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Installation instructions for the LT4 or aftermarket HPFP on Chevy LT engines

These instructions are a guideline for installing an LT4 or aftermarket HPFP (high pressure fuel pump) on all camshafts with bigger Fuel Pump Lobe (e.g. 32%, 38%).
Read the entire installation instructions before starting.

The LT4 pump has a maximum stroke of 9.0mm (0.354”).
The DI lobe has a lift of max 8.0mm (0.309”).

That means the pump has about 1.0mm (0.045”) more stroke than the biggest fuel pump lobe has lift. It is crucial to get the pump preload, lash cap thickness and/or installed height correct.
Therefore we have an install kit that comes with various different sizes lash caps, 0.060” / 0.070” / 0.080” and additional gaskets.

Also, the HPFP is installed on the valley cover. If you have an aftermarket valley cover with different wall thickness (e.g. Katech) you need to pay extra attention.

When installing the mechanical fuel pump, it is the installer’s responsibility to make sure that you have the proper pump installed height and/or lash cap thickness so that you have some preload but do not bottom out the pump.

Gains of an LT4 pump on an LT1 engine with bigger fuel lobe:

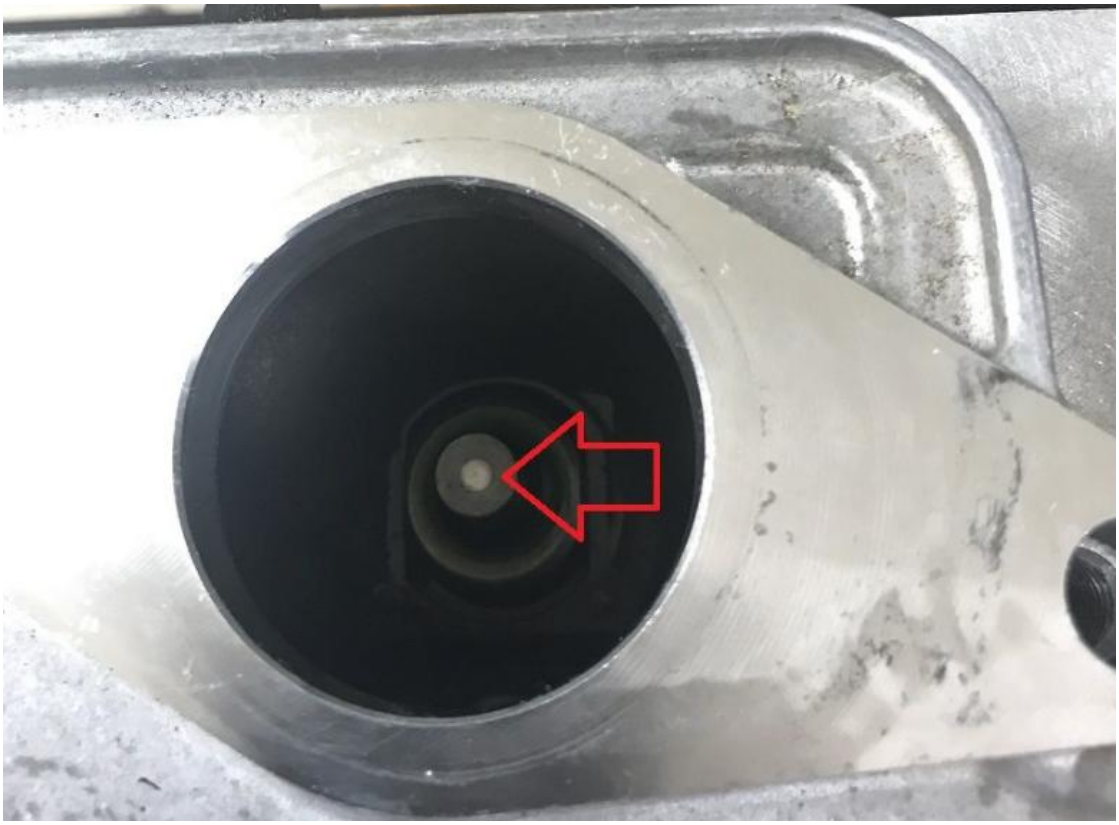
The HPFP has 20% more volume (per bigger piston diameter) compared to the stock LT1.
The DI cam lobe has an increased lift of 32-40%, which also creates 40% more volume.
This combination translates to a 65% overall gain in pump volume over the stock LT1 setup.
The pump also is capable of 31% more peak pressure which helps with injector flow and combustion quality (power and emissions).

