

# Chapter 2 - Tank & Cabin Fuel System Installation

The tasks outlined in this section can be accomplished prior to the arrival of your motor. The airframe must be outfitted with an additional fuel line for returning unused fuel to the tanks. Thus, each tank will have a supply, return, and vent line. An Andair six-port "duplex" selector valve is required. This valve is available from Eggenfellner Aircraft. The duplex valve assures that fuel is always supplied and returned to the selected tank. The Andair valve can be fitted into the existing valve location. The fuel lines must be bent in fairly tight radius to mate with the valve. The AN fittings must be threaded into the valve ports prior to installing the valve ports to the valve body with the supplied screws. Orient the fittings to allow the lines to mate with the fittings. Use an appropriate *paste type thread sealant* such as "Tightseal" available from Aircraft Spruce on NPT pipe thread fittings (use nothing under flared fittings or nuts). Avoid using Teflon thread tape. More than one accident (none involving our engine) has been related to small pieces of thread tape plugging up fuel systems. Flared fittings install dry with no sealant. Despite the instructions that come with your *Andair* valve, we suggest that you use blue LocTite thread locker rather than "spiking" the screws. This allows you to remove the fittings if you ever need to rework a line.

**Supply Line:** 3/8" tubing supplied with your kit.

**Vent Line:** 1/4" tubing supplied with your kit.

**Return Line:** 5/16" tubing you must purchase (12' - Aircraft Spruce p/n 03-39400)

**NOTE:** 5/16" tubing and AN #5 fittings are uncommon sizes in aircraft, but they are available from Wicks, Aircraft Spruce or other quality parts supplier. URL Reference: [www.wicksaircraft.com](http://www.wicksaircraft.com) or [www.aircraftspruce.com](http://www.aircraftspruce.com). This size tubing is very common in automotive installations. Some builders have chosen to use 3/8" return lines with AN #6 fittings. This is acceptable, although routing and bending these larger tubes is more difficult. Note also that Eggenfellner Aircraft only stocks these valves with the 5/16" fittings. Beware of using common brass fittings. Brass fittings and cheap AN style fittings have a variety of internal diameters. Brass elbows in particular are notorious for being restrictive. Ideally, your fittings should be 0.19" or greater inside diameter as shown below (0.22"). It is acceptable to drill out fittings if you use care and common sense. It is even better to use the right fittings to begin with! Aircraft Spruce sells 3003-0 "Versatube". This is coiled aluminum tubing that is much easier to install than the 5052-0 rigid tubing, particularly if you need to make tight bends.



***Refer to the parts list page and drawings for a full list of required fittings and lines.***

1. [ ] Note the starting time.
2. [ ] Install the 5/16" in-tank return line and fittings. An AN832-5D bulkhead fitting is used to connect the in-tank line to the tank end cover. Optionally, you may locate this fitting on the tank rib near the vent line fitting if desired. Be certain to avoid interference with fuel quantity senders and verify that the fitting will have room to mate to its counterpart on the side of the fuselage. Be aware of the location of the landing gear web and other fuselage fixtures before choosing your location. The specified location in the tank end lid is known to have ample clearance. On our factory RV-6A we were able to place the return fitting at the lower aft corner of the tank with a straight tube out into the second tank bay.

The in-tank segment of line is intended to return the fuel to a point just beyond the second rib of the tank. If you are using Vans capacitive fuel quantity senders, be sure to avoid contacting the capacitive plates with the return line. With float-type senders, bend the tube as needed to avoid interference with the float mechanism.

Fuel should be returned to a low point near the rear wall of the tank beyond the second tank rib. This assures that the warm fuel returning to the tanks will have a chance to mix with the cold fuel and disperse any bubbles. Keeping the return line below the level of the fuel in the tank will also help to prevent foaming.

