

12/25/03

Contact: Kevin Freeman  
The Sled Shop, Inc  
108 Main St  
Presque Isle, ME 04769

www.thesledshop.com  
207-764-2900

### *Stage Tuning '03 Ski-doo Rev 800 Series 3 Twin*

It was only a few short seasons ago in 1999 when Ski-doo introduced their ZX chassis twin cylinder snowmobiles, ushering in a new direction of lightweight models from the sledmaker from Quebec Canada. Going to these sleds meant going away from heavy multi-cylinder models, somewhat welcomed by ditch bangers but bemoaned by lake racers and tuners who loved to modify the triples into higher-powered snow scooters. On some of those models, a simple pipe change or a higher compression head would make the tuner a hero on the lake racing against his buddies. My dealership did piles of these tuneups for customers with excellent results.

Times have changed: What we've come to believe would work on triples took a few seasons to come to the realization that the new twins were a different tuning story completely: no one single bolt-on bullet really wakes these sleds up as much as they did on a triple. After the '99 600 MXZ introduction soon followed the 700, then the bigger 800 in 2001. Being a bigger bored version of the 700, most 800 riders soon found out they weren't much faster than the 700. Stock for stock, it offered more torque than the 700 twin, particularly from part throttle rollons, but not blazingly faster on top end. With the emergence of the new 600HO twin in 2003, its power was very close to the 700 motor, thus Ski-doo began dropping it from the lineup. Now however in stock form the 600HO could give the 800 a run, particularly on top end. Now with 4 seasons of 800 Rotax twins there are plenty of drivers now looking for the means to improve the power output.

A couple seasons ago, the internet forums were full of posts discussing the stock cylinder head was hurting the series 3 engines. "Hemi" style heads were sold and alot of people thought they gained power over the stock top-hat design. I installed one as well, only to find no real noticeable gain seat-of-the-pants. Without a major step up in compression they were not much better than stock. The stock cyl head was certainly not keeping the 600HO down as it was consistently at or near the top of most shootouts and dyno test comparisons for the past few seasons. Our customers and many Ski-doo owners were looking for answers. Frustrated by our 800 field testing/hit and misses we decided to make the 15-hour 800 mile road trip to Dynotech Research in Batavia NY. I wrote a couple stage tuning articles in the mid 90's for them from our dyno test sessions and hoped we could finally get an answer for trail guys with Rotax 800 twins.

The snowmobile we brought with us was our Sled Shop 4500 mile demo "beater" sled from last season: 2003 MxZ 800 Sport. This sled is commonly referred to as a REV 800. There were actually two 800 motors for 2003: in addition to my model, the 2003 Summits appeared with a new "HO" 800. It was published widely in magazine journals that dyno tests of a typical 800 regular motor made 132 CBHP stock. While I started the season with the regular model, I soon had enough parts to update the motor to the HO Specs which mainly included cylinder head, cylinders, reeds and reed spacers. Now for 2004 the 800HO is offered standard on all REV models. This is the way the motor was trail ridden for nearly 4000 miles. We were curious what a seriously "broken-in" motor would make on the dyno (no ring seating issues here, and no timing chip to guess around): below is our first test as the engine was driven on the snow last season: it posted a maximum of **137.5 CBHP@7800 rpm** and a maximum torque of **93.1**

**ft/lbs@7700 rpm.** Note the power falls off 12 horses at 8200! Clutch people beware: overrev on the REV 800HO could make the engine feel more like a 700 or 600HO.

test 03KFHO8A

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF
6200	66.6	78.7	0.57	44.3	12.8	123	101.4	41
6300	68.6	82.2	0.59	47.4	12.8	132	104.3	41
6400	70.6	86.1	0.59	50.3	12.7	139	107.4	41
6500	71.9	89.2	0.61	52.2	12.7	145	109.4	41
6600	73.5	92.4	0.62	54.2	12.7	150	111.9	41
6700	83.1	105.8	0.84	86.3	10.7	202	126.3	41
6800	83.1	107.5	0.82	85.7	10.8	203	126.4	41
6900	85.1	111.8	0.81	87.4	10.8	207	129.5	41
7000	86.7	115.6	0.82	90.3	10.6	210	132.1	41
7100	88.4	119.5	0.77	89.7	10.9	214	134.6	41
7200	90.9	124.7	0.75	91.7	11.1	220	138.5	41
7300	91.2	126.7	0.74	92.1	10.9	222	138.8	41
7400	91.7	129.2	0.73	92.7	11.1	225	139.6	41
7500	91.9	131.2	0.74	95.2	11.1	228	140.2	39
7600	92.2	133.4	0.75	98.5	10.7	231	140.7	39
7700	93.1	136.5	0.74	100.2	10.6	232	141.9	40
7800	92.6	137.5	0.75	101.5	10.6	234	141.3	39
7900	91.3	137.3	0.75	101.6	10.7	236	139.1	40
8000	89.6	136.5	0.72	96.5	11.3	238	136.3	41
8100	85.6	132.1	0.77	99.4	11.1	239	130.3	41
8200	80.1	125.1	0.85	104.4	10.4	238	121.8	41