Cleanliness is highest priority !!

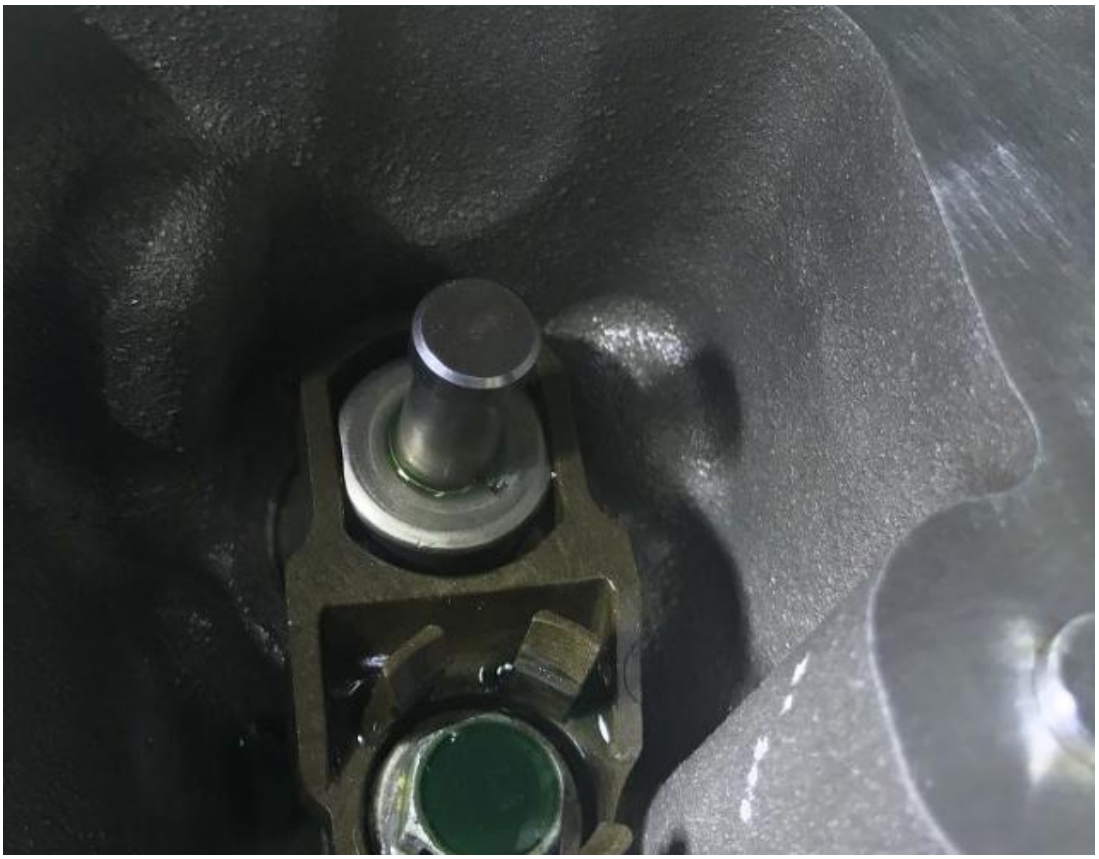
Avoid dust and dirt anywhere around the HPFP mounting position while changing the pump.
Clean the area with break cleaner or similar if necessary.
Always keep all openings in engine, low pressure and high pressure fuel lines and pump covered.

Installation

1. Mount the 0.070” lash cap on the lifter in the engine below the valley cover.



Mounted lash cap



2. Rotate the engine and or camshaft until the mechanical fuel pump lifter is resting on the camshaft fuel pump lobe's lowest lift point or "base circle".

3. Remove the outer spring of the HPFP. Do not discard.

4. Install the fuel pump with gasket by hand and see if there is preload between the fuel pump lifter and the fuel pump drive rod.

If there is no preload, install the 0.080” lash cap. You will want to achieve maximum preload so the lifter stays on the cam-lobe at all rpm (no float). A good pre-load would be 0.5-0.58mm (0.020-0.025”).

5. Next rotate the engine and or camshaft until the mechanical fuel pump drive lobe raises the fuel pump lifter to its peak or highest lift point.