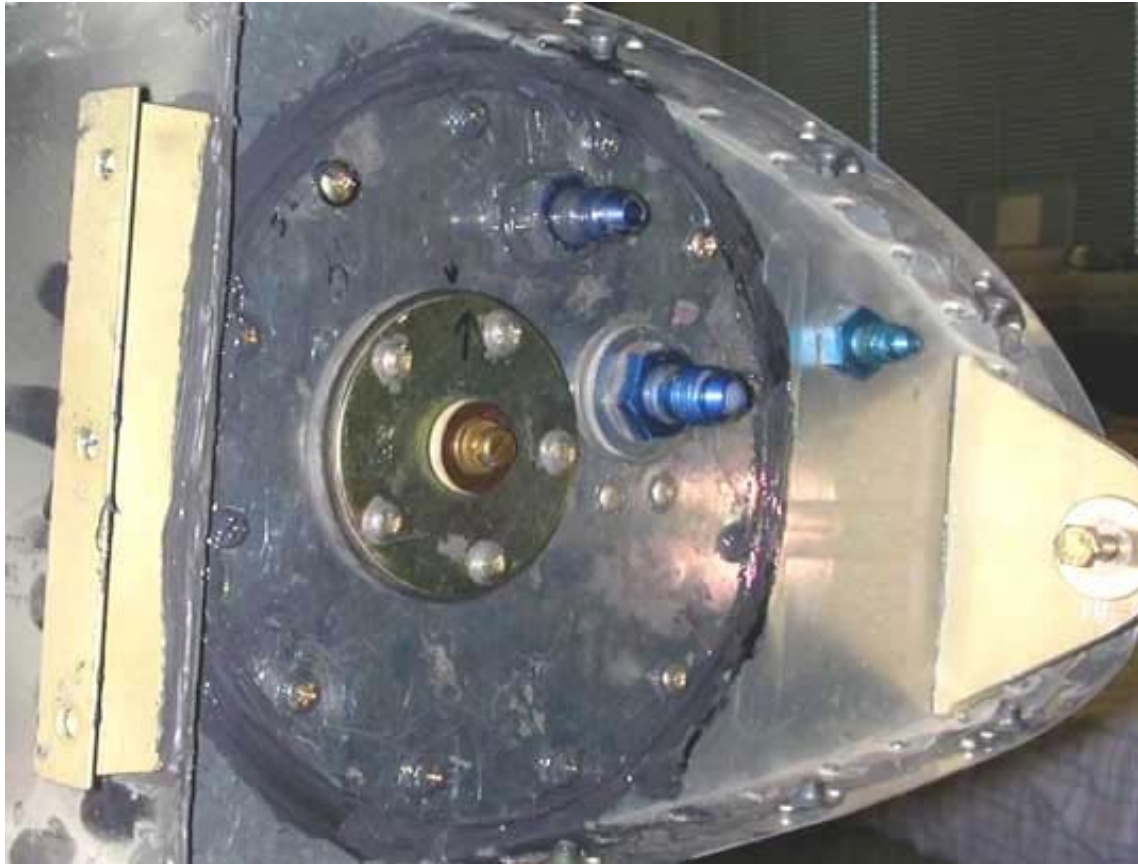
By orienting the return tube near the rear wall of the tank, the tube will be unable to rotate and become loose. A small amount of ProSeal around the fitting nut will help to prevent tube rotation inside the tank. A snap bushing, drilled for 5/16" tubing, can be used in the second bay rib to prevent tube vibration. If you are using the capacitive fuel quantity senders you should never have a need to open the tank end plate again, so you might consider a dab of ProSeal rather than snap-bushings to prevent vibration. The same applies if you position the return fitting on the tank rib itself rather than the tank end plate.

[Diagram of EFI Fuel Return System - Tank Fitting and Tube \(492KB PDF File\)](#)

Photo of Tank Fitting and Tube with Float-Type senders.



3. [ ] Seal the tank cover plates with ProSeal and new cork gaskets. Van's catalog lists them if you need a new set. Note that many builders have reported leaks in their cork gaskets over the years. A general trend is to omit the gaskets entirely, in favor of straight ProSeal. This decision is yours to make.



4. [ ] Install the Andair (p/n FS-20-20-D2) six-port duplex fuel selector valve. Note that the three snap bushings are used for, top to bottom, the supply lines, return lines and brake lines. The tight radius bend at the valve can be made with a conventional hand tubing bender. A "Rigid Model 456" bender (\$20 from Home Depot) was used for this installation.

To make the tight bends, thread the fuel lines in from the side of the fuselage toward the valve so that the tubing passes the valve by about 12". Next, insert the fitting nut and sleeve and make the end flare using a RoloFlare or similar **37-degree** flaring tool. (BEWARE THAT MANY AUTOMOTIVE AND PLUMBING FLARING TOOLS ARE 45-DEGREE FLARES!). Once the flare is done, insert the tube into the bender as close to the end fitting as possible and make the bend in a single smooth motion. Don't hesitate to scrap a bend if it contains dents or other defects. Tubing is cheap. Just pull some more length through and try again until you get good bends. When all the lines are properly bent and tightened, you should be able to wiggle the valve body slightly to verify that no undue stresses exist in the line installation. It is important that the lines are not under mechanical stress, otherwise cracks and leaks can develop over time.