Having tuned some 700 twins trail sleds in the past to 129+ on the dyno, I knew (or at least hoped) there should be some way of gaining 10HP or so for the 800 engine. Assuming this motor/carb/pipe combo can't flow enough air through the engine, some serious out-of-the-box thinking was in order. I had heard rumours of a company in Ontario Canada cutting some wild new ports in the 800 cylinders and had run them on the snow and the infamous "Kevlar Lakes" of Ontario where snow pilots hold their sleds for miles and miles at WFO. I shipped some stock 800 cylinders to Don Emery of DNE Performance (705-487-3689) who performed his magic. Don's a really great guy and was nice enough to drive 3 hours one way and meet us at Dynotech Research. The following test is with DNE's ported 800 cylinders installed on our engine. Note the airflow through the engine increased 3%. The ported cylinders helped the engine power output posting a maximum of **141.1 CBHP@7900 rpm** and torque peaked at **94.4 ft/lbs@7800 rpm**.

test 03KFHO8G

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF
5900	64.1	72.1	0.68	48.2	12.2	126	97.1	44
6000	64.9	74.2	0.69	50.1	12.1	131	98.3	44
6100	65.8	76.4	0.69	51.8	11.9	135	99.5	45
6200	66.3	78.3	0.69	52.5	11.9	137	100.3	45
6300	67.5	81.1	0.69	54.4	11.8	141	102.2	45
6400	69.1	84.1	0.68	56.2	11.8	145	104.3	45
6500	70.8	87.7	0.68	58.1	11.9	150	107.3	44
6600	74.2	93.2	0.66	59.9	12.1	159	112.2	45
6700	77.8	99.3	0.65	63.3	12.3	170	117.8	45

6800	85.5	110.7	0.77	83.1	11.3	206	129.5	44
6900	85.8	112.7	0.79	87.5	10.8	207	129.8	45
7000	87.9	117.2	0.77	88.1	11.1	213	133.2	44
7100	88.1	119.1	0.77	89.6	10.9	214	133.5	44
7200	90.2	123.7	0.75	90.8	11.2	219	136.6	45
7300	91.8	127.6	0.74	92.4	11.1	223	139.1	45
7400	94.1	132.6	0.73	94.7	11.1	227	142.5	45
7500	93.9	134.1	0.73	95.6	11.1	230	142.4	44
7600	93.3	135.1	0.74	98.1	10.9	233	141.4	44
7700	93.2	136.7	0.74	99.1	10.8	234	141.3	44
7800	94.4	140.3	0.71	97.9	11.1	238	143.1	44
7900	93.8	141.1	0.73	101.5	10.8	239	142.2	44
8000	92.2	140.5	0.74	101.5	10.9	241	139.7	44
8100	89.2	137.5	0.77	103.5	10.7	241	135.1	44
8200	85.4	133.3	0.81	105.2	10.5	241	129.4	44

DNE's experience was their customers could run on the lakes all day on leaner main jets, so we jetted the motor down, and pulled the following test: (this should still be a safe trail spec on pump gas) and the power improved to **142.7 CBHP@7900 rpm**, torque now maxed at **96.6 ft/lbs@7400 rpm**. Probably most significant was the ported cylinders/ leaner jetting and hotter resultant exhaust now made the motor run a much wider powerband than our first pass. Torque climbing to 95@7300 holding pretty much straight through to 7900 rpm making it virually idiot-proof to clutch now. We even picked a little over-rev up now, falling off 3Hp now at 8100 rpm from maximum power.

