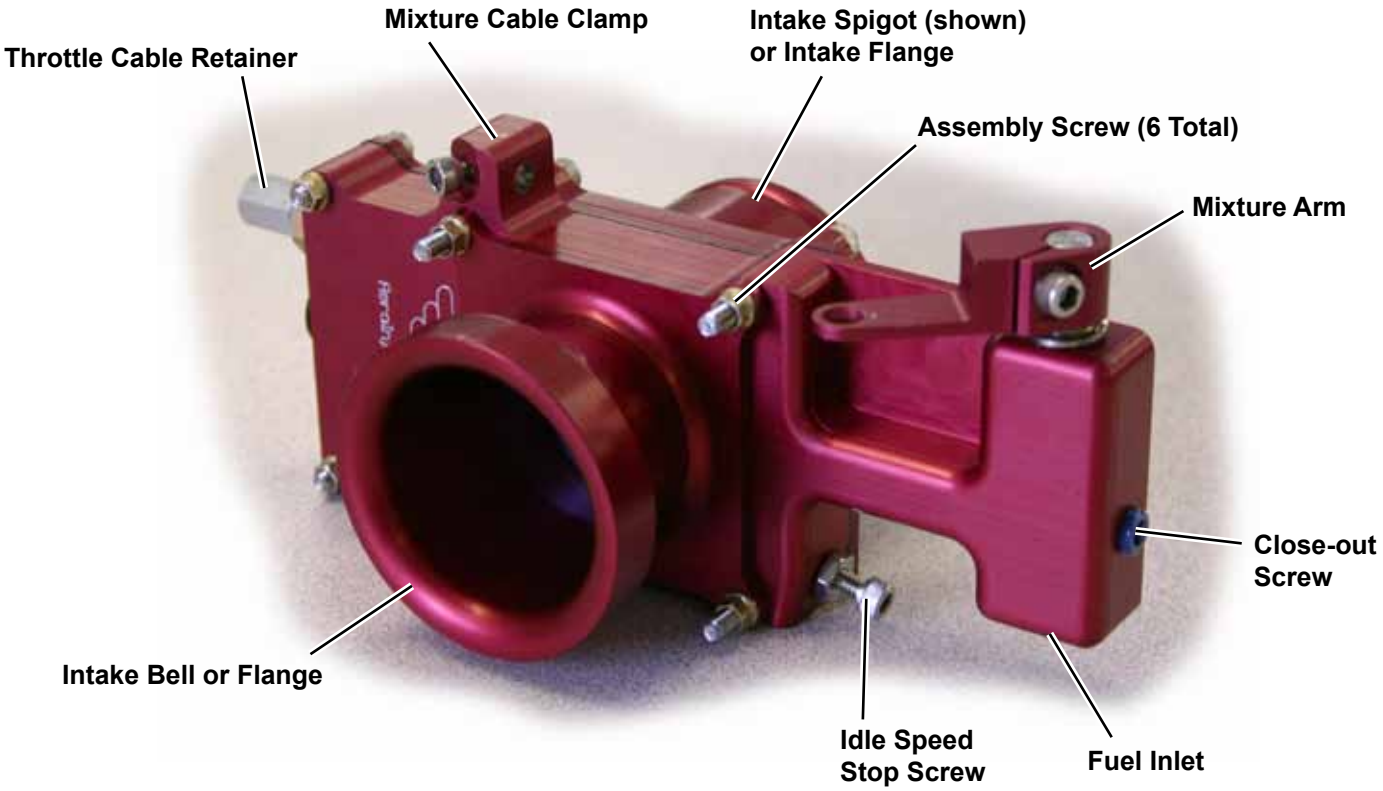
Weights:

AeroInjector* ..... 1 lb. 4 oz.
Air Filter (optional) ..... 11.6 oz.

*Average weight - actual weight varies slightly by mount size and style.

Specifications subject to change without notice.





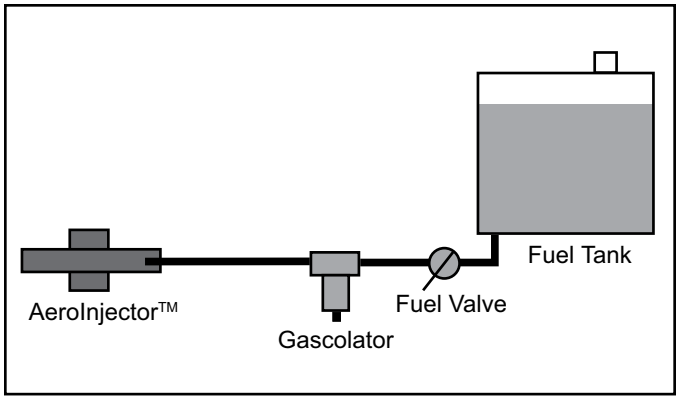
Fuel Delivery Systems

Most fuel systems can be made to work with the AeroInjector's floatless design. If you have a system not represented on this page, please call for advice.

IMPORTANT: The fuel system must be able to deliver 1.5 times the engine's required fuel flow at full throttle.

Gravity Feed System

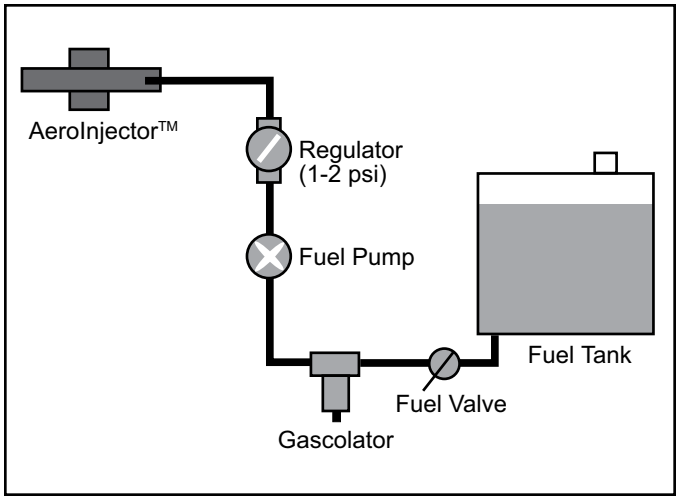
A gravity feed system is by far the safest and most reliable. The AeroInjector requires very little head pressure to operate effectively. For this system to be effective, the fuel tank outlet must be higher than all the other components of the fuel delivery system in a tail low (climb) configuration or fuel flow may be disrupted.



The gravity feed system.

Fuel Pump and Regulator System

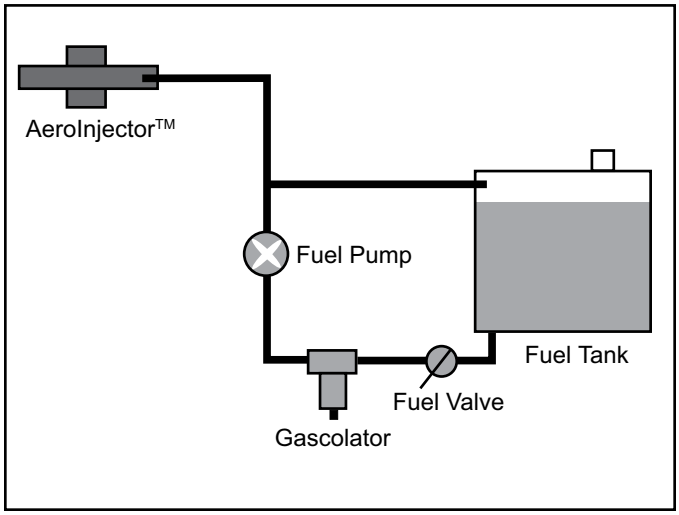
If your aircraft requires a fuel pump (i.e.: for wing tanks or pusher engines) a fuel pressure regulator must also be installed to limit fuel pressure to about 1 to 2 psi. A Holley Standard Pressure Regulator (1-4 psi range, or equal), has been found to be effective for these installations.



The fuel pump / regulator system.

Return Line System

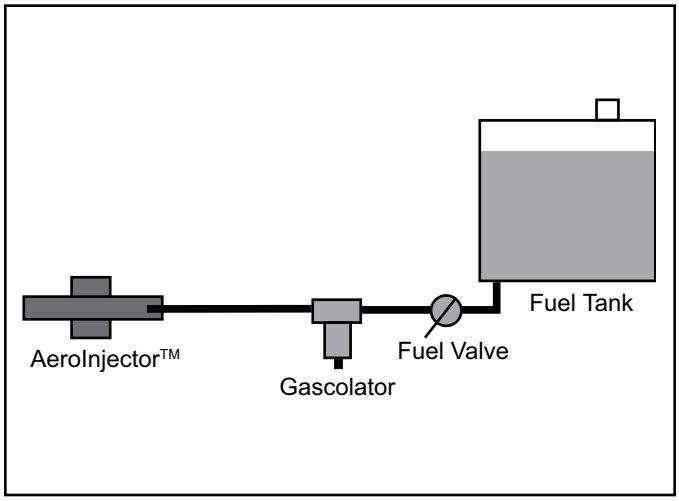
In a fuel return system a fuel line "T" is installed between the regulator and the AeroInjector with a return line to the tank. This will supply fuel to the AeroInjector without excessive pressure. Excess fuel returns to the tank.



The return line system.

Header Tank System

Pumping fuel from the main tank(s) to a small header tank mounted above the injector will provide gravity feed to the AeroInjector. A return line from the header to the main tank(s) is required so excess fuel can return to the main tank without a build-up of pressure. This type of system assures some reserve fuel in the event the fuel pump fails, and eliminates the need for a fuel regulator.



The header tank system.

Section Contents

Mounting the AeroInjector

The ideal mounting position for an AeroInjector is in the updraft configuration, as low as possible, to assure constant gravity fuel flow even in extreme nose high attitudes. However, the AeroInjector functions well in any position.

WARNING: Fire hazard. Do not install the AeroInjector where dripping fuel can contact hot exhaust or electrical equipment. If necessary, install a drip pan to catch/deflect dripping fuel. Always close the mixture shut-off valve and fuel valve when the engine is off.

IMPORTANT: If the cockpit mixture control is not pulled to the Idle/Cut-off position when the engine is off, fuel will continue to flow through the AeroInjector. This may fill the AeroInjector/intake causing engine flooding or spill-over, which is a fire hazard.

Note: If you are using an optional AeroConversions Air Filter or Intake Flange Adapter it is easier to install these before mounting the AeroInjector to the intake manifold. See page 15.