Be sure to clean each line with a blast of air to remove any metal filings. **DO NOT BLOW AIR THROUGH THE FLOW SENSORS, PUMPS, OR VALVE!**



[Diagram of EFI Fuel System Components and Plumbing \(718KB PDF File\)](#)

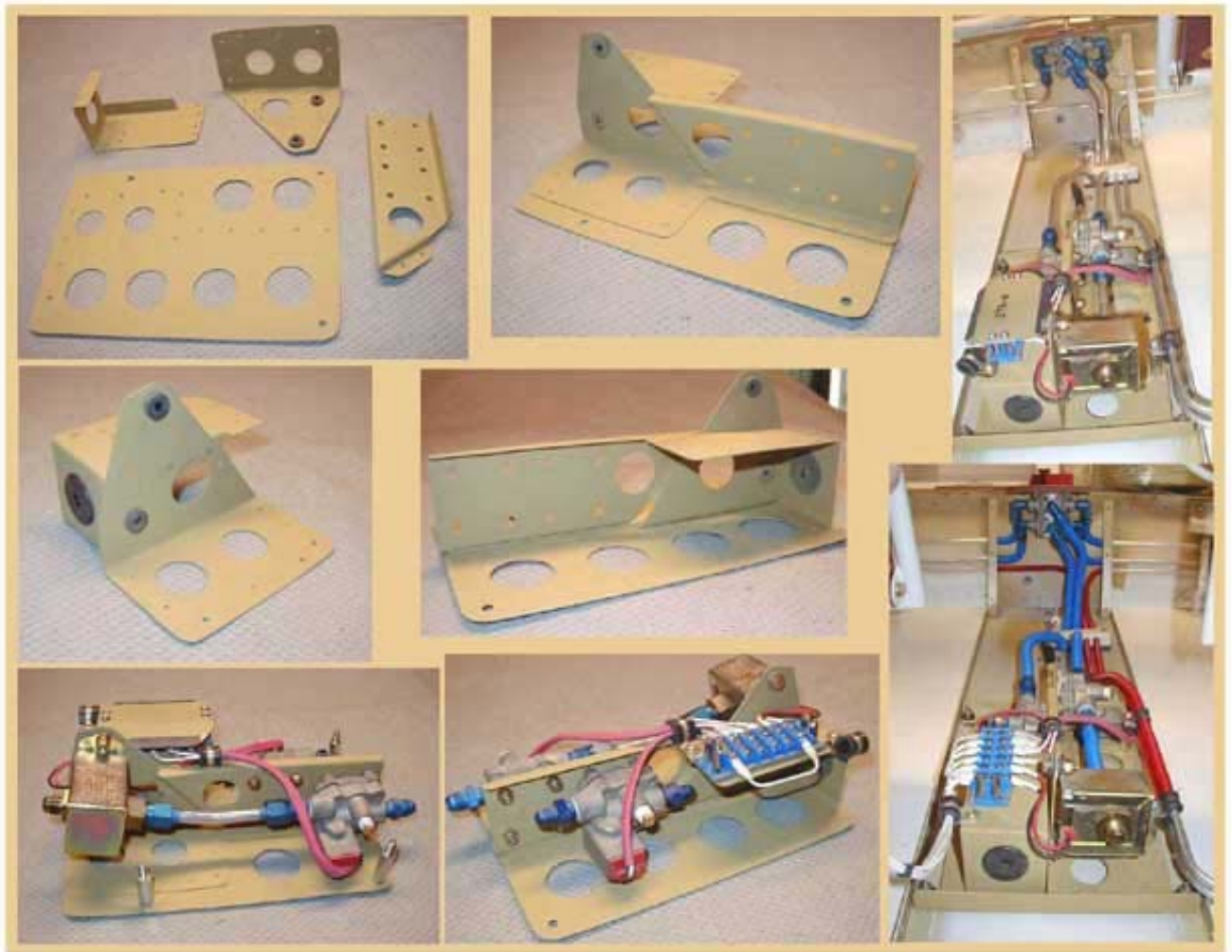
5. [ ] If you are using the optional flow sensors, you should install them inside the center cabin floor panel. Flow sensors are sensitive devices that are prone to erroneous indications if they are subject to extreme vibration, temperature, or turbulent fuel flow. Ideally, they should be mounted in a level section of straight tubing, away from heat and vibration sources. Unfortunately, Vans center console panel is only an inch tall, so if you choose to mount the large type FloScan sensors under the center panel, you will need to add aluminum strips along the sides to raise the panel. Optionally, you can fabricate your own custom center console out of aluminum or fiberglass. This is a good place for builders to express their own creativity. If you order the small type flow sensors from Grand Rapids (as used with the EIS), these will fit under the factory center cabin floor panel without modification.

