Yamaha APEX with MPI Mountain Performance supercharger kit.

This is our first Apex tested with MPI intercooled centrifugal supercharger kit and boost referenced fuel management controller. NJer Art Andre was at DTR 15 years ago with some mod drag sled, probably half the HP of this new trail sled he's planning to ride this year. This MPI setup has 11 psi boost at peak revs, recommended by MPI to run with 50/50 race gas pump gas mix that is surely the cheapest insurance considering a deto'd piston takes maybe 40 hours to repair plus the cost of piston(s), head and/ or block. With any sort of boosting or N2O injection octane is your friend. If you want to run 87 octane or lower mystery gas please "X" off of this page and google "Apex air filter kits" that might get you one HP. This, like the turbo systems we've tested here, is serious HP and you must spend $ for safe gas.

As most of you know I'm a turbo person, have twin turbos on my 2000 Silverado 5.3 (102,000 miles on engine w/turbos), a turbo Ford Focus, a 99 Victory motorcycle with Aerodyne turbo, and a 99 Triumph Tiger (my favorite) with an Aerodyne turbo built by Turbo Connection in Rapid City SD.

I have intercooled B&M 420 roots superchargers on twin 540 Chevy engines in a 30' red Max Cat (Chris Cat mold) that I haven't driven since my copilot wife got pregnant nine years ago. I can't afford the gas today, but it my pal at the marina runs the engines each year, then puts the boat back in heated storage again. I miss the whine of the toothed belt drives of the blowers on the engines. Maybe when my son is 10 we can go for a ride again.

To copy Turbo Connection's website name, Boost is Good.

Being a turbo person, I've always had a dislike for centrifugal superchargers, since they are supposed to be slowest to build boost as revs climb. Turbos, once spooled up (very instant with ball bearings) build max boost at low revs then hold that boost through RPM band. Roots superchargers build boost in direct proportion to RPM. My boat is like that; at 3000 RPM my pulley setup gets me 3.5 psi, at 6000 RPM where MSD rev limiters control engine speed boost is about 7 psi. But centrifugal superchargers build boost pressure as the square of engine RPM. If I had centrifugal superchargers on my boat, to achieve 7 psi at 6000 RPM I should only have about 1.75 psi at 3000. That's better than NA but painfully low compared to an identical boat with 3000 rpm boost of 7 psi (turbos) or 3.5 psi (roots SC). Screw superchargers like Whipple fall somewhere in between Roots and turbo in making exceptional low RPM boost. Boats surely spend most of their time accelerating in the midrange. Sleds with their CVT drives spend very little there.

I was most impressed with this MPI Apex' midrange boost. According to physics, the midrange boost of this centrifugal blower on the Apex is higher than expected. Doing the math, this setup gave us 5.5 psi boost at 6700 and at 10,800 should have built to 15 psi boost. But instead 10,800 rpm boost was 12 psi, extremely flat for a centrifugal supercharger. Is compressor efficiency higher than any other centrifugal blower? Or is there some slippage, somewhere in the drive system then drops blower revs as engine revs climb? I don’t know but the boost curve here is quite good, very excellent for a centrifugal SC.

Regardless, we have a very flat, turbo-like HP curve from the boosted otherwise bone stock Apex. Another issue is the quality and workmanship of this kit. The replacement oil tank required to clear belt drive is much nicer than OEM. The intercooler/ air plenum is the usual perfect piece from BellIntercoolers.com.

Art Andre was impressed with the ease of installation of the kit on his Apex.

Mechanical niceties aside, I was disappointed in the management of the fuel with the MPI supplied boost-sensing electronic injector-fooler. My opinion after tweaking on 200 sleds, both NA and boosted with the MPI and Boondocker EFI fuel controllers is that the MPI does not have nearly as fine resolution as Boondocker. We’ve tweeked turbo Boondockers here to perfection, way better than we could do with the MPI.

On the dyno with my mechanical meters showing instantaneous changes in A/F ratio (as evidenced in the following dyno test) way more instantaneous than the Innovate wide band (LAMAF1), feeding throttle with the MPI to load the dyno A/F ratio would flash from rich to lean to rich, then at WOT would be reasonably OK from low RPM to high RPM when the stock fuel pump would be tapped out, causing deathly lean drop in fuel pressure as injector pulsewidth increased with boost.

While the Apex’ stock pump limitation is creating the drop in fuel pressure and resulting extremely lean A/F ratio at peak, impossible to enrichen top end A/F ratio. The MPI EFI box seems to be inconsistent from ¼ to ½ to ¾ to full throttle at any RPM. The Boondocker system has not shown that inconsistency on my dyno on other NA or boosted applications.