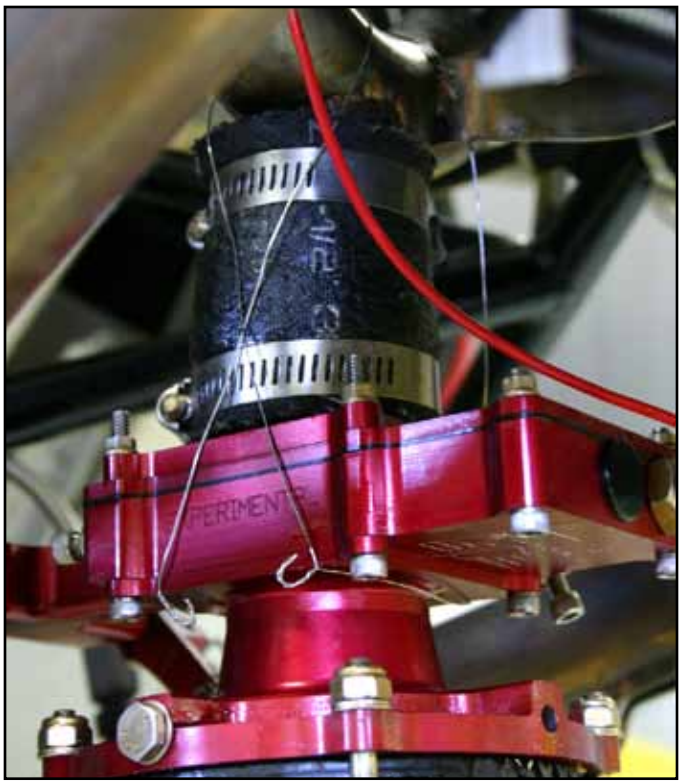
Spigot Mounted AeroInjector

The outside diameter of the AeroInjector's spigot must match the inside diameter of the engine's hose mount.

If you are replacing a carburetor, the existing hose mount can mostly likely be reused after inspection. Replace the hose if it shows signs of deterioration.

If you do not have a hose, we recommend fuel tank filler hose (or equivalent fuel proof hose) of the proper diameter. *Do not use radiator hose.*

Attach the hose and AeroInjector to the engine with two stainless steel hose clamps. Updraft and sidedraft installations must be further secured with safety wire to the intake manifold, as shown in the photo, next column.

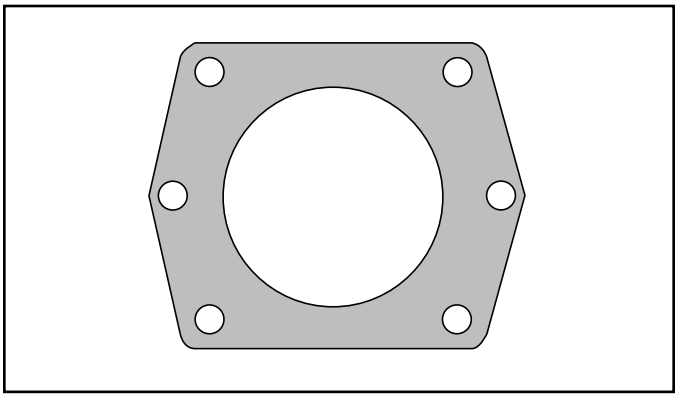


This spigot-mounted AeroInjector is also safety wired to the intake manifold for further security.

Flange Mounted AeroInjector

A flange mounted AeroInjector will bolt directly to a four-hole Continental or Lycoming intake manifold. Use a standard gasket or a small amount of gasket-maker when mating the AeroInjector to the manifold.

To mount a standard four-hole flange to a two-hole manifold, fabricate an adapter plate from 1/4" to 3/8" thick 6061-T6 aluminum flat stock. Use standard gaskets or a small amount of gasket-maker on both sides of the adapter when mating the AeroInjector to the manifold.



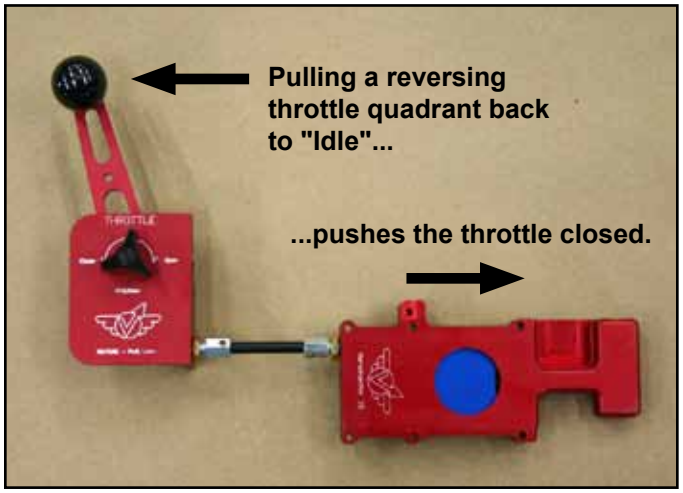
This sample adapter plate has 4 holes matched to the AeroInjector's flange, and 2 matched to the 2-hole intake manifold. The center hole matches the inside diameter of the intake bell.

Throttle Installations Acceptable for Use with the AeroInjector

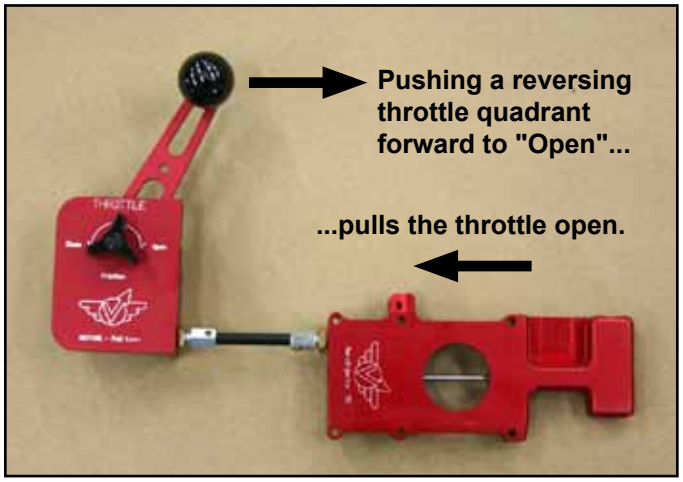
The AeroInjector's design requires the use of a reversing throttle quadrant or reversing bellcrank for proper operation of the throttle slide. Either of these convert the standard "push to accelerate" cockpit throttle motion into the AeroInjector's required "pull to accelerate" cable motion. As such, "push/pull" throttle cables which do not reverse the throttle cable's motion must not be attached directly with the AeroInjector.

Reversing Throttle Quadrants

A reversing throttle quadrant is the preferred installation for the AeroInjector as it provides the proper cockpit control and cable motion while eliminating the need for an intermediate reversing bellcrank. The AeroConversion Throttle Quadrants are the ideal match for the AeroInjector.



For clarity, only a portion of the AeroInjector is shown.



A reversing throttle quadrant is required for the AeroInjector. AeroConversions offer three options to suit most cockpit configurations.

Push / Pull and Vernier Throttle Cables

DANGER. DO NOT connect a push/pull or vernier throttle cable directly to the AeroInjector as this will result in a non-standard control installation where *pulling* the cockpit throttle control will result in the application of full throttle. The installation of a push/pull or vernier throttle cable requires a reversing bellcrank between the cockpit throttle control and the AeroInjector to convert the pushing action of the cockpit throttle control into the pulling action the AeroInjector requires to open the throttle.

*The common push/pull throttle cables, as shown here, **can not** be connected directly to the AeroInjector. To use this type of throttle cable a reversing bellcrank **must** be installed between the throttle cable and the AeroInjector.*

Cable Routing

The throttle cable must be routed so it does not have any sharp bends. A grommet must be used where the throttle cable passes through the firewall.

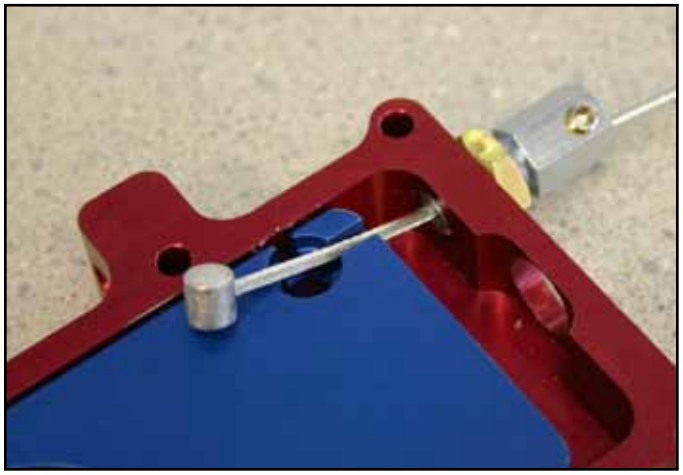
CAUTION: Do not allow the throttle cable to come in contact with the battery terminals.

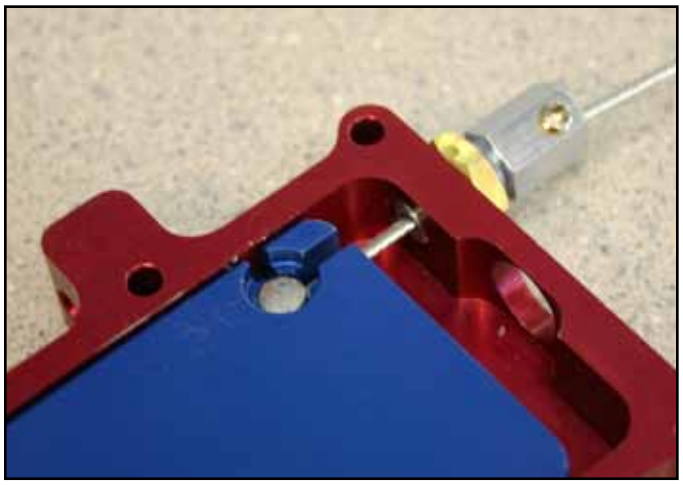
CAUTION: Do not allow the throttle cable to come in contact with the exhaust.

Flexible Throttle Cable Installation

The standard installation uses the AeroConversions throttle cable, part number ACV-Q01-45, flexible cable with a cast cylindrical end. That cable is included with each AeroConversions Reversing Throttle Quadrant and can be purchased separately.

1. Disassemble the AeroInjector by removing the 6 machine screws which hold the body together. You will need a 9/64" hex wrench and a 7/32" open end wrench.
2. Remove the flexible cable from the cable housing.
3. Pass the cable through the cable adjuster and insert the cylindrical end in the recess in the throttle slide.