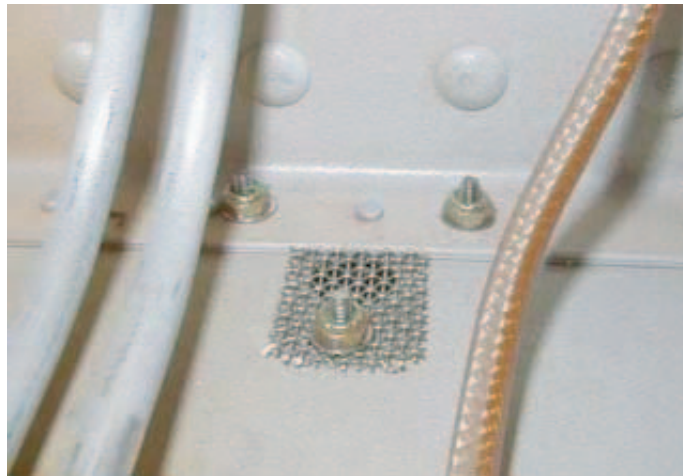
Install the supply and return lines between the optional flow sensors and selector valve. Pay attention to the orientation and direction of flow for the flow sensors. The arrow on the supply side tube will point toward the motor, whereas the arrow on the return side will point toward the selector valve. Flow sensors also have a correct "UP" side. Retain the paper calibration cards that come with your flow sensors. If you are using any sort of programmable indicators, you may need these numbers for calibration.

FloScan flow sensors come in two sizes. The larger type (p/n 264PB-15) uses 1/4" NPT fittings. The 3/8" supply line uses AN816-6D nipples which are available with 1/4" NPT thread. For the return line which uses AN816-5D fittings, you will need to install reducer bushings to adapt to your line fittings. Note that MRP and Earls Performance Parts make an AN#5 to 1/4 NPT adapter fitting if you would like to avoid using separate reducer bushings. If you are using the EIS engine monitoring system, it will come with the smaller type of flow sensors which also use 1/4" NPT fittings.

## *Customization*

The photo below shows one example of a cabin fuel system which places both supply and return flow sensors in the center console. This particular installation uses the optional Facett low-pressure priming pump. This pump is no longer required on new installations. A homemade bracket mounts everything on rubber cushions to reduce vibration and noise. Note that the Facett pump must be mounted on an angle with the outlet fitting higher than the inlet fitting. The finished cabin plumbing is protected with PVC wrapping and a custom fiberglass console and access lid (not shown). It is not necessary to do it this same way. Note in the photo that this builder has added a small screen-covered drain hole and air vent towards the rear of the console to allow fuel to drain away if a leak should ever occur.





6.  Install the supply line between the optional forward flow sensor and optional primer pump or gascolator. Testing has shown that the high-pressure EFI fuel pumps that come with your engine are capable of priming themselves under normal conditions. For this reason, the Facett low-pressure primer pump has been declared optional. If you intend to fly aerobatics where there is a high chance of un-porting a fuel tank pickup tube, you may choose to install the optional Facett primer pump, but keep in mind that it will present a slight pressure restriction during normal (Facett pump off) operation.

7.  Install the supply line to the bulkhead fitting on the firewall. The exact location of the supply line firewall fitting should be determined once the motor is mounted to the firewall and you have determined the location of the batteries and fuel pumps. The diagram provides a general guideline, but it is up to the builder to make the final decision as to its location.

8.  Install the return line between the optional return flow sensor and a bulkhead fitting. The diagram shows the desired location for this fitting in the upper right corner of the firewall.

9.  Clamp all fuel lines as needed using Adel clamps.

10.  The remaining fuel system connections on the engine side of the firewall, and all related wiring, will be described later.

11.  Note the ending time.