

Atomic Fabrication and Performance

GM Truck 1999-2018 In-Tank Fuel Surge Tank

V1.0



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Purpose and Background Info

This product was designed with the intention of solving the biggest problem most guys encounter when they upgrade the fuel pump on their truck: fuel pump starvation from fuel sloshing. A surge tank is usually a separate fuel tank fed by the main tank with the sole purpose of keeping the main fuel pump and pump pickup completely submerged to prevent a disruption in fuel flow. If fuel flow is disrupted it will result in a loss of fuel pressure to the engine which can easily cause engine damage from a lean condition.

The AFP Surge Tank puts the surge tank inside of the main fuel tank so there is no need for external feed and return lines between the main and surge tanks. There is no modification necessary to the main fuel tank except for mounting the fuel level sensor (optional). This is compatible with the 04+ “returnless” fuel tanks that have the larger 5” opening. The 99-02/03 “return style” tanks have a smaller opening (~3”) and must be swapped out for a later tank for this to be installed. A compatible fuel tank is generally easy to find at any local salvage yard.

There are currently 3 versions of the AFP Surge Tank utilizing different fuel pump configurations. There is a dual pump version utilizing 2x Walbro 450 or 525 pumps, a triple pump version utilizing 3x Walbro 450 or 525 pumps, and a version for the Aeromotive in-tank brushless pumps. The versions with the Walbro pumps will include the pumps, however the Aeromotive version will not include the large pump, it will only include the tank and fill pump. Currently all versions utilize a Walbro 255 as the fill pump to keep the surge tank full. The compatible Aeromotive pumps are for their “universal” kit which means you have to trim the inlet tube yourself (only difference to the vehicle or cell specific kits). It will need to be trimmed to 4.25” in length.

Aeromotive Brushless Compatible Pumps				
Pump Size	3.5 GPM	5.0GPM	7.0GPM	10.0GPM
Standard Speed Part #	18374	18375	-	-
Variable Speed Part #	18394	18395	18384	18385

18395 is my pump recommendation for the Aeromotive pumps.

Surge Tank Design Overview

Overall Design

The AFP Surge Tank is made from 6061 aluminum and is compatible with all fuels. The surge tank is secured to the factory tank utilizing the stock tank Oring and top locking ring. All welds are TIG welded as needed. The top and bottom pieces are laser cut for the highest accuracy and best finish possible. The joining hardware is 304 stainless. For the dual and triple Walbro pump versions the pumps are suspended from the top via an aluminum rod and held in place by 2 laser cut holders and stainless clamps. The fuel hoses are corrugated plastic so there is no risk of leaks as with rubber (even the fancy 30R10 rated stuff) hose.

The pump outlets are joined to a single -8AN ORB (for dual pumps) or -10AN ORB (for triple pumps) outlet via a custom billet bulkhead fitting. The return fitting for all versions is a -8AN and has a elongated return tube to prevent aeration in the surge tank by excessive fuel splashing. The vent has both rollover and splash prevention features by using both an internal floating and sinking ball and has a -6AN connection at the top. In the event of a vehicle rollover or overfilling the tank the vent will be plugged to prevent fuel from spilling out.

Wiring

The fuel pumps are wired to electrically insulated ¼-20 stainless bolts attached to the top of the surge tank. These bolts are secured to the top of the surge tank with locking nuts and are meant to be used with ring terminals for the main wiring from the truck power source.

There will be 3 studs in total with different color locking nuts to differentiate their use. The BLACK nut will be the ground to be wired to the nearby frame or directly to the “-“ on the battery. The SILVER nut will be for the primary pump (the one that will always be running) power (battery “+”) and will also power the surge tank fill pump. The GOLD nut will be the secondary pump(s) that should be activated from an external trigger. Typically, this will be a signal from a boost controller, aftermarket ECU, or hobbs switch, or TPS window switch. It is not recommended to run all pumps all the time as this will cause excessive electrical load and fuel heating and may make idle fuel pressure unstable.



Figure 1: AFP Surge Tanks, Assembled

A separate universal wiring harness will be offered with high quality relays, wiring terminals, and 8ga pump wiring.