6. Now install the mechanical fuel pump by hand WITHOUT gasket. If it will install by hand, with no gasket, without the fuel pump drive rod bottoming out, then you will have enough clearance when the gasket is installed to not damage the pump.

However if the fuel pump drive rod does bottom out before the bolts are tight, with no gasket, while the fuel pump lobe is at full lift (see picture), you will destroy the pump if the engine is ran this way.

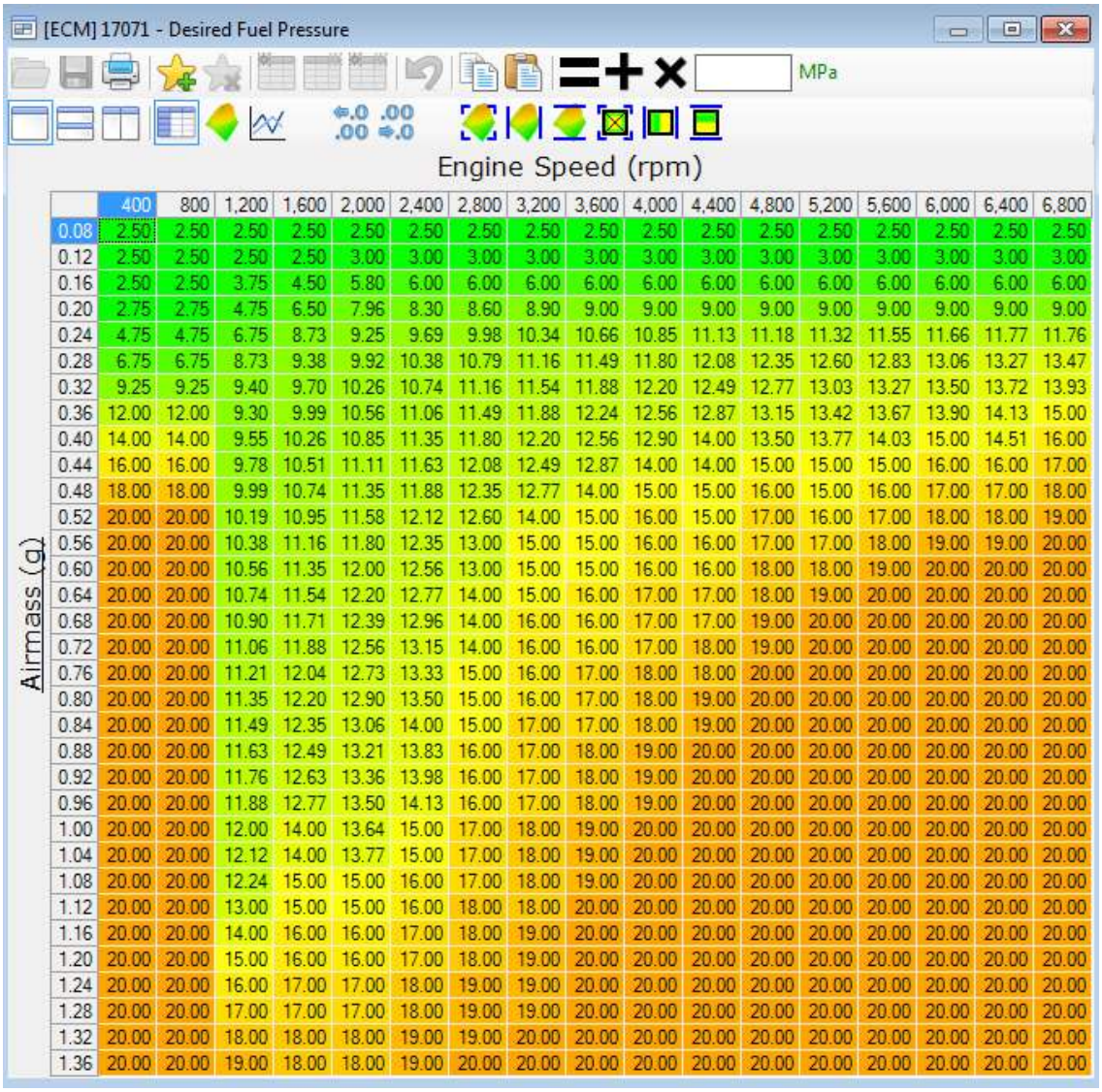
7. Now measure the clearance between the pump and the valley cover. To do this, use feeler gauges. For example it is 0.005" of clearance. In that case install a lash cap that is 0.010"smaller, e.g. 0.060". The gasket will add another 0.010" of clearance to it.
8. If you have changed the lash cap in this process, repeat all steps and make sure you have clearance with gasket at the lowest point and no clearance w/o gasket at the highest point.
9. Remove the HPFP, mount the outer spring again and mount the HPFP back on the engine.