**test 03KFHO8J**

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF
6300	72.9	87.4	0.71	60.5	11.5	152	109.7	50
6400	73.5	89.5	0.71	61.1	11.5	153	110.7	50
6500	75.2	93.1	0.71	62.6	11.6	159	113.3	50
6600	75.9	95.4	0.69	63.1	11.7	161	114.4	50
6700	77.6	99.1	0.68	64.7	11.7	165	116.9	50
6800	81.7	105.7	0.67	67.6	11.9	175	123.1	50
6900	85.9	112.8	0.66	71.1	12.1	188	129.4	50
7000	88.3	117.7	0.64	72.4	12.4	196	133.1	50
7100	92.6	125.2	0.64	77.4	12.4	209	139.6	50
7200	94.4	129.4	0.69	87.1	11.6	220	142.2	50
7300	95.1	132.1	0.71	90.2	11.3	223	143.3	49
7400	96.6	136.1	0.71	92.8	11.2	227	145.8	49
7500	95.6	136.5	0.71	95.1	11.1	230	144.4	48
7600	95.1	137.6	0.71	95.9	11.1	232	143.6	48
7700	95.1	139.4	0.68	92.7	11.6	235	143.6	48
7800	95.2	141.5	0.69	94.5	11.5	237	143.6	49
7900	94.8	142.7	0.71	96.6	11.3	239	143.1	49
8000	93.3	142.1	0.72	98.4	11.2	241	140.7	49
8100	90.4	139.4	0.74	98.6	11.2	241	136.2	49
8200	78.4	122.4	0.82	97.5	11.2	239	118.2	48

Next step was jet down again and for those guys who are smart about using the throttle for limited distances this would be the edge of pump gas safe for the trail. This now brings us close to Arctic Cat's ZR900 stock specs and should put the REV in the ball game on the race your buddy 1000' lake runs. Power maxed out at **147.2 CBHP@8000 rpm** with torque now peaking at **97.2 ft/lbs@7900**.

test 03KFHO8M

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF
6200	70.1	82.6	0.72	58.4	12.2	156	106.3	43
6300	70.1	84.1	0.71	58.4	12.2	156	106.3	43
6400	70.6	86.1	0.7	58.8	12.2	157	107.1	44
6500	72.1	89.1	0.68	59.4	12.4	160	109.3	44
6600	75.4	94.7	0.65	60.9	12.6	167	114.5	43
6700	77.9	99.4	0.64	62.2	12.8	173	118.4	43
6800	84.5	109.4	0.72	77.3	12.2	206	128.6	42
6900	84.8	111.4	0.72	78.6	12.1	207	129.1	42
7000	89.1	118.7	0.67	77.9	12.4	211	135.4	43
7100	89.9	121.5	0.65	78.2	12.5	214	136.6	43
7200	92.1	126.2	0.65	80.2	12.5	218	139.9	43
7300	92.1	128.1	0.64	81.1	12.4	220	140.2	42
7400	93.7	132.2	0.64	82.9	12.3	223	142.4	43
7500	95.1	135.6	0.64	85.1	12.2	226	144.2	44
7600	95.2	137.7	0.63	85.6	12.2	228	144.7	43
7700	95.4	139.9	0.61	84.4	12.6	232	145.1	43
7800	96.7	143.6	0.62	87.1	12.3	234	147.2	43
7900	97.2	146.2	0.61	86.5	12.6	237	147.8	43
8000	96.6	147.2	0.61	88.5	12.4	239	146.8	43
8100	94.7	146.1	0.63	90.8	12.1	240	143.9	43
8200	92.1	143.7	0.67	95.2	11.6	241	139.9	43

Fire Ball Coating in Ontario (519-925-6342) sent a stock 03 800REV pipe for testing, which we installed next. This is a ceramic coated pipe on the outside only and looks really cool. I was curious to see if the naked ceramic pipe without the heat shields installed would "hold" the heat of the stock pipe. This would be a great thing for Ski-Doo owners who have their heat shields vibrated off after a season or two of use. (Not to mention the pipe looks way cooler than stock.) Fireball has other colors available as well for those not liking the near nickel looking finish of this pipe. The following test is with the Fireball ceramic coated stock REV pipe (and same jetting as previous test) making maximum power at **147.8CBHP@7900 rpm** with torque of **98.2 ft/lbs@7900**.

test 03KFHO8R

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF
6000	66.3	75.7	0.61	45.1	14.4	142	100.3	47
6100	66.4	77.1	0.61	46.3	14.3	144	100.5	47
6200	67.8	80.1	0.61	47.7	14.3	149	102.6	47
6300	70.7	84.9	0.61	50.4	13.9	154	107.1	47
6400	79.4	96.7	0.7	66.3	13.1	189	120.3	47
6500	80.3	99.4	0.71	68.6	13.1	195	121.8	46
6600	80.2	100.8	0.71	69.3	12.9	195	121.6	46
6700	84.4	107.7	0.71	75.3	12.3	203	128.1	45
6800	84.4	109.3	0.71	75.8	12.3	204	128.1	45