Fuel Level Sensor

In order to maximize the surge tank volume the fuel level sensor will



Figure 2: Fuel Level Sensor

need to be mounted separately from the surge tank. A separate fuel level sensor assembly is included (float also included but not shown) and utilizes a stock 40-250ohm sensor from a 2005 and later truck. It is directly compatible with a stock fuel level gauge or any programmable aftermarket ECU. If you have a 99-03 "return style" truck with the factory gauge cluster then for the sensor to read correctly it will either need to be flipped on the holder so it is upside down, or the tables in the ECU will need to be reversed. Connection is similar to the fuel pumps using electrically insulated studs and ring terminals with locking nuts. Polarity is not important in the connection.

Mounting location will need to be towards the driveshaft side of the tank with enough room for the float to move freely. The studs are 1/4" diameter and 3/4" apart for the holes that need to be drilled for installation. The float should be positioned such that the arm moves across the

tank from left to right as shown below (it is perpendicular to the mounting bolts). There are multiple sensor mounting hole locations so it can be adjusted up or down on the mount if needed. For reference there is approximately 2" of fuel left when the low fuel light comes on.



Figure 3: Surge Tank and Level Sensor Installed

Wiring Harness

Optional with the surge tank will be a wiring harness with appropriately sized 8ga wiring for the ground and power leads to the pumps. In the case of the triple walbro 525 setup, the combined current from all pumps at 80psi is close to 70amps! This is not insignificant. The wiring kit will contain 2x 75amp or 80amp relays along with 3x 15ft runs of 8ga GXL wiring (red, orange, and black). GXL wiring has a thicker coating than the common TXL wire used mainly for ECUs. The ground should be run directly to a clean spot on the frame and secured with a bolt or self-tapping screw, or directly to the negative post on the battery works well also. If you are grounding to the frame by the tank you could easily make 2x runs from the top bulkhead to the frame. May as well. There will also be 3x 15ft (black, yellow, and pink) runs of 18ga wire for activation of the relay.

Installation Notes

The installation will be relatively straight forward with the only modification necessary being the two holes for the fuel level sensor. The surge tank itself is a direct drop in and is accomplished by first inserting the fill pump towards the rear of the truck then swinging the rest of the tank into place and letting it drop down. It should be aligned such that the fill pump is toward the rear of the truck and/or the return fitting is towards the front (the large -8AN fitting on top). The factory large o-ring is installed between the surge tank hat and the tank and the surge tank is secured by the factory lock ring which may need to be tapped into place with a rubber mallet.

The vent line should be run to a filter/breather at least 6" above the tank level, preferably to above the fuel fill port on the bed side. There should also be a loop in the line to prevent any vapor smell. If your truck still uses a tank pressure sensor, you can tee it into this line.

FIRST START: On first startup the surge tank will need to be primed before you attempt to start the engine. This can be accomplished by either filling the tank via the return fitting with 1/2 gallon of fuel, or you can power the main/fill pump for 30 seconds to let it fill with fuel to submerge the pumps.

Walbro Dual/Triple Surge Tank

The connectors at top of the surge tank consist of the following:

- 8AN (male) return line
- 6AN (male) vent line
- 10AN ORB (triple) or -8AN ORB (dual) pump feed line
- 1/4" power connectors (for dual and triple setups)
- #8 screw power connectors for Aeromotive compatible surge tank
- 1/4" fuel level sensor connectors
- #8 fuel pump power connectors for big Aeromotive setup

After following the steps above make sure the electrical connectors are all tightened between the locking nut and the cap nut. Use 2 wrenches (one on each nut) to ensure the bolt is not turned in the tank.