Tuning Changes

With an LT4 pump and stock LT1 or LT4 injectors the commanded fuel pressure can safely be increased to 20MPa from the stock setting of 15MPa. If you have aftermarket injectors (like our XDI-30/50/70%), you need to contact the manufacturer about safe rail pressures. The injectors will misfire even at single pressure overshoot events.
To achieve better combustion or more injector flow, the desired fuel pressure can be increased to maximum 24MPa, again this is valid for stock injectors or some aftermarket injectors.
In highly boosted applications you can adjust the y-axis "Airmass".
With other HPFPs than the LT4 pump, please contact the manufacturer for recommended pressure levels.

The power gains are not coming from more pressure, but from more flow !!

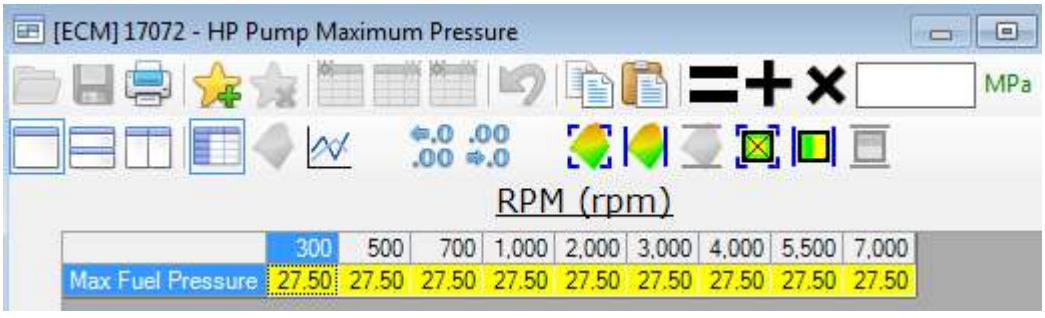
If also bigger injectors are added, it may make sense to lower the overall fuel pressure level again which helps HPFP efficiency and thus peak performance.