These photos show how the ACV-Q01-45 cable is installed in the throttle slide.

4. Make sure the inside of the AeroInjector body is free of debris and re-assemble the AeroInjector. Check for free movement of the throttle slide.
5. Attach the AeroInjector to the intake manifold.
6. Route the throttle cable so it does not have any sharp bends. A grommet must be used where the throttle cable passes through the firewall.

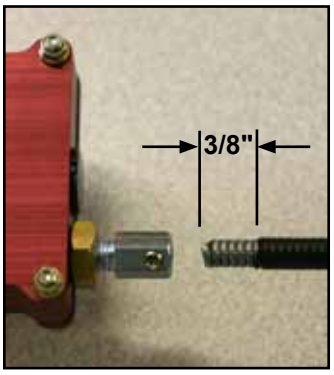
CAUTION: Do not allow the throttle cable to come in contact with the battery terminals.

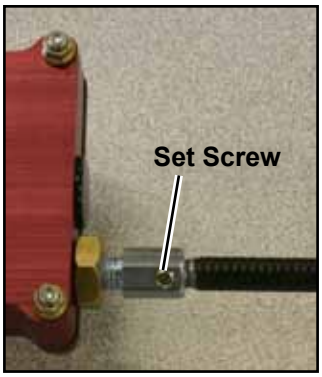
CAUTION: Do not allow the throttle cable to come in contact with the exhaust pipes.

The cable housing must be long enough to be inserted in the cable adjuster on the AeroInjector and the cable adjuster on the throttle quadrant.

After determining the best cable routing, trim the *housing* to length. *Do not trim the cable.*

7. Strip 3/8" of the black casing off each end of the cable housing, exposing the metal core.





Left: Strip 3/8" of the outer jacket off the throttle cable sleeve. Right: Insert the exposed metal core into the cable adjuster and tighten the set screw to secure the housing.

8. Push the exposed metal core into the cable adjuster and secure it with the included set screw (ACV-Q01-23). **Do not over-tighten or you may pinch and bind the cable.**
9. Insert the flexible cable between the washers and through the hole in the wire retainer swivel but *do not tighten the locking nut*.

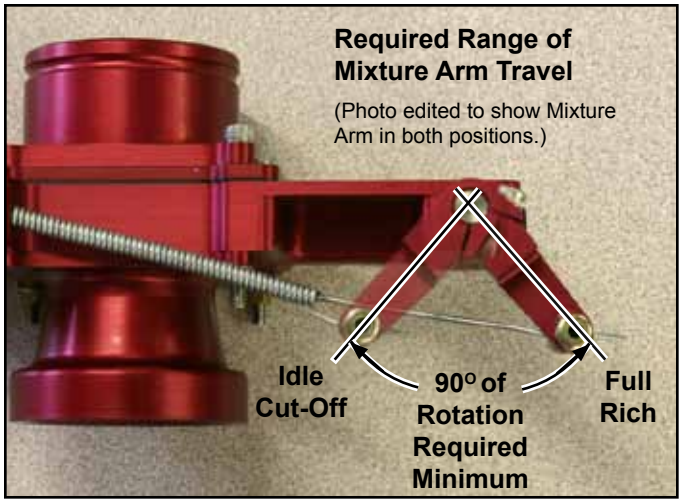
10. Push the cable housing into the cable adjuster on the throttle quadrant and secure it with the included set screw. **Do not over-tighten the set screw or you may pinch and bind the cable.**
11. Push the throttle quadrant lever to the "full throttle" position.
12. Make sure the slide of the AeroInjector is fully open (full throttle position).

13. Tighten the nut on the wire retainer swivel to lock the cable in the swivel. An access hole in the mounting plate allows the swivel to be held with a screwdriver while the nut is tightened.

A hole in the mounting plate provides access to the slotted cable swivel when the throttle is in the "Full Throttle" position.

14. Operate the cockpit throttle control through it's full range of movement and make sure the throttle slide is opening completely as well as closing against the idle stop screw. Adjust the cable length as needed to provide the full range of throttle movement.
15. Install the wire stop on the cable end, securing it with the set screw. See photo, previous column.
16. Trim the exposed throttle cable, leaving 1/4" extending beyond the wire stop.

Install the Mixture Cable



The mixture shut-off valve must rotate 90 degrees from the factory pre-set "Idle cut-off" position to the user set "full rich" position. These steps describe that process.

Cable Type and Routing

The mixture cable must be a push-pull bowden wire cable.

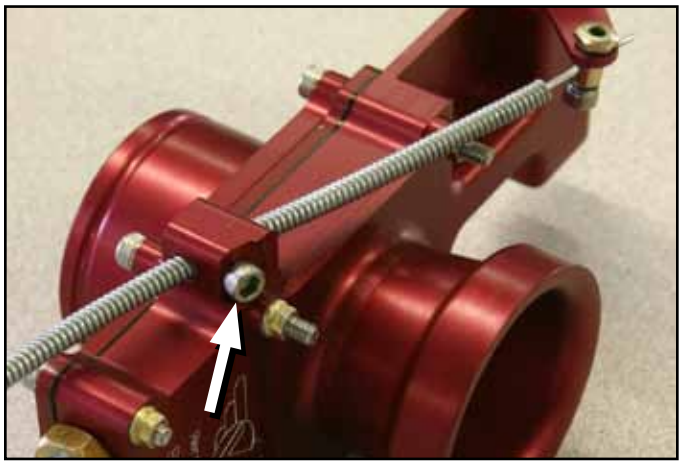
The mixture cable must be routed so it does not have any sharp bends. A grommet must be used where the mixture cable passes through the firewall.

CAUTION: Do not allow the mixture cable to come in contact with the battery terminals.

CAUTION: Do not allow the mixture cable to come in contact with the exhaust pipes.

Connecting the Mixture Cable

1. Insert the mixture cable housing in the mounting hole. **Do not tighten the clamping screw at this time.** If necessary, up-drill the hole for the mixture cable clamp to fit your cable. **Do not over-size the hole.**

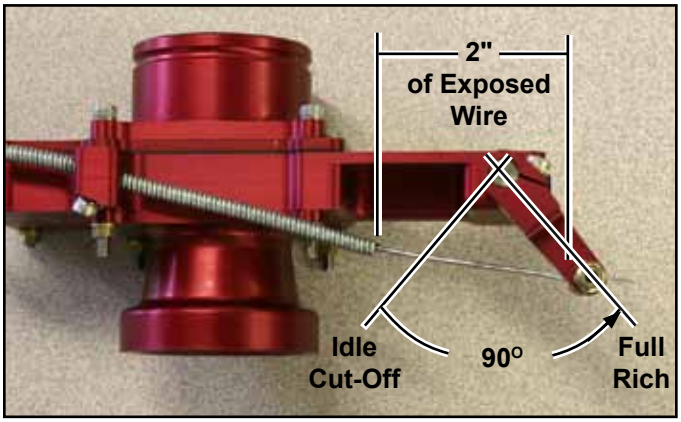


A passage through the injector's body and a set screw (arrow) secure the mixture cable to the AeroInjector.

2. Remove 2.5" of the end of the cable sleeve to expose the cable end. (Reference Step 6, below).
3. Pass the mixture cable through the swivel nut in the mixture arm. **Do not tighten the swivel nut at this time.**

Pass the mixture cable through the swivel nut as shown.

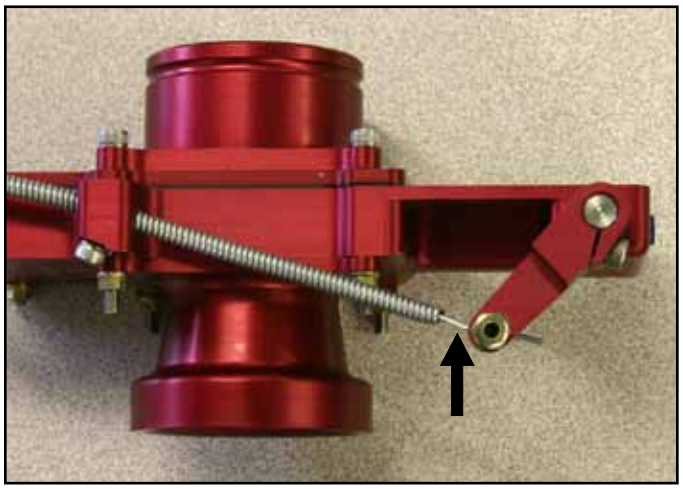
4. Push the cockpit mixture control knob all the way in (full rich).
5. Rotate the mixture arm 90° from the factory pre-set Idle Cut-off position as shown in the following photo.



Setting the "Full Rich" position of the mixture arm and the mixture cable as shown in this photo will provide the full-range of cockpit mixture control.

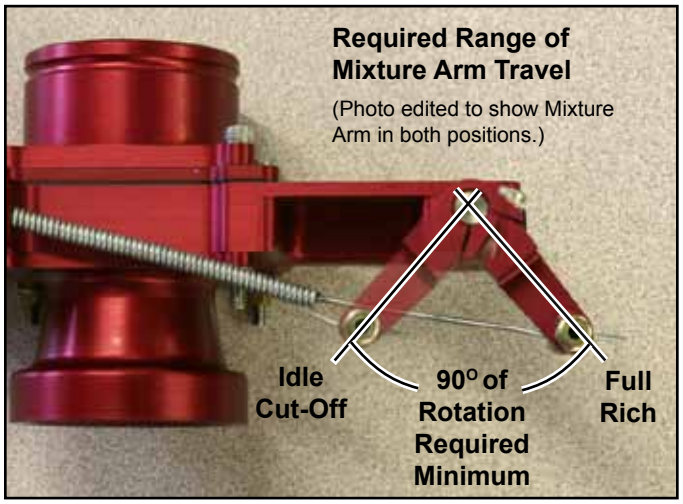
6. Slide the mixture cable housing through the mounting hole until there is 2" of wire exposed between the mixture arm and the end of the mixture cable housing (see photo, above). Make sure the mixture arm is still in position (step 5) and the cockpit mixture control knob is still pushed all the way in ("Full Rich").
7. Secure the mixture cable in the mixture cable clamp with the set screw. **Do not over-tighten the set screw.** The set screw should firmly grip the mixture cable housing but not bind the movement of the wire.
8. Tighten the screw of the swivel nut against the wire. **Do not over-tighten the screw.** The set screw should firmly grip the mixture cable but allow the swivel freedom to turn as the mixture arm is operated.

