INSTALLATION INSTRUCTIONS
20-049X-XX FUEL CELL SURGE TANK

Document: 19-0200
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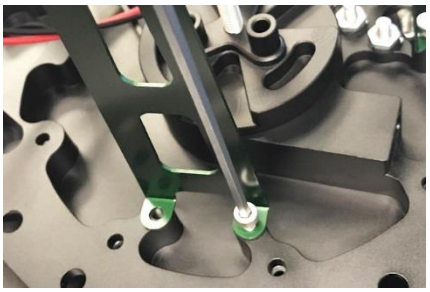
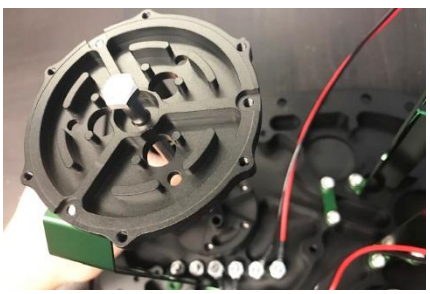
The RADIUM Engineering Fuel Cell Surge Tank (FCST) flange is compatible specifically for fuel cells that utilize a 6-inch x 10-inch (24-bolt) fill plate.

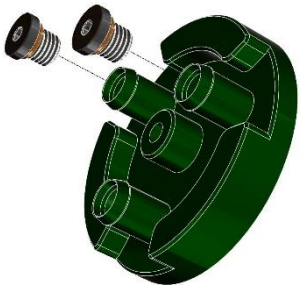
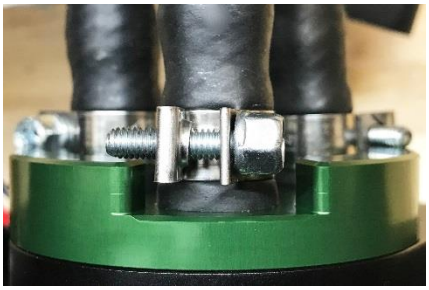
CAUTION

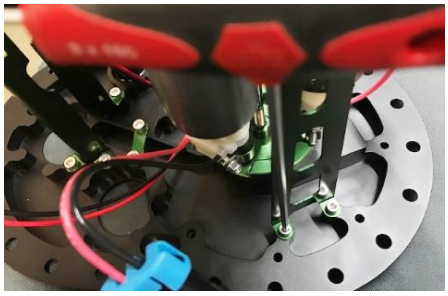
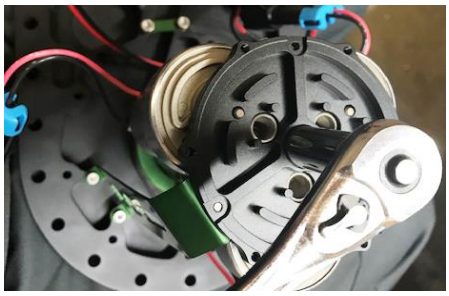
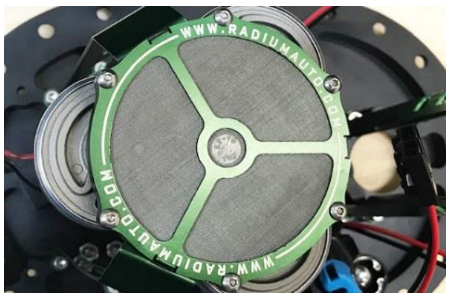
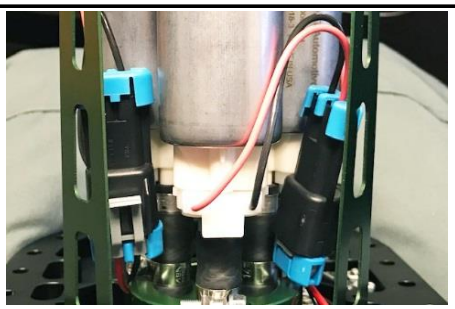
Only a qualified technician following applicable safety procedures should perform the installation of this product.
One must have knowledge in repair and modification of fuel systems and general vehicle modifications to install this product.
Gasoline and other fuels are flammable and can be explosive.
Only install in a well-ventilated location to minimize buildup of fuel vapors.
No sparks, open flames, smoking or other ignition sources are to be present. Draining and removal of all fuel from the fuel system is recommended.
Proper eye and personal protection is required at all times during installation.

