

INSTALLING SURGE TANKS ON VEHICLES WITH MODERN RETURNLESS FUEL SYSTEMS

OVERFLOW PORT

Most modern cars do not feature a return port on the fuel pump hanger since the regulator is internal to the tank and pressure is variably controlled using an electronic fuel pump control module. A surge tank has an overflow port that supplies fuel and any air picked up by the lift pump back to the tank. This is a necessity for a correctly functioning surge tank. So, these modern cars must have a port added to the tank somehow in order to return fuel and air.

Without this port the surge tank will be pressurized by the lift pump and will then be pushing fuel through the surge pump. Air picked up by the lift pump will have no escape other than through the surge pump and into the engine, which will eliminate the function of the surge tank entirely. This can also have adverse affects on the health and lifespan of lift and surge pumps and impact final fuel pressure at the engine in an unpredictable manner.

It is absolutely critical that the overflow port cannot be plugged on the surge tank, and this step cannot be skipped in any installation.

The two most common methods to add this port are:

1. Bulkhead fitting into the OEM pump hanger. This involves drilling a hole into the pump hanger top and installing a bulkhead fitting into the drilled hole. The internal side must have a return hose installed to push fuel into the bottom to avoid aeration. The fitting below with nylon washers to seal are a common type used.



2. Tee fitting into the fuel tank filler neck. This method cuts into the filler neck and installs a tee'd fitting inline to allow a 6AN fitting to be installed. For this method we do offer tee fittings for two hose sizes: 1.25" and 1.75". They incorporate a $\frac{1}{4}$ " NPT port to install a fitting for the overflow hose.

<https://www.radiumauto.com/Barbed-Hose-Adapters-with-14-NPT-Port-P834.aspx>

Below are some images showing installation on a sample vehicle.



VENTURI JET PUMP FUNCTION

Vehicles with saddle style tanks use a venturi jet pump system to siphon fuel from the passive saddle (no electric pump) to the active saddle where the fuel pump is located. Many modern vehicles power this venturi by borrowing fuel flow from the fuel pump on the pressurized side of the fuel system.

When a surge tank and overflow port are added, the pump in the main tank becomes the lift pump. The fuel flow from the main tank into the surge tank now flows back into the main tank is no longer pressurized. Because the jet pump has a small orifice that fuel flows through to create the siphon effect, pressure is required to function. Since the path through the supply line and overflow line is the path of least resistance, the venturi jet pump will not function.

To counteract this, there are three potential solutions:

1. **Orifice restrictor**

In single pump surge tanks, you can remove the 6AN fitting where you connect your supply line and replace it with an orifice fitting. This will restrict flow into the surge tank without pressurizing the surge tank and will build pressure in the main tank allowing the jet pump to see flow, and function properly.

This will have limitations on how much fuel flow can be supported. Because of the orifice size required, you will not see more than about 200lph entering the surge tank through that fitting regardless of how large the lift pump is. Because your lift pump needs to be roughly 40-50% of the flow rate of the surge tank pump, this method will only support single pump surge tanks.

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2. Pressure regulator restriction

This method involves installing an additional fuel pressure regulator to pressurize the lift pump side. The surge tank to engine side would still have its normal fuel pressure regulator for setting the standard pressure for the engine's requirements. But a second fuel pressure regulator would be installed inline on the supply line to the surge tank. The output of the lift pump would plumb to the FPR's high-pressure port and the FPR return port would plumb to the supply port of the surge tank. The pressure on this regulator should be adjusted only high enough to get the jet pump to function, which will require some experimentation. This ensures that the maximum amount of bypassed fuel flow that the jet pump does not consume will bypass through the return port and into the surge tank. This method will allow more fuel to be bypassed as the lift pump capacity is increased, allowing the use of multiple surge tank pumps. This method can be used on any FST.



This is an example of a DMR attached to the supply port of the MPFST.

3. Conversion to return style jet pump

This method is much more advanced and would take extensive customization, but completely removes any limitations from the supply line from the lift pump. We cannot offer any specifics or guidance on how to go about it on any vehicle. To do this the overflow line would have to be plumbed through method 1 in the overflow port section; a return bulkhead fitting. Under this return port, a universal jet pump would need to be installed and the siphon hose that reaches to the passive side of the tank would need to be removed from the stock jet pump and attached to the universal jet pump. Below is an image of a Radium universal jet pump and the plumbing diagram for a return port jet pump.