9. Operate the mixture knob several times. The mixture should operate smoothly. If it does not make sure the mixture cable set screw has not been over-tightened (step 7), the swivel nut has not been over-tightened, and the cable routing is free of sharp bends.
10. Pull the mixture cable out until it stops ("Idle Cut-Off"). The mixture control arm must be in the "closed" position with some wire still exposed beyond the cable housing. If there is no wire visible the mixture arm may not be fully closed (see photo, below).



When the cockpit mixture control knob is pulled all the way out (Idle Cut-off), there must still be some wire exposed between the cable housing and the mixture lever (see arrow). If there isn't, the cable housing may keep the mixture arm from closing fully.

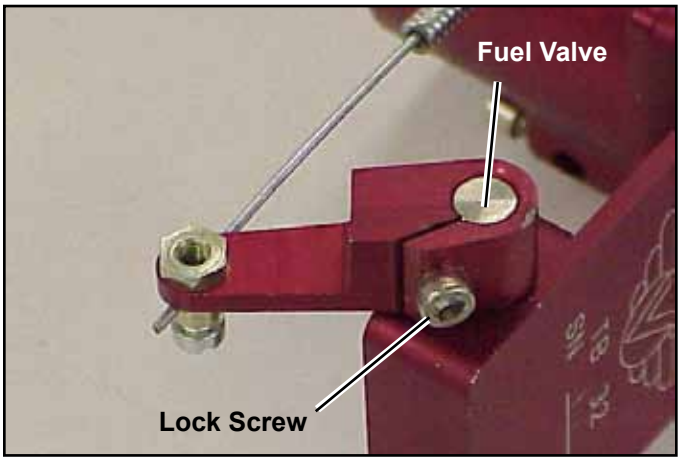
11. Push the cockpit mixture control all the way in ("Full Rich"). The mixture arm must rotate 90-degrees minimum.



The cockpit mixture control must rotate the mixture arm 90-degrees minimum from the factory pre-set "Idle cut-off" position to the user set "full rich" position.

Note: The position of the mixture arm on the fuel valve can be adjusted if needed. The need to do this is unusual

a. Loosen the swivel nut and remove the mixture cable.
b. Turn the mixture arm clockwise until the fuel valve is seated in the off position.
c. Loosen the screw which locks the mixture arm on the fuel valve.



A screw locks the mixture arm in place on the fuel valve. Loosening the screw allows the position of the mixture arm in relation to the valve to be adjusted.

d. Rotate the mixture arm on the fuel shaft to the desired position. This will be the new "Idle Cut-off" position of the mixture arm.
e. Tighten the screw to lock the mixture arm in place.
f. Reconnect the mixture cable.
g. Make sure the cockpit mixture control still provides enough movement of the mixture arm to open the valve from "Idle Cut-off" to "Full Rich".

Install the Fuel Line

Use "AN" aircraft grade fuel lines and fittings to connect the AeroInjector to your fuel system. The use of barbed fittings and hose clamps in the fuel system is strongly discouraged.

AeroConversion recommends a 3/8" diameter fuel line (-06 hose).

The body of the AeroInjector is tapped to accept 1/8 NPT fittings. Apply teflon paste (**do not use teflon tape**) to the threads before installation.

An AN pipe fitting is installed in the 1/8 NPT fuel orifice. The small plug (or screw) on the end of the AeroInjector can be ignored, it seals a hole required for the production of the AeroInjector.

Intake Air, Air Filter, and Carburetor Heat Installation

The intake bell of the AeroInjector is designed to accept 2-1/4" SCAT tubing. It may also be fitted directly with the optional AeroConversions air filter assembly (see next page).

Carburetor Heat

The design of the AeroInjector makes it resistant to icing typically associated with carburetors that have venturis and butterfly valves. While each owner must make their own decision on installing and using carburetor heat - and some countries require it - we do not recommend it's use.

Intake Air and Air Filtering

The AeroInjector must be allowed to draw combustion air freely - it is not designed for use with ram air. Ram air will cause the mixture to become lean as speed increases.

Intake air can be drawn through a remotely mounted carb heat/air filter box, or the optional AeroConversions air filter. Installation of the optional AeroConversions air filter is described on the next page.

Installing the Optional AeroConversions Air Filter or Intake Flange Adapter

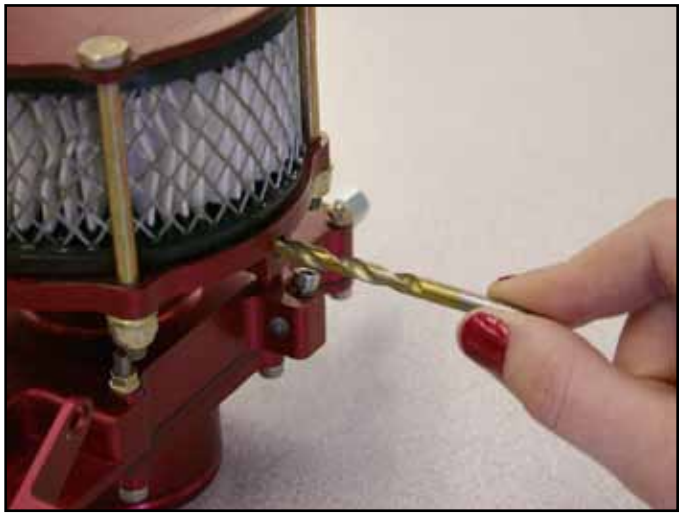
The optional AeroConversions air filter or intake flange adapter are mounted directly to the intake bell of the AeroInjector.

IMPORTANT: While drilling and tapping the intake bell use care to keep debris from entering the AeroInjector.

1. Slide the air filter over the intake flange adapter until the hole is centered on the mounting surface of the intake bell (see photo, below).

Note: Only one bolt is needed to secure the air filter to the AeroInjector. At least two bolts must be used to mount the intake flange adapter.

2. Insert a 3/16" diameter drill bit through any of the mounting holes in the air filter or intake flange adapter and twist it a few times to mark the AeroInjector's intake bell.



A 3/16" drill bit inserted in a mounting hole and twisted by hand will mark the intake bell of the AeroInjector for drilling.

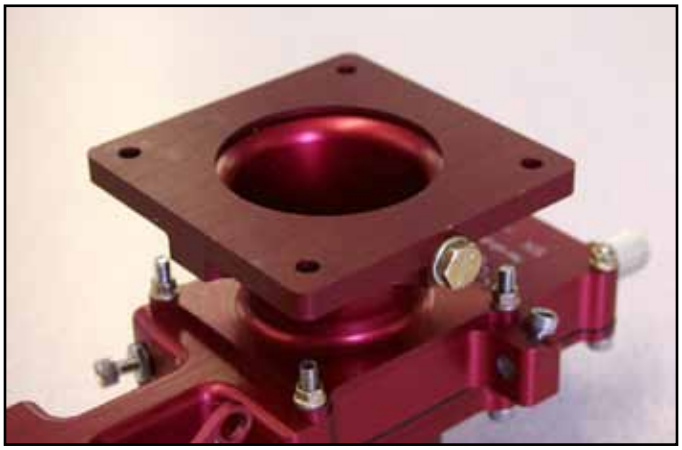
3. Remove the air filter or intake flange adapter and carefully drill a 1/8" diameter pilot hole squarely through the intake bell at the mark.
4. Up-drill the hole with a #21 drill.
5. Tap the hole with a 10-32 tap and cutting fluid.

The intake bell drilled and tapped for an AN3 bolt.

6. Slide the air filter in place, apply Locktite 242 to the threads of the AN3 bolt, and install the bolt and AN960-10 washer.

   Note: If the bolt does not smoothly engage the threaded hole it is acceptable to enlarge the hole in the air cleaner or intake flange adapter to provide a degree of play.

The hole in the intake flange adapter or air cleaner can be enlarged slightly if the AN3 bolt does not smoothly engage the threaded hole in the intake bell.



The intake flange adapter (shown) and air filter are attached with the AN3 bolt(s) and AN960-10 washer(s).

Section Contents

For Best Results...

Read and understand this entire chapter before tuning your AeroInjector. This chapter is broken into three sections: How the AeroInjector Works, Idle and Mixture Adjustments, and Tuning the AeroInjector. The first two sections contain important information you should understand before you begin to tune your AeroInjector.

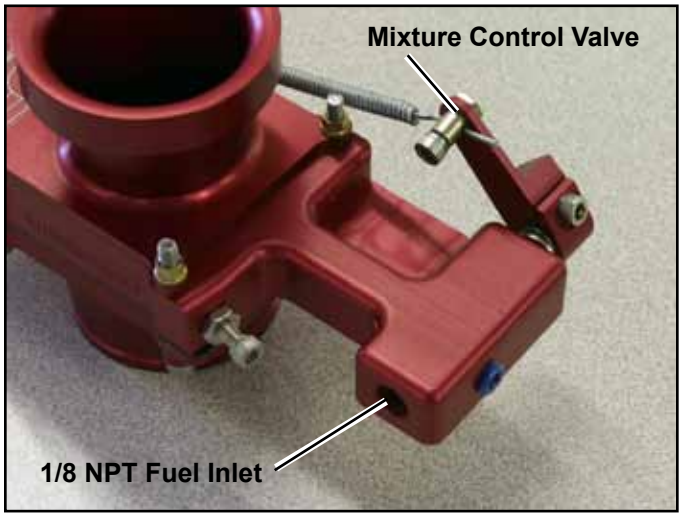
How the AeroInjector Works

The Fuel Mixture Needle and Throttle Slide move as one unit when the cockpit throttle control is operated. The position of the mixture needle relative to the throttle slide determines the fuel/air ratio. The tuning process establishes the optimum fuel/air ratio for the full range of throttle travel.