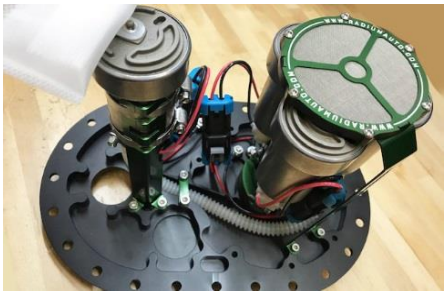
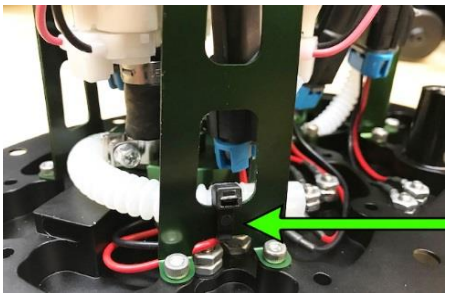
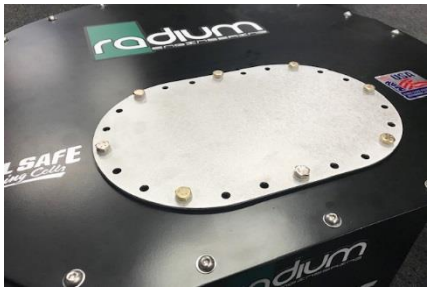
WARNING

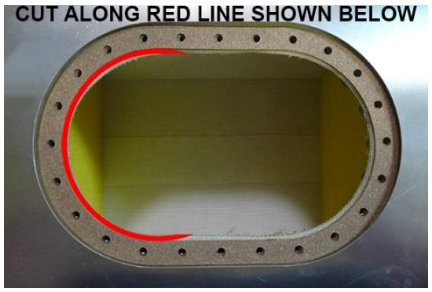
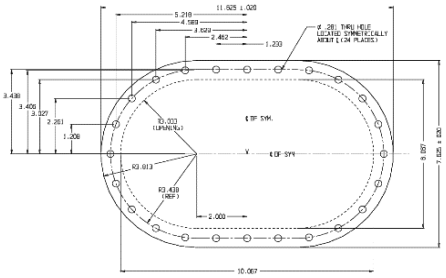
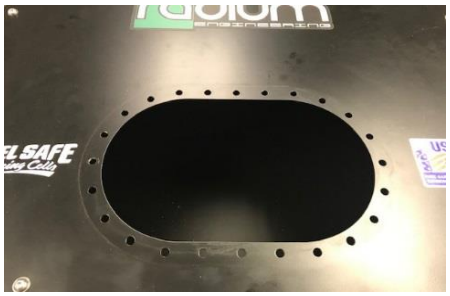
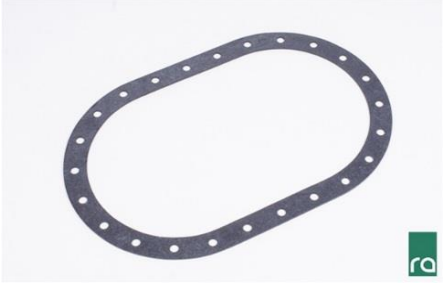
The fuel system is under pressure! Do not loosen any connections until relieving the fuel system pressure.
Consult a service manual for instructions on relieving fuel pressure safely. This product is designed for off-highway and racing use only.
Fuel system components may not be legal for sale or use on emissions controlled motor vehicles. Consult local, state, and federal laws.