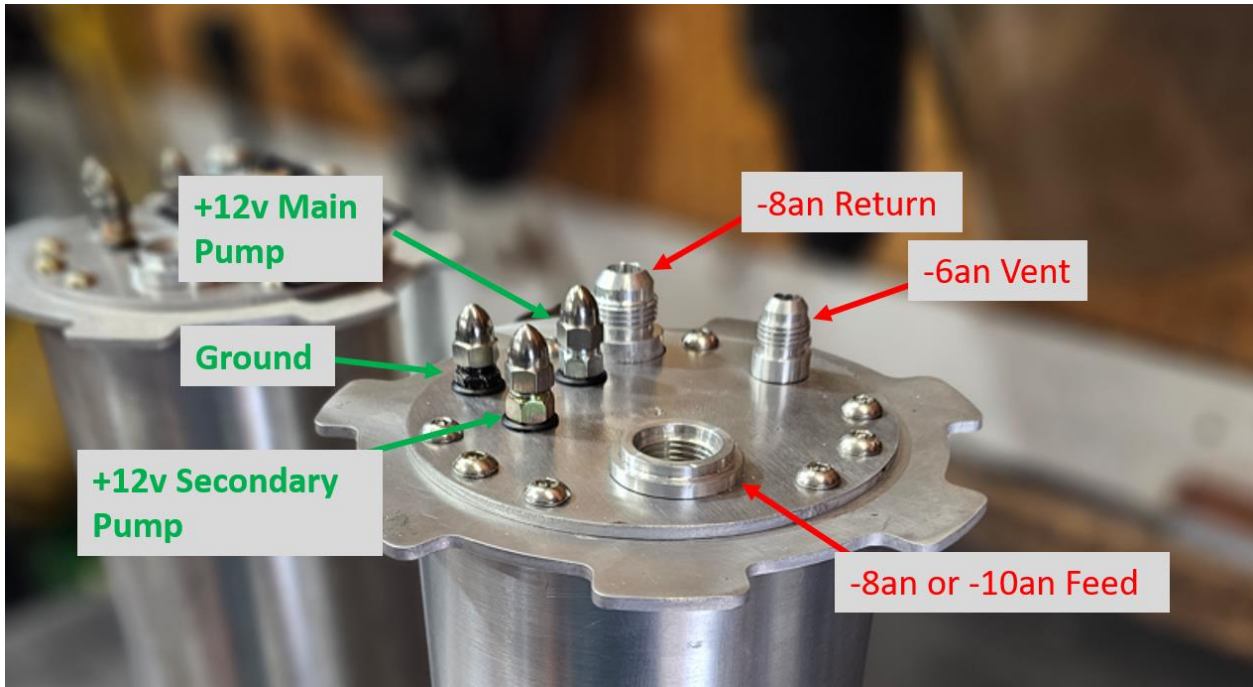


Figure 4: AFP Surge Tank for Walbro Pumps



Figure 5: Surge Tank Installed

Aeromotive Compatible Surge Tank

This version will include the external fill pump and aluminum tank, but will need the main pump supplied separately (I do not stock these currently). Refer to the chart on page 2 for part numbers. The fuel inlet tube will need to be trimmed to 4.25" in overall length to fit correctly.

When installing the pump retaining ring (black in the picture below) the gap should be faced towards the fuel return tube (see below). The pump inlet filter will be a tight fit, but the top is notched to allow the filter to pass through.

The electrical connectors for the fill pump is not pictured below, however they are similar to the Walbro version only smaller to accommodate the larger pump. They are connected to power in a similar way and should be set to always be powered with ignition power.

The tank will need to be installed with the external fill pump situated towards the rear of the vehicle. It is designed to swing in to the tank similar to the Walbro tank version. It may be snug but should not need to be forced.