Fuel Metering

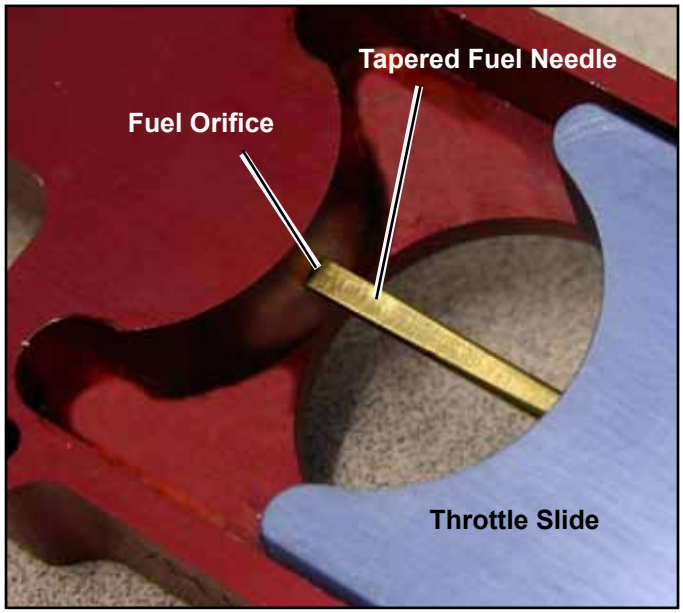
Fuel enters the AeroInjector at the Mixture Control Valve, which is cockpit controllable with a mixture control cable. The valve controls the volume of fuel *available* to the engine: from none (cockpit mixture control set to "Full Lean" or "Idle Cut-off"), to maximum (cockpit mixture control set to "Full Rich"). Like any other carburetor with a cockpit mixture control, the mixture is normally set to "Full Rich" for start-up, climb, and landing, yet provides mixture control (leaning) for optimum performance and fuel efficiency while cruising.

Important: *When tuning the AeroInjector, the Mixture Control Valve must be in the "Full Rich" position.*



The fuel inlet and Mixture Control Valve.

The fuel passing through the AeroInjector for combustion is metered by a tapered fuel needle. The needle moves with the throttle slide as the cockpit throttle control is operated, allowing more fuel to enter as the throttle is opened.



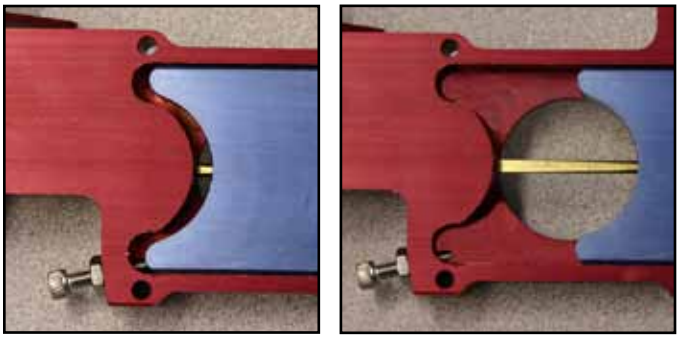
This cut-away view shows the tapered fuel needle and fuel orifice. The throttle slide, in which the fuel needle is mounted, is also identified.

The AeroInjector is supplied with 3 different fuel needles. Each needle provides a different over-all fuel/air ratio and is stamped with a number: 2, 2.5, and 3. The #2 needle is the leanest, and the #3 needle is the richest. The #2 needle is pre-installed, and is the correct needle for the majority of installations.

Note: A more lean no. 1 needle (part no. ACV-C10-11) and more rich no. 4 needle (part no. ACV-C10-14) are available options.

Air Metering

Combustion air is metered by the Throttle Slide. The throttle slide moves when the cockpit throttle control is operated, altering the opening of the air passage.

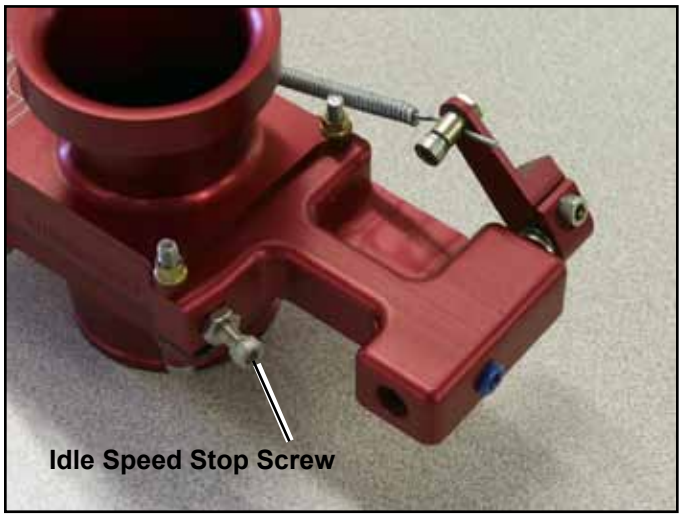


These cut-away views show the slide in the idle position (left photo) and in the wide open throttle position (right photo).

For most installations the throttle slide should be allowed to open all the way. However, some installations may encounter rough engine operation or "balking" near full throttle. If this occurs - a characteristic of "over-carburation" - note the position of the throttle slide just before the engine balks and adjust the throttle linkage to prevent the throttle slide from opening further. See page 19.

Idle Speed

The idle speed is set by the position of the idle speed stop screw. This screw, located near the fuel inlet, limits how far the throttle slide can close, assuring the engine has an adequate supply of air to run when the cockpit throttle control is fully retarded.



The idle speed stop screw limits how far the throttle can close. The idle screw is locked in position by a locknut which is tightened against the body of the AeroInjector after the idle speed has been set.

Mixture and Idle Adjustments

IMPORTANT: Read and become familiar with the entire Tuning Procedure before tuning your AeroInjector. This section does not describe how to *tune* the AeroInjector, rather, how to make the individual mixture and idle adjustments which will be necessary during the tuning process.

Adjusting the Mixture Needle

The mixture needle is mounted in a needle carrier which is installed in the throttle slide. The needle carrier has an adjustment screw which allows infinite adjustment of the mixture needle.

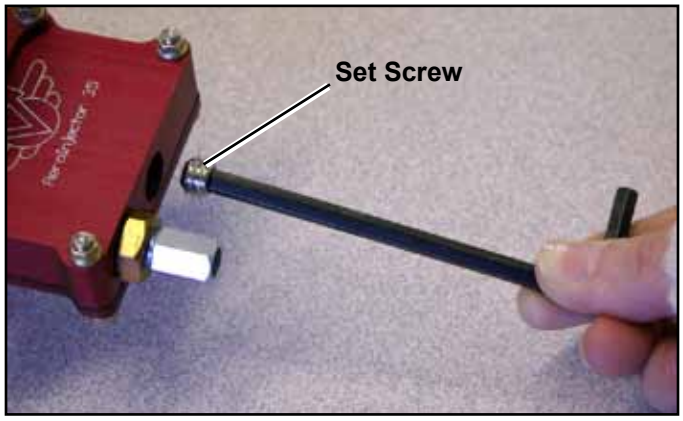
While it is seldom necessary to remove the needle carrier during tuning, this photo shows the needle carrier which is installed in the throttle slide. The AeroInjector is shipped with three different needles, no. 2, no. 2.5, and no. 3.

To adjust the Mixture Needle:

1. Lock the throttle in the "Full Throttle" position.
2. Remove the dust cap

Remove the dust cap to gain access to the Needle Adjustment Screw.

3. A set screw locks the needle carrier in place. Remove the set screw with a 3/16" ball end hex wrench.

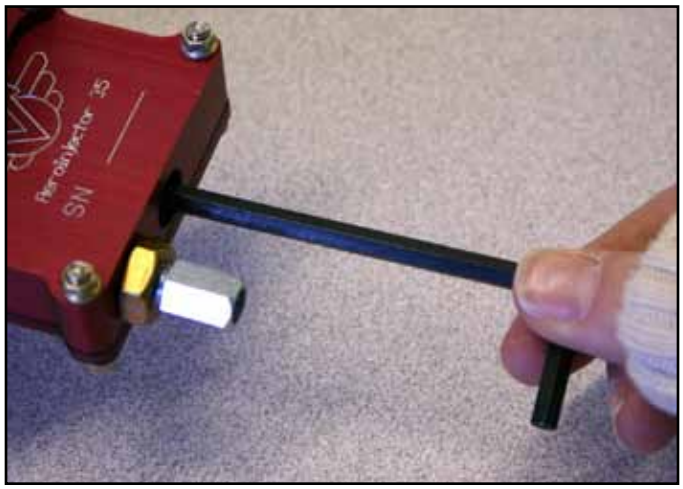


Use a 3/16" ball end hex wrench to remove the set screw which locks the needle carrier in place.

4. Adjust the mixture needle with a 3/16" ball end hex wrench. Adjust the needle in 1/8 to 1/2 (maximum) turn increments.

   To *richen* the mixture, turn the wrench *counter-clockwise*.

   To *lean* the mixture, turn the wrench *clockwise*.



Use a 3/16" hex wrench to adjust the position of the Mixture Needle.

5. Re-install the set screw so it is snug against the needle carrier.

   IMPORTANT: Always re-install the set screw after an adjustment has been made. Running the engine without the set screw in place can allow the position of the mixture needle to change.

6. Re-install the dust cap.

Changing the Mixture Needle

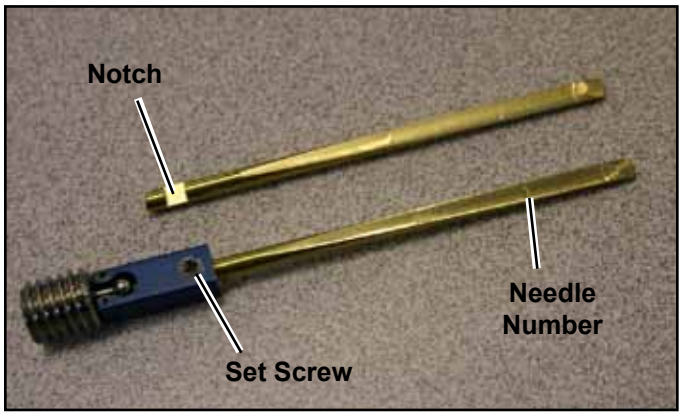
The AeroInjector is supplied with three different mixture needles, each offering a richer or leaner fuel ratio across the entire throttle range. Each needle is stamped with a number on its flat taper: 2, 2.5, or 3. Needle 2 provides the leanest mixture, and 3 the richest. The number 2 needle is factory installed and is the correct needle for most applications.

Note: Other needle profiles (no. 1, more lean, and no. 4, more rich) are available. Please contact AeroConversions to discuss your needs if the standard needles do not provide proper results.

A needle should only be replaced after tuning efforts have shown the installed needle is too rich or too lean across the entire throttle range, as described in "Tuning the AeroInjector".