STEP	TOOLS NEEDED	INSTRUCTIONS	PHOTO
1		**Read and understand these instructions before beginning the work.** If the FCST was purchased with fuel pumps included, the FCST will be delivered ready to be installed into the fuel cell. Start reading at step 22. If the FCST was purchased with "no fuel pumps included" (as shown), assembly is required. Start reading at step 2.	
2	3mm Allen Wrench	**<u>Assembly for "Pumps Not Included"</u>** NOTES: 1. Purchase the appropriate fuel pumps as the provided components and the following assembly procedure are specific to the pumps. 2. Only the "lift" pump will require a fuel pump inlet filter sock. The FCST will be partially assembled. To remove the fuel surge tank (FST) canister, remove the eight M5 bolts on the top plate. Note that there are O-rings (shown) underneath these bolts. Even though they will likely remain pressed into the counterbores, be careful not to lose them.	
3	3mm Allen Wrench	Unscrew the four M4 bolts that secure the fuel pump cradle support brackets to the underside of the FCST fill plate.	
4		Move the 2 support brackets down and unscrew the long center bolt (shown). Temporarily place the fuel pump cradle assembly to the side.	

5	3/8" Socket Wrench	Determine how many FST pumps will be installed. Attach the corresponding number of fuel pump connectors to the electrical wiring studs (shown). NOTE: Red wires are positive (+) and black wires are negative (-). Reference the top of the FCST fill plate.	
6	Oil Lubrication	Follow this step only if installing 1 or 2 **Walbro F90000267 / F90000274 / F90000285** FST pumps. The triple pump collector must be green color. Block-off the unused port(s) on the underside of the triple pump block using the included 2AN ORB plug fitting(s). Lubricate the O-ring(s). -If installing 1 FST pump, use 2 plugs (shown). -If installing 2 FST pumps, use 1 plug. -If installing 3 FST pumps, do NOT install any plugs. Any of the 3 ports can be used as they share the same external outlet.	
7	4mm Allen Wrench Oil Lubrication 1/8" Allen Wrench	Follow this step only if installing 1 or 2 **Walbro GSS342 or AEM 50-1000 or AEM 50-1200** FST pumps. The triple pump collector must be black. Remove the 6 fill plate bolts that secure the triple pump block collector. Install the included 2AN ORB plug(s) to any of the 3 threaded holes. -If installing 1 FST pump, use 2 plugs (shown). -If installing 2 FST pumps, use 1 plug. -If installing 3 FST pumps, do NOT install any plugs. Properly seat the gasket and reinstall all pieces. NOTE: The 6-bolt flange cannot be improperly orientated as the bolt spacing is not symmetrical.	
8	Hose Cutter	Verify that the provided submersible hoses are properly cut to length for each FST pump. **Fuel Pump Hose Lengths** Walbro F90000267 E85 1.73" (44mm) long sections Walbro F90000274 E85 1.73" (44mm) long sections Walbro F90000285 E85 1.73" (44mm) long sections Walbro GSS342 255LPH 1.73" (44mm) long sections AEM 50-1000 Gas 1.65" (42mm) long sections AEM 50-1200 E85 1.65" (42mm) long sections	
9	Pinch Clamp Pliers	Install the submersible hose onto each fuel pump outlet. Slide 1 of the provided pinch clamps over each fuel pump hose. Use pinch clamp pliers (shown in blue) to cinch the clamp(s). However, a standard pair of diagonal cutters (shown in red) can also be used. It is recommended to make the crimp on the connector side of the pump, as shown. This will make serviceability easier if they ever need to be removed. It will also allow the necessary clearance for the long M6 bolt when reinstalling the fuel pump cradle.	
10	Phillips Screwdriver	Slide the provided screw-driven EFI clamp(s) over each fuel pump hose. One by one, install each fuel pump hose onto the barbs on the underside of the triple pump block. Rotate each pump so the wire connectors are facing outwards. As shown, make sure the clamp(s) do not interfere with the triple pump block. Use a Phillips head screwdriver to tighten the clamps. NOTE: If using less than 3 fuel pumps, ensure a fuel pump is not accidentally installed into a plugged port.	