6900	86.8	114.1	0.71	79.1	12.1	209	131.8	45
7000	88.1	117.2	0.68	78.3	12.3	211	133.5	45
7100	90.1	121.8	0.67	80.1	12.3	215	136.8	45
7200	93.1	127.7	0.65	81.8	12.4	221	141.4	45
7300	94.3	131.1	0.65	83.1	12.3	223	143.1	45
7400	95.6	134.7	0.64	84.1	12.3	226	145.1	45
7500	97.1	138.5	0.64	87.1	12.1	229	147.3	45
7600	96.4	139.5	0.63	86.3	12.2	230	146.4	45
7700	96.6	141.6	0.61	84.8	12.6	233	146.7	45
7800	97.5	144.8	0.57	81.1	13.3	235	148.1	45
7900	98.2	147.8	0.57	82.7	13.2	238	149.2	45
8000	96.2	146.6	0.61	86.4	12.7	240	146.1	45
8100	93.5	144.2	0.66	92.4	12.1	241	141.9	45
8200	88.9	138.8	0.71	96.4	11.5	242	134.9	45

We were flirting very close to the "magic 100 ft/lb" number and felt there was a chance of hitting it. Terry Paine from nearby Bender Racing in Colden NY (716-941-5010) loaned us a Ski-Doo REV silencer his company has developed. This was the boost we needed: with the REV stock tuned pipe now re-installed (shields and insulation intact) and the Bender Racing "REV CAN" silencer installed, power maxed out at **150.9CBHP@8000 rpm** with torque now peaking at **99.7 ft/lbs@7900 rpm** as per the following test.

**test 03KFHO8S**

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF	
6400	81.6	99.4	0.72	69.6	12.6	191	123.5	48	
6500	82.9	102.6	0.73	73.2	12.1	194	125.5	48	
6600	83.4	104.8	0.72	74.3	12.2	195	126.3	48	
6700	85.1	108.4	0.69	73.7	12.3	198	128.8	47	
6800	86.8	112.4	0.67	74.2	12.4	202	131.4	48	
6900	87.2	114.6	0.67	75.6	12.4	204	132.1	48	
7000	90.2	120.2	0.66	77.7	12.4	210	136.6	47	
7100	92.1	124.4	0.65	79.1	12.4	213	139.6	46	
7200	92.4	126.7	0.64	79.3	12.4	215	140.2	46	
7300	95.4	132.7	0.62	81.4	12.3	219	145.1	45	
7400	97.1	136.8	0.63	84.1	12.1	222	147.5	45	
7500	97.9	139.7	0.63	85.8	12.1	224	148.5	46	
7600	98.2	142.1	0.62	86.1	12.1	227	149.1	46	
7700	98.1	143.6	0.62	84.8	12.4	229	148.7	46	
7800	99.1	147.1	0.59	84.6	12.5	231	150.2	46	
7900	99.7	150.1	0.59	86.1	12.4	233	151.2	47	
8000	99.1	150.9	0.61	89.9	12.1	236	150.4	46	
8100	96.7	149.1	0.65	94.6	11.5	237	146.7	46	
8200	92.3	144.1	0.67	94.5	11.5	238	140.1	46	

Man, we were OH SO CLOSE TO 100 ft/lbs!! But Jim, was not saying it was official yet.... We next spoke with the good folks at DynoPort (315-253-9631) to inquire what their pipe testing showed over stock. They were pretty confident we would see a few more HP. We had with us a new DynoPort 800REV tuned pipe. Having re-installed the stock muffler to isolate the improvements the Dynoport pipe

made, the following test results verified what Dynoport had said and power maxed out at **150.1 CBHP@8000 rpm** with torque just under the 100 ft/lb mark (again!) at **99.1 ft/lbs@7900 rpm** as per the chart below.