To Replace a Mixture Needle:

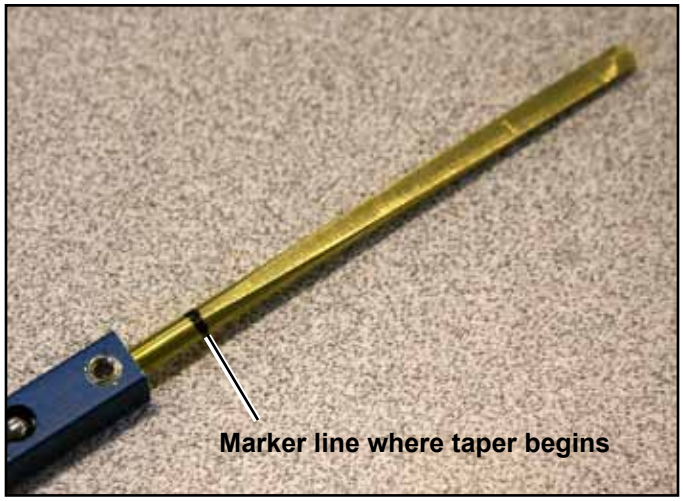
1. Lock the throttle in the "Full Throttle" position.
2. Remove the dust cap.
3. Remove the needle locking set screw with a 3/16" ball end hex wrench.
4. Remove the needle carrier from the throttle slide with a 3/16" ball end hex wrench turned counter-clockwise.
5. Loosen the set screw which locks the mixture needle in the needle carrier with a 1/16" hex wrench and remove the needle.



Use a 1/16" hex wrench to remove the set screw which locks the needle in the needle carrier in place.

6. Install a needle with a richer or leaner profile, as needed. Make sure the notch in the needle lines up with the set screw in the needle carrier and re-install the set screw.
7. Use a fine point marker to mark the beginning of the needle's taper. Make sure the mark encircles the entire needle.

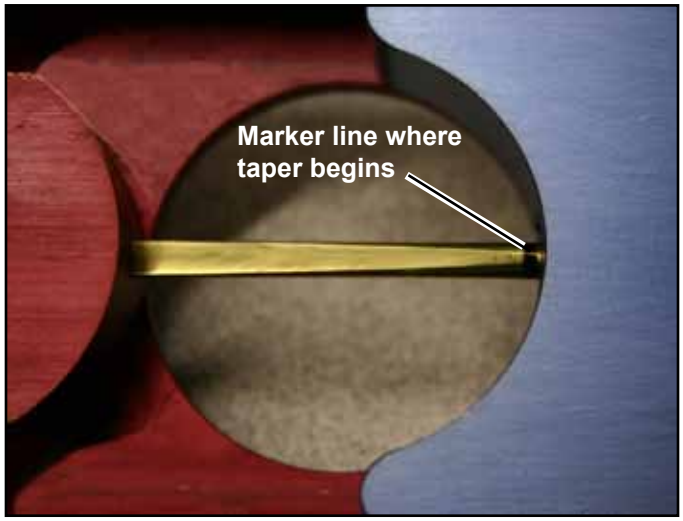
8. Re-install the needle carrier in the throttle slide. **Make sure the flat, tapered side of the needle faces the engine side of the AeroInjector.** Screw the carrier into the throttle slide until the marker line on the needle is visible at the edge of the throttle slide.



Draw a line around the needle where the taper begins.

9. Re-install the set screw so it is snug against the needle carrier.

   IMPORTANT: Always re-install the set screw after an adjustment has been made. Running the engine without the set screw in place can allow the position of the mixture needle to change.



Screw the needle carrier into the throttle slide until the beginning of the needle's taper is even with the edge of the slide, as shown in this cut-away.

10. Re-install the cap.

Adjusting the Idle Speed Stop Screw

The Idle Speed Stop Screw controls the idle speed by limiting how far the throttle slide can close. If the slide closes too far, fuel and air will be restricted and the engine will stop. If the slide does not close enough, the engine will idle too high. The idle speed stop screw is adjusted with a 9/64" hex wrench. The screw is locked in place with lock nut tightened against the AeroInjector's body.

To *increase* the idle speed, turn the idle screw *clockwise*.

To *decrease* the idle speed, turn the idle screw *counter-clockwise*.

Idle adjustments may be needed during initial tuning, but the final idle setting is performed after the mixture needle has been properly set and the engine is warm (oil temperature at least 100^{O} F.) Refer to your engine specifications for the correct idle speed.

A 9/64" hex wrench is used to adjust the idle speed stop screw. The lock nut is tightened / loosened with an 11/32" open-end wrench.

Adjusting the "Full Throttle" Position of the Throttle Slide

Some installations may encounter rough engine operation or "balking" near full throttle. If this occurs, the movement of the throttle slide needs to be limited to prevent it from opening and exposing the entire intake air passage.

1. Note the position of the throttle slide just before rough operation begins.
2. Adjust the throttle cable's length/position so the throttle lever is in the full throttle position, but the throttle slide is in the position noted in step 1. This will generally require shortening the throttle cable.

When is it in Tune?

A properly tuned AeroInjector will accept throttle changes smoothly, without missing or balking, and, at full throttle, will exhibit an Exhaust Gas Temperature (EGT) increase of 90^{O} to 100^{O}F when the cockpit mixture control is pulled from "Full Rich" to "Peak Lean".

We define Peak Lean as the engine manufacturer's maximum recommended EGT. While this varies from engine to engine, most engines set a maximum EGT near 1400^{O}F. Refer to your engine's operating limits.

Note: Since calibration of EGT gauges/probes is difficult, the EGT should be used to measure *change* in temperature rather than *absolute* temperature.

Peak Lean generally occurs just before the engine begins to run rough. Continuing to pull the cockpit mixture control further lean will result in higher than recommended EGTs, rough engine operation, and, eventually, fuel starvation.

What is "Rich"?

We define "rich" as a fuel/air ratio which has too much fuel.

Symptoms:

- Black, smoky exhaust.
- Engine runs with weak, intermittent firing.
- Pulling the mixture control knob towards lean will improve engine firing and reduce the amount of black exhaust.
- EGT increases more than 100^{O}F when the cockpit mixture control is pulled back from "Full Rich" to "Peak Lean".

Action to take:

- Turn the needle adjustment clockwise in 1/8 to 1/4 turn increments and run the engine to test the new setting.
- If continued needle adjustments do not produce the desired 90^{O} to 100^{O}F EGT spread, install a lowered number needle. See page 18.
- If your fuel system requires a fuel pump, the pressure regulator may need to be set lower (1 to 2 psi is normal).

What is "Lean"?

We define "lean" as a fuel/air ratio which has too little fuel.

Symptoms:

- Engine will not start
- Engine runs rough and exhaust is free of black smoke.
- Engine runs rough and does not improve, or stalls, as the cockpit mixture control is pulled towards lean.
- Engine will not take throttle.
- EGT climbs quickly to, and above, temperatures recommended for your engine.
- EGT increases less than 90^{O}F when the cockpit mixture control is pulled back from "Full Rich" to peak lean.

Action to take:

- Turn the needle adjustment counter- clockwise in 1/8 to 1/4 turn increments and run the engine to test the new setting.
- If continued needle adjustments do not produce the desired 90^{O} to 100^{O}F EGT spread, install a higher number needle. See page 18.
- If your fuel system requires a fuel pump, the pressure regulator may need to be set higher (1 to 2 psi is normal).

Compensating for Seasonal Changes

Some climates may require small seasonal adjustments to the mixture needle. These are generally needed once in late Fall and again in late Spring to compensate for changing air density. If your engine exhibits symptoms of running too rich as the weather warms, and too lean as the weather cools, the mixture needle may need to be adjusted no more than 1/4 to 1/2 turn richer or leaner, as appropriate.

Tuning the AeroInjector - Step by Step

IMPORTANT: Read and understand this entire chapter before tuning your AeroInjector. This chapter is broken into three sections: How the AeroInjector Works, Mixture and Idle Adjustments, and Tuning the AeroInjector. The first two sections contain important information you should understand before you begin to tune your AeroInjector.

DANGER: Avoid serious injury or death. Turn the engine off using a checklist before making any adjustments to the AeroInjector. A typical checklist is provided on page 22 of this manual, but it may need to be modified for your particular aircraft.

DANGER: Avoid serious injury or death. Remain clear of the propeller at all times while tuning the AeroInjector.

DANGER: Avoid serious injury or death. Tie down and chock the aircraft while tuning the AeroInjector.

WARNING: Avoid serious burns. The engine and exhaust will become hot during the tuning process.

CAUTION: Avoid damaging the engine. Air cooled engines are not adequately cooled during ground operations. Monitor your engine's temperatures and oil pressure, and limit ground running as much as possible.

IMPORTANT: Tuning should be done with a qualified helper. One person remains in the cockpit to operate the throttle and monitor the engine instruments while the other makes adjustments to the AeroInjector (only after the engine is shut down!) and observes the exhaust.

Tools Required

- ❑ 3/16" Hex Wrench
- ❑ 9/64" Hex Wrench
- ❑ Start-up checklist (see page 20)
- ❑ Shut-down Checklist (see page 20)

To Tune the AeroInjector:

1. Tie-down and chock the aircraft.
2. Set the parking brake
3. Make sure the aircraft has an adequate fuel supply. The use of 100LL is strongly recommended during the tuning process to eliminate poor fuel quality as a possible source of poor engine performance and tunability.
4. Start the engine using an appropriate checklist.
   - If the engine starts and idles smoothly, even with slightly black exhaust, allow the engine's oil temperature to warm up to 100^{O}F. **Do not allow the CHT and EGT to exceed the engine manufacturer's limit.** Continue to step 5.
   - If the engine does not start, or starts and runs rough, shut down the engine using an appropriate checklist and adjust the mixture needle as needed. See "When is it in Tune?" page 18. After making an adjustment, repeat this step.
5. Gradually increase the throttle to full static RPM.
   - If the engine takes full throttle well with clean exhaust, continue with step 6.
   - If the engine takes full throttle well but exhibits some black exhaust, shut down the engine using an appropriate checklist and adjust the mixture needle leaner. See "When is it in Tune?" page 18. After making an adjustment, repeat step 4.
   - If the engine runs rough, balks, or quits, shut down the engine using an appropriate checklist and adjust the mixture needle as needed. See "When is it in Tune?" page 18. After making an adjustment, repeat step 4.
   - If the engine takes throttle well but balks or runs rough only at or near full throttle, the Throttle Slide's travel needs to be limited. Shut down the engine using an appropriate checklist and adjust the Throttle Slide. See page 17. After making an adjustment, repeat step 4.
6. With the engine running at full throttle:
   a. Gradually pull the cockpit mixture control lean until the engine begins to run rough, and then richen slightly for smooth operation. Note the EGT.
   b. Advance the cockpit mixture control to full rich and note the EGT.
   c. Retard the throttle smoothly to idle and shut down the engine using an appropriate checklist
   - If the EGT spread was 90^{O} to 100^{O}F, and the engine responded well to the throttle through the entire range, the mixture needle is properly set. Continue with step 7.
   - If the EGT spread was *greater* than 90^{O} to 100^{O}F, the mixture is too rich. Adjust the mixture needle for a leaner mixture (see page 16).
   - If the EGT spread was *less* than 90^{O} to 100^{O}F, the mixture is too lean. Adjust the mixture needle for a richer mixture (see page 16).
   - If continued adjustment does not achieve the desired 90^{O} to 100^{O}F spread, try the next numbered mixture needle. See "Changing the Mixture Needle", page 17.
7. After the mixture needle is properly set, final idle adjustments can be made (see page 17).
8. Test run the engine through it's full RPM range and make sure it:
   - Responds to the throttle smoothly
   - Idles properly
   - Exhibits a 90^{O} to 100^{O}F EGT differential at full throttle when the cockpit mixture control is pulled from full rich to "peak lean".