Airmass (g)	400	800	1,200	1,600	2,000	2,400	2,800	3,200	3,600	4,000	4,400	4,800	5,200	5,600	6,000	6,400	6,800
0.08	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
0.12	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
0.16	2.50	2.50	3.75	4.50	5.80	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
0.20	2.75	2.75	4.75	6.50	7.96	8.30	8.60	8.90	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
0.24	4.75	4.75	6.75	8.73	9.25	9.69	9.98	10.34	10.66	10.85	11.13	11.18	11.32	11.55	11.66	11.77	11.76
0.28	6.75	6.75	8.73	9.38	9.92	10.38	10.79	11.16	11.49	11.80	12.08	12.35	12.60	12.83	13.06	13.27	13.47
0.32	9.25	9.25	9.40	9.70	10.26	10.74	11.16	11.54	11.88	12.20	12.49	12.77	13.03	13.27	13.50	13.72	13.93
0.36	12.00	12.00	9.30	9.99	10.56	11.06	11.49	11.88	12.24	12.56	12.87	13.15	13.42	13.67	13.90	14.13	15.00
0.40	14.00	14.00	9.55	10.26	10.85	11.35	11.80	12.20	12.56	12.90	14.00	13.50	13.77	14.03	15.00	14.51	16.00
0.44	16.00	16.00	9.78	10.51	11.11	11.63	12.08	12.49	12.87	14.00	14.00	15.00	15.00	15.00	16.00	16.00	17.00
0.48	18.00	18.00	9.99	10.74	11.35	11.88	12.35	12.77	14.00	15.00	15.00	16.00	15.00	16.00	17.00	17.00	18.00
0.52	20.00	20.00	10.19	10.95	11.58	12.12	12.60	14.00	15.00	16.00	15.00	17.00	16.00	17.00	18.00	18.00	19.00
0.56	20.00	20.00	10.38	11.16	11.80	12.35	13.00	15.00	15.00	16.00	16.00	17.00	17.00	18.00	19.00	19.00	20.00
0.60	20.00	20.00	10.56	11.35	12.00	12.56	13.00	15.00	15.00	16.00	16.00	18.00	18.00	19.00	20.00	20.00	20.00
0.64	20.00	20.00	10.74	11.54	12.20	12.77	14.00	15.00	16.00	17.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00
0.68	20.00	20.00	10.90	11.71	12.39	12.96	14.00	16.00	16.00	17.00	17.00	19.00	20.00	20.00	20.00	20.00	20.00
0.72	20.00	20.00	11.06	11.88	12.56	13.15	14.00	16.00	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00
0.76	20.00	20.00	11.21	12.04	12.73	13.33	15.00	16.00	17.00	18.00	18.00	20.00	20.00	20.00	20.00	20.00	20.00
0.80	20.00	20.00	11.35	12.20	12.90	13.50	15.00	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00
0.84	20.00	20.00	11.49	12.35	13.06	14.00	15.00	17.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00
0.88	20.00	20.00	11.63	12.49	13.21	13.83	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
0.92	20.00	20.00	11.76	12.63	13.36	13.98	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
0.96	20.00	20.00	11.88	12.77	13.50	14.13	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.00	20.00	20.00	12.00	14.00	13.64	15.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.04	20.00	20.00	12.12	14.00	13.77	15.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.08	20.00	20.00	12.24	15.00	15.00	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.12	20.00	20.00	13.00	15.00	15.00	16.00	18.00	18.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.16	20.00	20.00	14.00	16.00	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.20	20.00	20.00	15.00	16.00	16.00	17.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.24	20.00	20.00	16.00	17.00	17.00	18.00	19.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.28	20.00	20.00	17.00	17.00	17.00	18.00	19.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.32	20.00	20.00	18.00	18.00	18.00	19.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.36	20.00	20.00	19.00	18.00	18.00	19.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Never exceed 25MPa of fuel pressure! The pump will suffer permanent damage and cannot be repaired. This fault is easy to detect in the pump.

Increase the maximum HP Pump Pressure to 27.5MPa



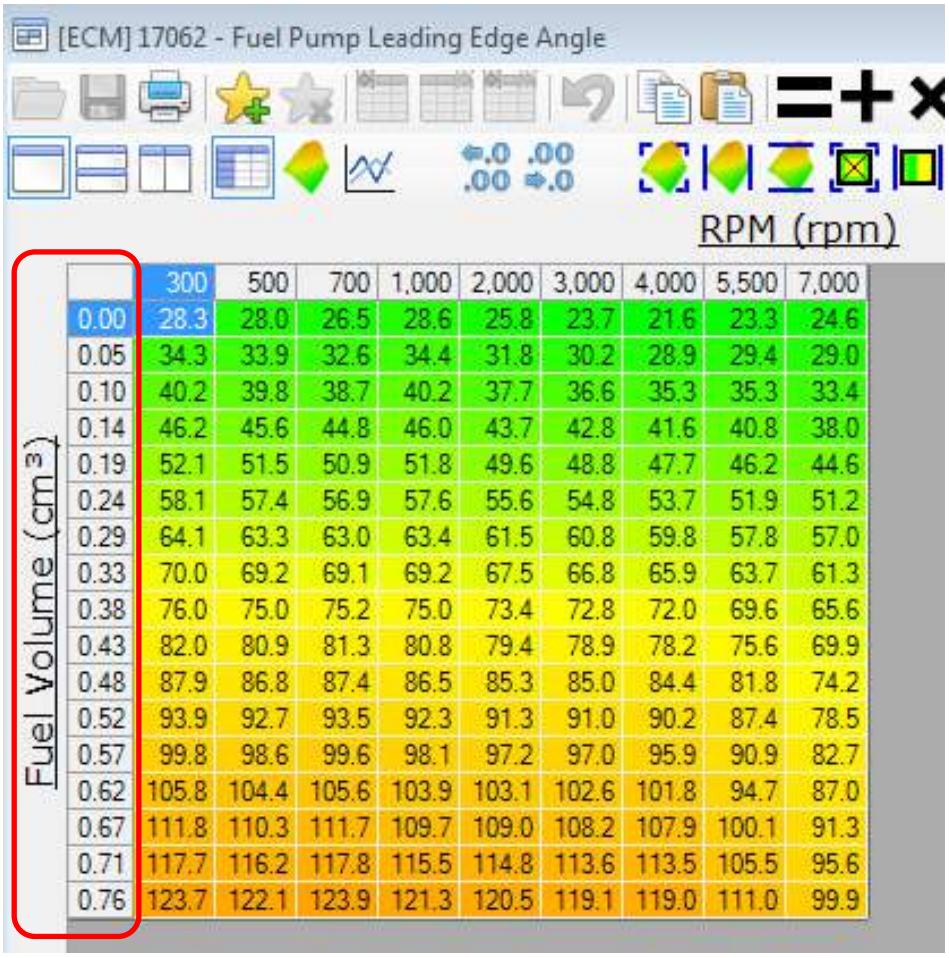
	300	500	700	1,000	2,000	3,000	4,000	5,500	7,000
Max Fuel Pressure	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50