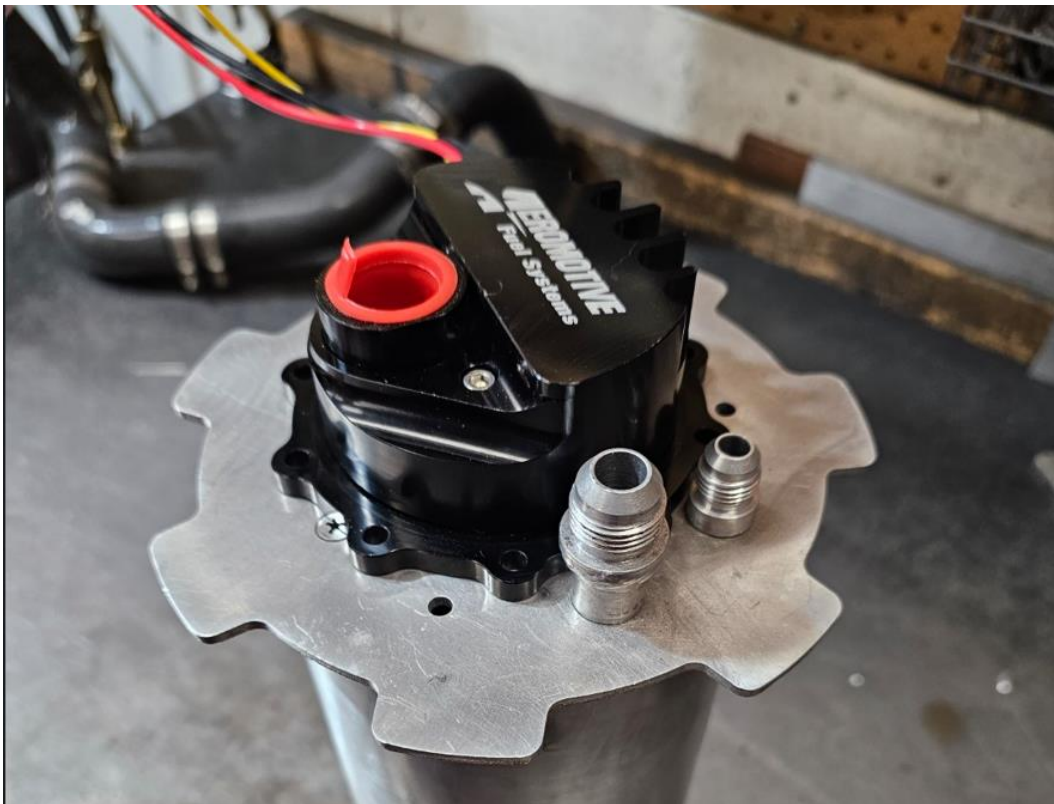


Figure 6: AFP Surge Tank with Aeromotive Pump

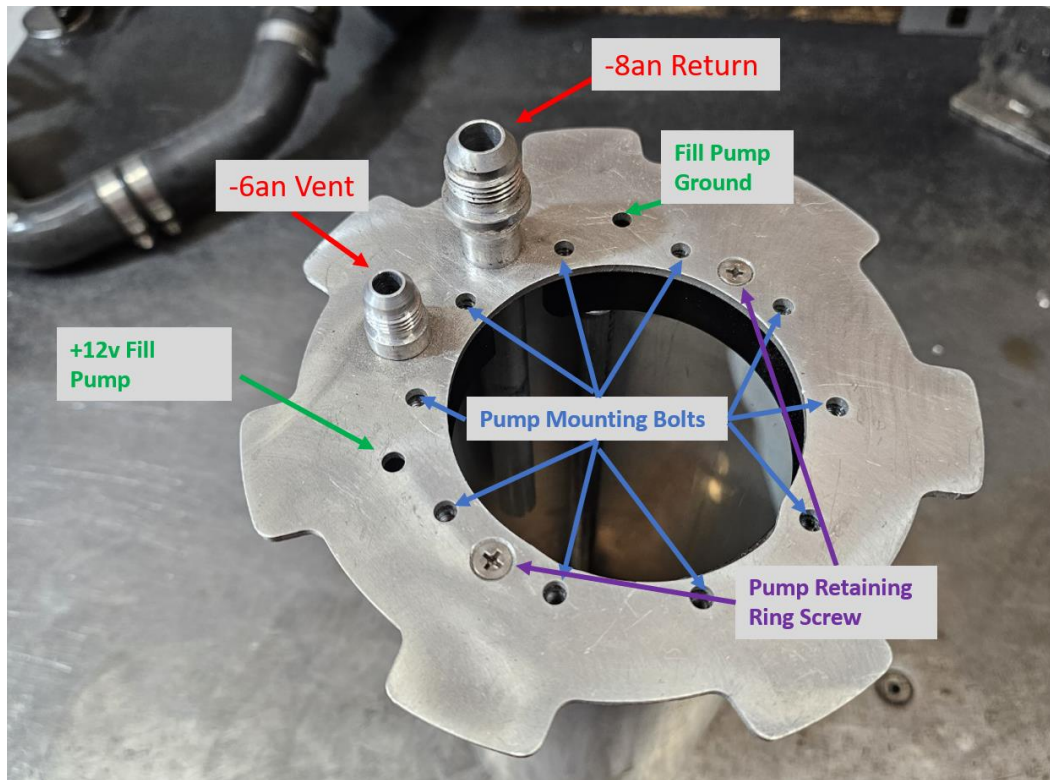


Figure 7: AFP Surge Tank for Aeromotive Pump Diagram

Fuel Pump Assembly Removal

The dual/triple setups are installed in the surge tank before shipping. There is no reason to disassemble the surge tank before installation, but if you choose to do so, you will need to be careful with certain aspects.