Keep in mind that MPI is at high altitude, their testing is in thin air where stock fuel pump can supply adequately. But here at sea level, 40 degree air the stock fuel pump is tapped out at 11-12 psi boost.. Note the fuel pressure drops from 48 psi to 39 psi as we tried to tweak injector pulsewidth to match the airflow of the SC’s engine, and A/F ratio leaned out to 14/1 = possible death on long runs on pump gas but dandy here for 15 seconds on Art’s wise 100+ octane mix.

Art (and all the low altitude boosted Apex owners) need higher capacity fuel pumps. We must have 150 lb/hr capacity at 48 psi to safely support the 275 HP this combo is capable of at zero degrees F, sea level. It’s all about BSFC.

Here’s Art Andre’s bone stock Apex, 12 psi boost, with fuel pump’s tongue hanging out. I’m betting that it would make 5 HP more if the fuel pump could keep up at this boost level.

EngSpd	STPTrq	STPPwr	LAMAF1	BOOST	A/FA-B	Air1+2	FuelP	FulA-B
RPM	Clb-ft	CHp	Ratio	in hg	Ratio	scfm	psig	lb/hr

6700	107.2	136.7	11.5	11.5	9.91	170	46.9	78.6
6800	106.8	138.2	11.5	11.8	9.73	174	47	81.9
6900	107.1	140.6	11.5	12.1	10.13	176	47	79.8
7000	107.8	143.6	11.5	12.3	10.06	181	47.1	82.3
7100	108.7	146.9	11.5	12.5	9.96	185	47.2	85.1
7200	110.1	150.8	11.5	13.1	9.66	188	47.3	89.2
7300	111.5	154.9	11.4	13.4	9.59	193	47.5	92.2
7400	111.8	157.5	11.4	13.6	10.04	198	47.6	90.2
7500	111.9	159.8	11.4	13.9	9.89	200	47.7	92.8
7600	112.3	162.5	11.4	14.3	9.92	206	47.8	95.1
7700	113.7	166.7	11.4	14.5	10.01	209	47.8	96.5
7800	113.8	169.1	11.4	14.9	10.06	213	47.9	97.1
7900	114.3	171.9	11.4	15.2	10.35	220	47.8	97.3
8000	114.3	174.1	11.3	15.5	10.18	225	48.1	101.2
8100	115.1	177.5	11.3	15.8	10.18	228	47.8	102.7
8200	115.2	179.9	11.3	16.1	10.27	233	47.8	104.1
8300	115.3	182.2	11.3	16.2	10.32	237	47.8	105.3
8400	115.6	184.9	11.3	16.5	10.21	243	47.7	109.2
8500	116.2	188.1	11.3	16.8	10.48	247	47.9	107.9
8600	117.6	192.5	11.3	17.3	10.42	255	48.1	111.9
8700	118.8	196.8	11.4	17.7	10.79	260	47.9	110.4
8800	119.2	199.8	11.3	17.9	11.04	264	47.9	109.3
8900	119.6	202.6	11.4	18.4	11.44	268	47.9	107.3
9000	119.5	204.8	11.4	18.8	11.57	275	48.1	108.7
9100	119.7	207.3	11.4	19.2	11.25	279	48.1	113.7
9200	120.4	210.9	11.5	19.7	12.11	285	47.8	107.8
9300	120.5	213.4	11.5	19.9	12.24	288	47.4	107.8
9400	121.5	217.5	11.5	20.2	12.51	293	46.9	107.3
9500	121.9	220.6	11.6	20.4	12.93	298	46.4	105.6
9600	121.5	222.2	11.6	20.7	13.07	303	45.9	106.1
9700	123.1	227.3	11.7	21.1	13.45	308	45.2	104.9
9800	123.5	230.4	11.7	21.4	13.51	314	44.5	106.4
9900	123.1	232.1	11.7	21.7	13.78	318	44.1	105.8
10000	123.6	235.3	11.7	21.6	13.62	321	43.3	108.1
10100	123.7	237.9	11.7	22.1	13.64	325	42.7	109.2
10200	123.7	240.2	11.8	22.3	13.62	332	41.7	111.5
10300	124.1	243.4	11.8	22.5	13.85	335	41.1	110.8
10400	121.9	241.4	12.1	22.7	13.92	339	40.4	111.4
10500	120.1	240.2	12.2	22.8	13.95	345	40.1	113.2
10600	118.1	238.4	12.4	22.9	13.27	349	39.6	120.3
10700	114.2	232.6	12.5	23.1	13.36	349	39.5	119.6
10800	100.5	206.7	12.9	23.1	13.46	350	39.3	118.9

Note again how LM1 A/F ratio lags behind the dyno mechanical meters. The LM1 reads 12/1 as fuel pump is tapped out, actual SuperFlow meters’ reading is closer to 14/1.