11	Threadlocker	Apply a medium strength threadlocker to the end of the long M6 bolt. Insert this bolt through the fuel pump cradle and down into the triple pump collector. Hand tighten.	
12	3mm Allen Wrench	Reinstall and tighten the 4 fuel pump cradle bracket bolts.	
13	10mm Socket	Screw in the long M6 bolt until the head touches the retaining plate. Once contact is made, add one revolution to snug down the bolt.	
14	2mm Allen Wrench Threadlocker	Make sure the stainless mesh screen is preinstalled to the green filter mount. If not, there are 3 tabs that the mesh screen simply slips into. Place the green filter mount onto the black fuel pump cradle. Rotate the green filter mount so the 3 tabs (not shown) fall in place. Apply a medium-strength thread locker to each of the provided 6 small screws and secure, as shown.	
15		Plug in the fuel pump connector(s). For Walbro F90000267 / F90000274 / F90000285 fuel pumps (shown), lubricate the orange connector seal(s) prior to connecting. Do not reinstall the FST canister yet.	
16	Heat Gun 9/32" Socket Wrench	To prepare the lift pump, push the provided convoluted tubing to the fuel pump outlet barb. Depending on the fuel pump, it may be necessary to soften the tube material slightly with a heat gun or hot water. Secure with the included EFI hose clamp using a 9/32” nut driver or Phillips screw driver. Install the fuel sock filter to the lift pump.	

17	4mm Allen Wrench	Unscrew the two M5 bolts to remove the convoluted tubing hold down bracket shown.	
18	1/4" Nut Driver Flathead Screwdriver	Dislodge the worm drive hose clamps. As shown in the following picture, insert the lift pump in between the 2 mounting posts with the convoluted tube curved towards the FST pumps. The tube should sit into the machined channel. Rotate the lift pump for the largest tubing bend radius possible to prevent kinking. Align the hose clamps with 2 of the 3 slots in the posts. Tip: To make thread engagement easier, give the worm drive tails a slight bend inwards as shown. Do not tighten the clamps just yet.	
19	1/4" Nut Driver Flathead Screwdriver 4mm Allen Wrench	Measure the depth from the FCST flange to the fuel cell bottom and adjust the depth of the lift pump. Test fit for proper height. Next, reinstall the hold down bracket removed in step 17 and tighten the worm drive hose clamps to secure the lift pump in place. NOTES: 1. Allow some convoluted hose slack to prevent lift pump tension. 2. To prevent restriction and allow room for the lift pump filter sock, space is required between the pump inlet and the fuel cell floor. 3. For extremely shallow cells, the posts may need to be cut shorter. 4. For cells deeper than 9.5", use Radium P/N 20-0214 (sold separately).	
20		Wrap the convoluted tubing around the pumps tangentially. This will help prevent potential fuel agitation in the surge tank. Tip: Where the convoluted tubing ends will depend on the depth of the fuel cell. A cable zip-tie can secure the convoluted tubing in place. Plug in the lift pump connector. For Walbro F90000267 / F90000274 / F90000285 fuel pumps (shown), lubricate the orange connector seal(s) prior to connecting.	
21	3mm Allen Wrench Torque Wrench	Slide the canister over the FST pump(s) and line up the 8 holes. Reinstall the screws from step 2 and tighten to 25 in-lbs. in an alternating cross pattern. Do not overtighten the screws as this can damage the O-rings. The assembly is now complete and the unit is now ready for installation into the fuel cell.	
22	7/16" Socket Wrench	**<u>Installing the FCST into the fuel cell:</u>** Make sure all ancillary components are installed to the Radium fill plate, i.e.: fuel fill neck, fuel level sensor, etc. If needed, remove the current fill plate from the fuel cell. Discard the 24 bolts, fill plate, and gasket. NOTE: Depending on the fuel cell bladder type, the 24-bolt nut ring may or may not be glued to the underside of the bladder.	