Note: Additional tuning may be needed after initial flight testing or after a new engine has been broken in.

Note: These basic checklists may need to be altered for your particular aircraft.

Starting Checklist - Electric Start

1. Brakes - Set
2. Mixture - Full Lean (Idle Cut-off)
3. Fuel Valve - On
4. Master - On
5. Mags - On
6. Throttle - Slightly Open
7. Fuel Pump - On
8. Clear Prop
9. Mixture - Full Rich

   Note: With the mixture open and the fuel valve on, fuel will flow through the AeroInjector. Do not delay starting the engine.
10. Starter - Engaged

The engine will normally start with one or two turns of the propeller in warm weather and six to eight turns in cold weather. If the engine does not start immediately, pull the mixture off, turn off the fuel pump, and close the fuel valve before investigating the problem.

Starting Checklist - Hand Propping

DANGER: Do not attempt to hand prop an aircraft without proper training. Serious injury or death can occur.

WARNING: Do not hand prop an aircraft equipped with an electric starter. Remove the aircraft from service until proper repairs can be made to the electric starting system.

1. Tie down and chock the aircraft.
2. Brakes - Set
3. Mags - Off
4. Mixture - Full Lean (Idle Cut-off)
5. Fuel Valve - On
6. Throttle - Slightly Open
7. Mixture - Full Rich for a few seconds then Full Lean. This "primes" the engine.
8. Pull prop through 2 to 4 blades
9. Mags - On
10. Prop engine until it starts.
11. Mixture - Full Rich

If the engine does not start, repeat procedure.

Flooded Engine - Clearing

Weak, intermittent firing indicates flooding. Excess fuel can be cleared from the combustion chambers with the following procedure:

1. Mixture - Full Lean (Idle Cut-off)
2. Fuel pump - Off
3. Fuel shut off valve - Off
4. Mag switch - Off
5. Throttle - Full Open
6. Engage the starter for a few seconds.
7. Repeat the starting procedure.

Leaning for Best Performance at Cruise

Take-off, full-power climb, and landing must always be performed with the mixture set at full rich. Once level cruise has been established, however, engine performance and fuel economy will both benefit by proper leaning.

1. Establish level cruise.
2. Slowly pull the mixture control Lean until the engine begins to run a little rough.
3. Note the maximum indicated EGT (if the aircraft is equipped with an EGT).
4. Slowly push the mixture control Rich until the engine runs smooth. If your aircraft has an EGT, this will be approximately 50 degrees F. cooler than the temperature noted in step 3.

Adjusting the mixture as described above will result in maximum power (higher RPMs), as well as minimum fuel consumption for any throttle setting.

Important: Mixture adjustment must be repeated with any change in throttle setting or altitude.

5. Push the mixture control to "Full Rich" before landing.

Shut-Down Checklist

1. Mixture - Full Rich
2. Throttle - Idle
3. Fuel Pump - Off
4. Mixture - Full Lean (Idle Cut-off)
5. Ignition - Off
6. Fuel Valve - Off (Closed)
   WARNING: Fire hazard. Failure to turn off the main fuel valve may result in fuel flowing from the AeroInjector after shut-down.
7. Master switch - Off
8. Mags - Off

The AeroInjector is an extremely simple design which can be expected to function faultlessly if properly installed and tuned. If you experience problems with your AeroInjector, please review this list of troubleshooting tips for possible causes, and the contents of this manual for proper installation/tuning/operation. **Should you be unable to identify or resolve your problem, contact AeroConversions for technical assistance.**

Unable to Tune the AeroInjector

Fuel delivery inadequate.
Inspect fuel system for restrictions.

Make sure the cockpit mixture control is set on "Full Rich" and the AeroInjector mixture lever is properly positioned.

Make sure the fuel tank has sufficient fuel for consistent head pressure while tuning.

Fuel delivery excessive.
Install a pressure regulator if a fuel pump is used.

Fuel pressure set too high/low on aircraft requiring a fuel pump.

Mixture needle improperly installed.
"Flat" of the mixture needle not facing the proper direction. Refer to the "Tuning Procedures" section of this manual.

Mixture needle lock screw not installed after each mixture needle adjustment, allowing the needle to move while the engine is running.
Install the mixture needle lock screw after each mixture adjustment.

Incorrect needle installed.
Install a different needle per tuning instructions in this manual.

Needle has been modified from original profile.
Discard needle and replace with a new one from AeroConversions.

Needle adjustments too aggressive.
Limit needle adjustments to 1/4 turn or less.

AeroInjector modified by installer.
Restore AeroInjector to original configuration.

Air intake restricted.
Inspect air intake for restrictions, sharp bends, dirty air filters, etc.

Ram air installed.
Remove ram air.

Incorrect propeller installed.
A propeller which is too coarse or too large will limit the engine's ability to produce power. This cannot be tuned away with the AeroInjector. Install a propeller that will allow the engine to reach the engine manufacturer's minimum static RPM at wide open throttle.

Engine requires service.
An engine in need of maintenance will be difficult or impossible to tune. Check valve settings, cylinder compression, timing, magnetos, spark plugs and wires. Inspect intake manifold for leaks.

Sticky Throttle

Improper throttle cable used.
Replace cable.

Kinked or sharply bent throttle cable.
Reroute cable to eliminate kinks, sharp bends.

AeroInjector modified by installer with additional linkages, return springs, brackets, etc.
Restore AeroInjector to original configuration and install according to this manual.

Throttle cable lining melted from excessive heat.
Replace cable. Route cable clear of exhaust system.

Dirty throttle Slide.
If the AeroInjector ingests exhaust gases, oil fumes (saturated air filter, etc.), or other materials, they can coat the throttle slide and cause binding. Clean the slide and injector body.

Sticky Mixture Cable

Kinked or sharply bent mixture cable.
Reroute cable to eliminate kinks, sharp bends.

Unsupported length of mixture cable too long near AeroInjector mixture lever.
Install mixture cable as shown in this manual.

AeroInjector modified by installer with additional linkages, brackets, etc.
Restore AeroInjector to original configuration and install according to this manual.

Mixture cable lining melted from excessive heat.
Replace cable. Route cable clear of exhaust system.

Fuel Leaks from AeroInjector

Because of the AeroInjector's floatless design, fuel will drip/flow from the AeroInjector if the fuel is on. The flow will increase if the throttle is open, the cockpit mixture control is moved towards "Rich", or a fuel pump is on. This is normal and does not represent a defect.

To keep fuel from flowing from the AeroInjector when the engine is turned off, always keep the fuel shut-off valve turned off, the cockpit mixture control pulled out to "Idle Cut-off", the fuel pump off, and the throttle at "Idle". Always use one of the start-up/shut-down checklists in this manual to prevent fuel from running from the AeroInjector.

Fuel leak from Mixture Control Valve
Remove mixture control valve, replace O-Ring and lubricate it with fuel-proof valve seal.

Simplicity of design, combined with a proper installation, result in the AeroInjector requiring no routine or preventive maintenance, year after year.

If you are experiencing a problem with your AeroInjector, refer to the Troubleshooting section of this manual.

The following common topics arise concerning the operation, assembly, and disassembly of the AeroInjector.

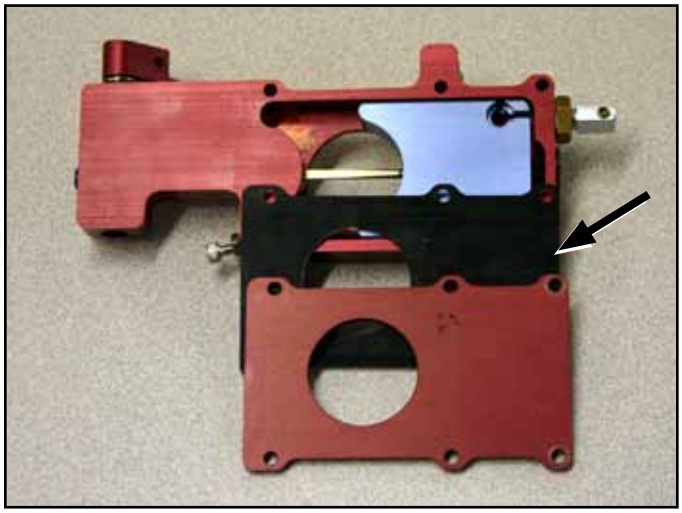
Body Assembly and Disassembly

Only six (6) screws and MS nuts hold the AeroInjector together. There is no specific torque value, nor tightening sequence.

The 6 screws that secure the AeroInjector's body can be removed / installed with a 9/64" hex wrench and a 7/32" box wrench.

Gaskets and Sealants

There are no sealants or gaskets used anywhere in the AeroInjector.



The AeroInjector is assembled without gaskets or sealants. The thin, black, anti-friction delrin gasket (arrow) is not a sealing gasket.

Delrin Anti-Friction Gasket

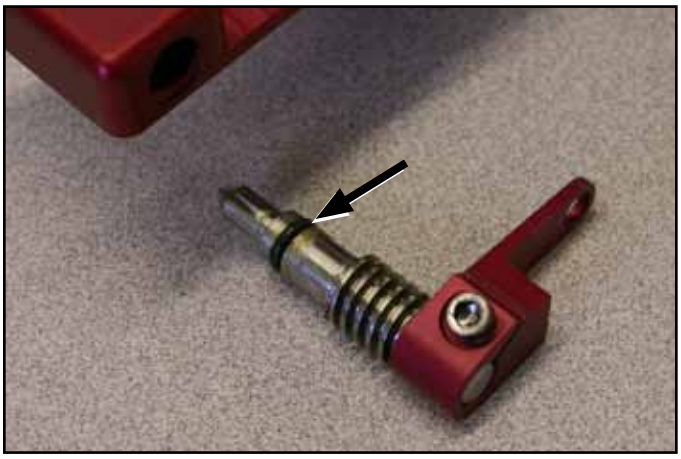
The black, anti-friction delrin gasket (see photo, above) is often believed to be a sealing gasket but it is not. Its purpose is to reduce the sliding friction of the throttle slide. It can be expected to last the lifetime of the AeroInjector unless it is warped from excessive heat (improper installation), or severely scratched by debris entering the AeroInjector.