Fuel Pump Leading Edge Angle (= feed forward for pump controller)

For a good starting point just multiply the y-axis (Fuel Volume) of the LT1 stock table by 1.65 (= 65% more volume). This value is valid for an LT4 pump on a 40% lobe and an LT1 base file.

Most people don't make this tuning change at the cost of bigger noise on the rail pressure and higher over and undershoots at transient conditions. The E92 controller is rather forgiving and the PI-Controller still maintains target pressure at stable conditions.

Example values:



Fuel Volume (cm³)	300	500	700	1,000	2,000	3,000	4,000	5,500	7,000
0.00	28.3	28.0	26.5	28.6	25.8	23.7	21.6	23.3	24.6
0.05	34.3	33.9	32.6	34.4	31.8	30.2	28.9	29.4	29.0
0.10	40.2	39.8	38.7	40.2	37.7	36.6	35.3	35.3	33.4
0.14	46.2	45.6	44.8	46.0	43.7	42.8	41.6	40.8	38.0
0.19	52.1	51.5	50.9	51.8	49.6	48.8	47.7	46.2	44.6
0.24	58.1	57.4	56.9	57.6	55.6	54.8	53.7	51.9	51.2
0.29	64.1	63.3	63.0	63.4	61.5	60.8	59.8	57.8	57.0
0.33	70.0	69.2	69.1	69.2	67.5	66.8	65.9	63.7	61.3
0.38	76.0	75.0	75.2	75.0	73.4	72.8	72.0	69.6	65.6
0.43	82.0	80.9	81.3	80.8	79.4	78.9	78.2	75.6	69.9
0.48	87.9	86.8	87.4	86.5	85.3	85.0	84.4	81.8	74.2
0.52	93.9	92.7	93.5	92.3	91.3	91.0	90.2	87.4	78.5
0.57	99.8	98.6	99.6	98.1	97.2	97.0	95.9	90.9	82.7
0.62	105.8	104.4	105.6	103.9	103.1	102.6	101.8	94.7	87.0
0.67	111.8	110.3	111.7	109.7	109.0	108.2	107.9	100.1	91.3
0.71	117.7	116.2	117.8	115.5	114.8	113.6	113.5	105.5	95.6
0.76	123.7	122.1	123.9	121.3	120.5	119.1	119.0	111.0	99.9

These are electric values for the HPFP valve; copy over from LT4 data if you have

[ECM] 17090 - Peak Duration

RPM (rpm)

Ignition Volts (V)

	300	500	700	1,000	2,000	3,000	4,000	5,500	7,000
6	3.16	3.16	3.16	3.16	3.16	3.14	3.15	2.63	2.22
8	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
9	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
10	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
11	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
12	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
13	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
14	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
16	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62

[ECM] 17093 - Peak Duration Temp Mult

RPM (rpm)

Pump Temperature

	300	500	700	1,000	2,000	3,000	4,000	5,500	7,000
-40	0.9050	0.6860	0.6030	0.5410	0.4890	0.4470	0.4130	0.3830	0.3330
104	0.9050	0.6860	0.6030	0.5410	0.4890	0.4470	0.4130	0.3830	0.3330
248	1.0000	0.8920	0.7660	0.6850	0.6210	0.5680	0.5210	0.4810	0.4210

Please check http://www.xtreme-di.com for updates related to additional tuning enhancements.