23		Test fit the FCST into the fuel cell. Because the diameter of the FST canister is 6", some minor trimming of the fuel cell bladder opening may be required (as pictured). Reconfirm that the lift pump is positioned at an optimal height and adjust if necessary. While test fitting, pay close attention to the arrangement of the foam inside the fuel cell (if equipped). Trim the foam to fit around the FCST components, as necessary.	
24		There are a couple different 24-bolt flange patterns on the market. The Radium FCST pattern (pictured) was designed to mimic nut rings found on the most common and popular fuel cells. Although uncommon, up to 4 holes in the FCST may need to be enlarged in order to be compatible with other fuel cell manufacturer's nut rings. NOTE: Depending on the fuel cell type, it may be easier to remove the fuel cell's top outer shell and install the FCST to the bladder first.	
25		There are 2 different types of fuel cell outer shell cans (new and old). Pictured is a "newer" style that all Radium Engineering fuel cells use. If the can has 24 holes in the outer shell, you have a "new" version. With this style, the 24 bolt gasket sits on top of the outer shell can. The "new" style outer shell cans do NOT require the provided 2-piece mounting tabs (shown in step 27). The "new" style outer shell can only requires 24 of the included nylon washers. Depending on the type of fuel cell and the bladder thickness, most "new" style cans use 12 of the 3/4" long bolts and 12 of the 7/8" long bolts provided with the FCST.	
26		Many of the other fuel cell manufacturers still use the "older" style of outer shell can (shown). With this style, the 24 bolt gasket sits directly onto the bladder (not shown). Because the 24 bolts do not directly interface with the outer shell can, the 2 mounting tabs (shown in the following step) must be used with all 36 nylon washers. Depending on the type of fuel cell and the bladder thickness, most "old" style cans will use 24 of the 3/4" long bolts provided with the FCST.	
27	5/32" Allen Wrench Torque Wrench	For the outer shell cans that use the "older" style, first place the gasket down onto the bladder, than install the FCST assembly. Next, place 24 of the nylon washers onto the FCST fill plate mounting holes. Next, line-up the 2-piece mounting plates to the FCST fill plate without disturbing the 12 nylon washers underneath. Place the last 12 nylon washers on top of the 12 mounting plate holes. Using the included 3/4" long bolts, torque to 65 in-lbs. NOTE: if your nut-ring uses stainless steel nut inserts, apply anti-seize to the stainless steel bolt threads to prevent galling.	
28	5/32" Allen Wrench Torque Wrench	For the outer shell cans that use the "newer" style, first place the gasket (shown) down onto the outer shell can, than install the FCST assembly. Next, place 24 of the nylon washers under the heads of twelve 3/4" long bolts and twelve 7/8" long bolts. Insert all 24 bolts into their respective holes and torque to 65 in-lbs in an alternating cross pattern. NOTE: if your nut-ring uses stainless steel nut inserts, apply anti-seize to the stainless steel bolt threads to prevent galling.	

29	Wire Terminal Crimper 3/8" Socket Heat Gun	Terminate the pump power wires (not included) with the ring terminals supplied in the kit. Apply the shrink tube to the terminals to prevent shorting of the wires to the plate. Secure the ring terminals to the studs on the FCST using the included plastic acorn nuts. Do NOT overtighten as the threads can strip out. If a nut is ever stripped, it can be substituted with a standard #10-32 steel nut.	
30		Fuel pump controlling is left up to the installer. However, the lift pump and at least 1 of the FST pumps should use the (priming/safety) fuel pump output strategy from the engine control unit. Optionally, an adjustable pressure switch, such as Radium Engineering P/N: 20-0236 (shown), can trigger the secondary pump(s) based on intake manifold pressure.	
31		**Important steps to properly route the vent line:** 1. From the fuel cell, the hose must first run upwards allowing any fuel captured in the vent line to drain back down into the cell. 2. After ascending vertically, the line should briefly route towards the front of the vehicle to prevent fuel from sloshing out. 3. Vertical loops should be added to act as a "make-shift" expansion chamber and allow air to escape and any fuel to drop to the bottom of the loops. 4. Depending on the application, the overall vertical height of the vent hose should be at least 12".	
32		**continued...** 5. For remote fuel fill applications, the vertical loops must be higher than the fill point. 6. The vent hose should terminate below and behind the fuel cell outside of the cabin away from the exhaust system. 7. Utilizing an expansion chamber that is larger than the vent hose diameter will further aid in preventing liquid fuel from escaping (Radium P/N: 20-0462 shown). *NOTE: There are vent kits available. (P/N: 20-0484-08 and 20-0484-12)*	
33		When fueling, don't top-off or overfill unless a vented fill cap is installed. Because the FST portion of the FCST must be primed before the engine will start, activate the lift pump for several seconds. Next, power up the fuel pumps and proceed to check system fuel pressure. Monitor all fittings and hoses for leaks and fix immediately if necessary. Check again for leaks after initial test drive. **Installation Complete**