- The 8x allen head bolts (standard thread) are stainless and threaded into aluminum. Absolutely no power tools should be used for assembly or disassembly and care must be taken not to overtighten or the threads will strip.
- The power connectors for the fill pump are shared to one of the internal main pumps. After the assembly bolts are removed, you'll pull out the pump assembly about half way and undo the power studs for the fill pump. Do not pull excessively on this or you will damage the wiring.
- The power studs use insulating bushings on the top hat as to not short on the metal. These will need to be installed correctly and not overtightened as not to be damaged.
- The fuel socks will need to be oriented in such a way as to be free flowing when installed, so don't just jam them down in there.

- It is an overall tight fit but goes together without issue so if you have to force something then something is not right.

The pump outlets are connected to the internal fitting with corrugated tubing and oetiker clamps, they are not reusable. If you need to modify a pump for whatever reason the hose and clamps (2) will need to be replaced.

Flow Charts

The following charts are provided for reference on which configuration would be best suited for a given power goal. I have a more detailed video walkthrough on a video on my youtube channel explaining how to read the charts: https://youtu.be/kg_dwWrLtRo Skip to about 18minutes 30seconds in to get right to the charts.

There are multiple layers of conservatism built into the calculation, so these are worst-case numbers.

Double Walbro450s with Fill Pump									
Name	Source	GPH	LPH	GPM	Total Amps				
Main Pump	Walbro525 at 13.5v 80psi	84.6	328.0	1.411	37.36	Max HP Recommendation	950HP on E85		
Fill Help	Walbro255 at 0psi 13.5v	87.0	329.3	1.45	5.00		1250HP on Gas		
Dual Walbro 450 Consumption with E85									
RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec		
800	0.95	760	1.96	2.62	2.11	0.15	-		
800	1.05	840	2.17	2.62	1.90	-0.26	162		
900	0.95	855	2.21	2.62	1.87	-0.34	125		
900	1.05	945	2.44	2.62	1.63	-0.80	53		
1000	0.95	950	2.45	2.62	1.62	-0.83	51		
1000	1.05	1050	2.71	2.62	1.36	-1.35	32		
Dual Walbro 450 Consumption with Gas									
RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec		
800	0.65	520	1.43	2.62	2.64	1.22	-		
800	0.75	600	1.65	2.62	2.42	0.78	-		
1000	0.65	650	1.78	2.62	2.29	0.50	-		
1000	0.75	750	2.06	2.62	2.01	-0.05	943		
1400	0.65	910	2.50	2.62	1.57	-0.92	46		
1400	0.75	1050	2.88	2.62	1.19	-1.69	25		
WOT Limit is the time that you could be WOT until the surge tank drains									

Double Walbro525s with Fill Pump

Name	Source	GPH	LPH	GPM	Total Amps
Main Pump	Walbro525 at 13.5v 80psi	93.2	361.0	1.553	44.40
Fill Help	Walbro255 at 13.5v	87.0	329.3	1.45	5.00

Max HP Recommendation	1050HP on E85 1350HP on Gas
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Dual Walbro 525 Consumption with E85

RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec
800	0.95	760	1.96	2.91	2.39	0.43	-
800	1.05	840	2.17	2.91	2.19	0.02	-
1000	0.95	950	2.45	2.91	1.90	-0.55	78
1000	1.05	1050	2.71	2.91	1.65	-1.06	40
1100	0.95	1045	2.70	2.91	1.66	-1.04	41
1100	1.05	1155	2.98	2.91	1.38	-1.60	27

Dual Walbro 525 Consumption with Gas

RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec
800	0.65	520	1.43	2.91	2.93	1.50	-
800	0.75	600	1.65	2.91	2.71	1.06	-
1000	0.65	650	1.78	2.91	2.57	0.79	-
1000	0.75	750	2.06	2.91	2.30	0.24	-
1400	0.65	910	2.50	2.91	1.86	-0.64	67
1400	0.75	1050	2.88	2.91	1.47	-1.41	30

WOT Limit is the time that you could be WOT until the surge tank drains

Triple Walbro450s with Fill Pump

Name	Source	GPH	LPH	GPM	Total Amps
Main Pump	Walbro450 at 13.5v	84.6	328.0	1.411	56.04
Fill Pump	Walbro255 at Opsi 13.5v	87.0	329.3	1.45	5.00