O-Rings

The spigot (or flange) is sealed against the cover plate with a reusable Viton O-ring (part no. ACV-Z01-50) installed in a groove in the mating surface of the spigot or flange. This O-ring can be expected to last the lifetime of the AeroInjector.

The spigot (or flange) has a Viton O-ring that can be expected to last the life of the AeroInjector. If replacement should become necessary, see parts list for correct replacement part.

The fuel shut-off valve has a Viton O-ring (part no. ACV-Z01-51) which is factory coated with a fuel proof lubricant. Under normal use the O-ring and lubricant never need replacement. If replacement should become necessary, see the parts list for correct replacement O-ring. If the mixture valve is wiped clean or the O-ring is replaced, the O-ring must be recoated with fuel proof lubricant. *Do not use grease.*



The mixture adjusting screw unscrews from the AeroInjector's body, revealing the viton O-ring. The O-ring must have a light coat of fuel proof lubricant applied. Do not use grease.

Throttle Slide Lubrication

The throttle slide should never require lubrication. If it binds, identify and correct the cause. *Under no circumstances should any lubricant other than a light spray lubricant be applied, and this should never be necessary.*

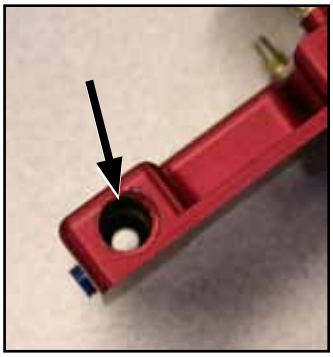
Throttle Slide Cleaning

If an AeroInjector is exposed to oily intake air (leaking engine, oil-soaked air cleaner) or is able to ingest exhaust gasses (exhaust leaks, improper exhaust system) the throttle slide can become covered with a black, sticky residue. This must be removed with solvents and the cause identified and corrected.

Fuel Passage Cleaning

Debris in the fuel passages (from improper fuel filtering) is easily removed, often without removing the AeroInjector from the aircraft.

The main fuel passage (right) can be cleaned by removing the fuel shut-off valve and the fuel line. Clear the passage with compressed air or by flushing with mineral spirits.

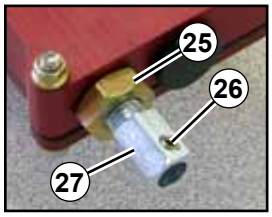


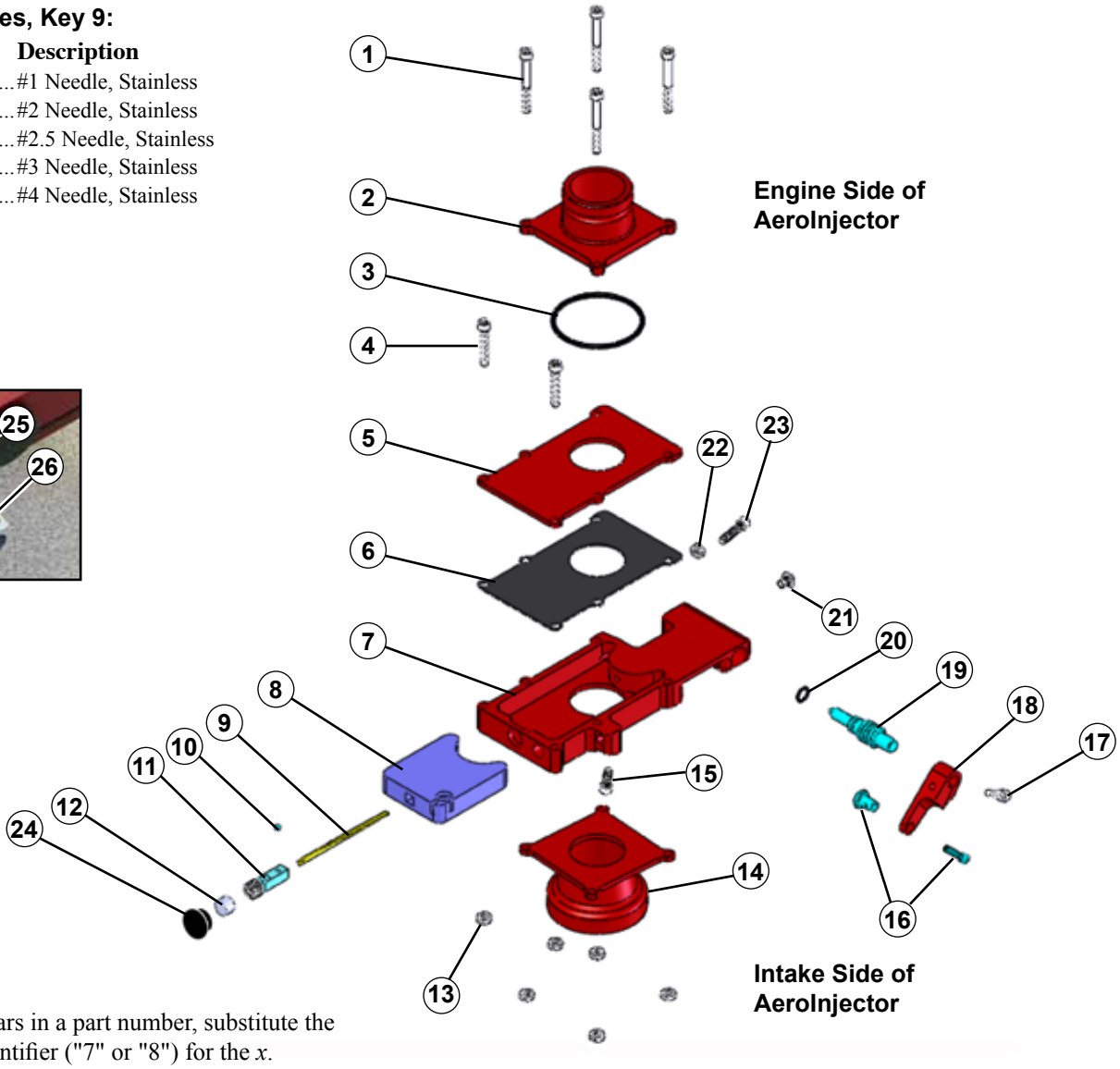
The fuel passage for the tapered mixture needle can be cleaned by removing both the needle carrier from the throttle slide and the small plug from the end of the AeroInjector (right). Clear the passage with compressed air or by flushing with mineral spirits.

Removing this plug exposes the metered fuel passage.

Mixture Needles, Key 9:

Part No.	Description
ACV-C10-41	#1 Needle, Stainless
ACV-C10-42	#2 Needle, Stainless
ACV-C10-46	#2.5 Needle, Stainless
ACV-C10-43	#3 Needle, Stainless
ACV-C10-44	#4 Needle, Stainless





When an *x* appears in a part number, substitute the AeroInjector identifier ("7" or "8") for the *x*.

AeroInjector 32mm x = 7
AeroInjector 35mm: x = 8

Key	Part No.	Description
1	ACV-Z01-78	8-32 x 1-3/8" SHCS
2	ACV-C07-05	32mm Spigot, 1.5" O.D. (shown)
	ACV-C08-05	35mm Spigot, 2" O.D. (not shown)
	ACV-C0*x*-07	2.5" Square Flange (not shown)
	ACV-C0*x*-08	3" Square Flange (not shown)
3	ACV-Z01-50	Viton O-Ring (#135)
4	ACV-Z01-52	8-32 x 1" Socket Head Cap Screw
5	ACV-CO*x*-02	Cover Plate
6	ACV-CO*x*-09	Delrin Gasket
7	ACV-CO*x*-01	AeroInjector Body
8	ACV-C0*x*-03	Slide
9	See chart above	Needle
10	ACV-Z01-58	6-32 x 1/8 Set Screw - S/S
11	ACV-C10-17	Needle Holder/Adjuster Assembly
12	ACV-Z01-57	3/8-16 x 1/4" Cup Point Set Screw
13	MS21042-08	MS Hex Nut
14	ACV-C0*x*-04	Intake Bell
15	ACV-Z01-54	8-32 x 1/4" Patched SHCS - S/S
16	AZUSA-2361	Azusa Wire Swivel Nut and Screw
17	ACV-Z01-55	8-32 x 1/2" Patched Cap Screw
18	ACV-C10-01	Mixture Adjustment Arm
19	ACV-C10-06	Mixture / Fuel Shaft
20	ACV-Z01-51	Viton O-Ring (#010)
21	ACV-Z01-77	Close-out Screw, 1/16 NPT
22	ACV-Z01-66	8-32 Jam Nut
23	ACV-Z01-65	8-32 x 3/4" Socket Head Cap Screw
24	ACV-Z01-60	Plug, Black Plastic
25	ACV-T01-28	5/16-24 Jam Nut (AN316-5)
26	ACV-Q01-23	Patched Socket Set Screw
27	ACV-Q01-21	Cable Retainer

MANUAL REVISIONS

Rev.	Date	Page	Change
A	04/08/10	7	Added photos of reversing throttle quadrant connected to the AeroInjector.
B	04/27/11	27	Key 1, ACV-Z01-78, 8-32 x 1-3/8" SHCS, was ACV-Z01-53, 8-32 x 1-1/2" SHCS
C	06/21/12	27	Key 9, Changed part number to Stainless Steel Needles. Key 2, Corrected part numbers for Spigots.
D	03/15/13	2	Replaced P.O. Box with physical address.
	03/15/13	27	Deleted Individual part numbers for Needle Holder / Carrier Assembly.
E	08/05/15	27	Replaced "ACV" part numbers of standard hardware items with their common nomenclature.
F	03/19/21	8-9	Eliminated all throttle cable options but ACV-Q01-45, cylindrical end flexible cable. (This resulted in the elimination of three pages from the manual, causing page numbers from "Installing Mixture Cable" and after to advance three page numbers from previous manual.)
		10-11	Added "minimum" to 90-degree rotation call-out for mixture arm travel.
		13	Remove note to slide the air filter onto the intake bell until it stopped.