Max HP Recommendation	1400HP on E85
	1800HP on Gas

Triple Walbro450 Consumption with E85

RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec
1000	0.95	950	2.45	4.23	3.23	0.78	-
1000	1.05	1050	2.71	4.23	2.97	0.27	-
1400	0.95	1330	3.43	4.23	2.25	-1.18	34
1400	1.05	1470	3.79	4.23	1.89	-1.90	21
1600	0.95	1520	3.92	4.23	1.76	-2.16	18
1600	1.05	1680	4.33	4.23	1.35	-2.99	13

Triple Walbro 525 Consumption with Gas

RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec
1000	0.65	650	1.78	4.23	3.90	2.11	-
1000	0.75	750	2.06	4.23	3.62	1.57	-
1500	0.65	975	2.68	4.23	3.01	0.33	-
1500	0.75	1125	3.09	4.23	2.59	-0.49	81
1800	0.65	1170	3.21	4.23	2.47	-0.74	54
1800	0.75	1350	3.70	4.23	1.98	-1.73	23
2100	0.65	1365	3.75	4.23	1.94	-1.81	22
2100	0.75	1575	4.32	4.23	1.36	-2.96	13

WOT Limit is the time that you could be WOT until the surge tank drains

Triple Walbro525s with Fill Pump

	Name	Source	GPH	LPH	GPM	Total Amps
	Main Pump	Walbro525 at 13.5v 80psi	93.2	361.0	1.553	66.60
	Fill Pump	Walbro255 at 0psi 13.5v	87.0	329.3	1.45	5.00

Max HP Recommendation	1600HP on E85
	2000HP on Gas

Triple Walbro 525 Consumption with E85

RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec
1000	0.95	950	2.45	4.66	3.66	1.21	-
1000	1.05	1050	2.71	4.66	3.40	0.69	-
1500	0.95	1425	3.68	4.66	2.43	-1.24	32
1500	1.05	1575	4.06	4.66	2.05	-2.02	20
1800	0.95	1710	4.41	4.66	1.70	-2.71	15
1800	1.05	1890	4.88	4.66	1.23	-3.64	11

Triple Walbro 525 Consumption with Gas

RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Fuel Aval. @80psi, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Limit, Sec
1000	0.65	650	1.78	4.66	4.32	2.54	-
1000	0.75	750	2.06	4.66	4.05	1.99	-
1500	0.65	975	2.68	4.66	3.43	0.76	-
1500	0.75	1125	3.09	4.66	3.02	-0.07	596
1800	0.65	1170	3.21	4.66	2.90	-0.31	127
1800	0.75	1350	3.70	4.66	2.40	-1.30	31
2100	0.65	1365	3.75	4.66	2.36	-1.38	29
2100	0.75	1575	4.32	4.66	1.79	-2.54	16

WOT Limit is the time that you could be WOT until the surge tank drains

Aeromotive 5GPM with Fill Pump						
	Pump	GPH	LPH	GPM	Amps	
	AEI 5GPM at 13.5v at 80psi	273	1033.31	4.55	27.0	
	Walbro255 at 13.5v Opsi	87	329.30	1.45	5.0	

AEI 5GPM Consumption with E85						
RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Time, Sec
1000	0.95	950	2.45	3.55	1.10	-
1000	1.05	1050	2.71	3.29	0.58	-
1500	0.95	1425	3.68	2.32	-1.35	27
1500	1.05	1575	4.06	1.94	-2.13	17
1800	0.95	1710	4.41	1.59	-2.82	13
1800	1.05	1890	4.88	1.12	-3.75	10

AEI 5GPM Consumption with Gas						
RWHP	BSFC	Fuel Req, lb/hr	Fuel Req, GPM	Return + Fill, GPM	Surge Tank Fill, GPM	WOT Time, Sec
1000	0.65	650	1.78	4.22	2.43	-
1000	0.75	750	2.06	3.94	1.88	-
1500	0.65	975	2.68	3.32	0.65	-
1500	0.75	1125	3.09	2.91	-0.17	207
1800	0.65	1170	3.21	2.79	-0.42	86
1800	0.75	1350	3.70	2.30	-1.41	26
2100	0.65	1365	3.75	2.25	-1.49	24
2100	0.75	1575	4.32	1.68	-2.64	14

Max HP recommendation: 1800hp on E85, 2100HP on gas

In this particular case 13 seconds may not seem like a long time, however keep in mind this is at over 2000hp at the crank. At most I would expect people would be at this power for 7-8 seconds for a ¼ mile run so 13 seconds is plenty.