test 03KFHO8V

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF	
6600	82.1	103.1	0.65	66.5	12.8	12.8	187	125.1	43
6700	83.9	107.1	0.67	69.7	12.9	12.9	197	127.8	43
6800	86.1	111.3	0.69	74.8	12.4	12.4	203	131.1	43
6900	86.6	113.8	0.7	77.2	12.1	12.1	205	132.2	42
7000	88.3	117.7	0.67	76.7	12.4	12.4	208	134.8	42
7100	91.6	123.8	0.66	78.9	12.4	12.4	213	139.6	43
7200	92.7	127.1	0.64	79.4	12.4	12.4	216	141.4	42
7300	95.2	132.3	0.64	82.2	12.3	12.3	220	145.1	43
7400	97.1	136.6	0.63	83.4	12.2	12.2	222	147.6	44
7500	98.1	140.1	0.62	84.1	12.3	12.3	225	149.3	44
7600	97.6	141.2	0.64	86.1	12.1	12.1	227	148.7	43
7700	97.7	143.3	0.63	87.1	12.1	12.1	229	149.1	43
7800	98.8	146.7	0.62	84.3	12.6	12.6	232	150.7	42
7900	99.1	148.9	0.59	83.6	12.8	12.8	235	151.1	42
8000	98.5	150.1	0.61	85.2	12.8	12.8	238	150.2	42
8100	96.7	149.2	0.61	89.6	12.2	12.2	239	147.8	41
8200	93.8	146.5	0.65	94.6	11.6	11.6	240	143.1	42
8300	79.5	125.6	0.74	91.2	12.1	12.1	238	121.2	42

For those REV owners who have to have it all, here's the final test. And also, we couldn't drive 800 miles all the way back to Presque Isle Maine and not be over 100 ft/lbs "officially". Reinstalling the Bender Racing "REV CAN" and the Dynoport big volume single pipe gave us the numbers we had been waiting for, maxing out at **152.2 CBHP@8100rpm** with torque now (finally) at **100.1 ft/lbs@7900 rpm!**

test 03KFHO8U

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	BMEP psi	AirTmp degF	
6500	81.9	101.4	0.69	69.4	12.4	12.4	188	124.6	45
6600	82.6	103.8	0.71	72.1	12.1	12.1	191	125.5	46
6700	84.4	107.6	0.69	73.1	12.3	12.3	196	128.1	47
6800	86.4	111.8	0.68	74.3	12.4	12.4	201	131.1	47
6900	86.1	113.1	0.68	74.5	12.4	12.4	202	130.6	47
7000	89.2	118.9	0.67	76.9	12.4	12.4	208	135.6	46
7100	89.3	120.8	0.65	76.8	12.5	12.5	210	135.7	46
7200	92.6	126.9	0.64	78.8	12.5	12.5	215	140.8	45
7300	92.9	129.1	0.63	79.3	12.5	12.5	217	141.3	45
7400	96.2	135.5	0.63	83.1	12.2	12.2	221	146.1	46
7500	96.7	138.1	0.61	82.2	12.4	12.4	223	146.8	46
7600	96.7	139.9	0.61	82.6	12.5	12.5	225	146.8	46
7700	97.3	142.6	0.59	81.2	12.8	12.8	227	147.8	46
7800	99.3	147.5	0.57	82.5	12.8	12.8	230	150.9	46
7900	100.1	150.6	0.59	87.6	12.1	12.1	232	152.1	46
8000	99.9	152.2	0.61	91.3	11.7	11.7	234	151.9	45

8100	98.7	152.2	0.62	92.1	11.7	236	150.1	45
8200	94.2	147.1	0.66	94.1	11.6	239	143.3	45

An impromptu check of the decibal meter showed a 2 dbA gain in sound over the stock pipe and stock silencer. Certainly among the quietest silencers I've heard on a snowmobile, the Bender REV CAN should work really well on the trails.

Note the low .60 BSFC data in this test: as mentioned a few paragraphs before this is good for the race your buddy brief 30 second or less lake race runs. Having said that, some people disagree: certain engineers I've spoken with feel that the Series 3 twin with its liquid-cooled crankcase will allow leaner than "normal" jetting. I will continue to push this theory on the trails this winter with another 3000 to 4000 trouble free miles. Given the combination of the DNE ported cylinders, the DynoPort big volume pipe and the Bender "Rev Can" the motor showed us a broad torque curve of 96 ft/lbs at 7400 running all the way to 94 ft/lbs at the 8200 overrev area. Again clutching should be pretty basic which is the next area we'll turn our attention once we get some trails to test with. Now the lake racer can have 100 ft/lb near Mach Z-like torque and have the agility of a ditch-banging sled nearly 140 pounds lighter in weight. Maybe the best of both worlds?!!

As I said at the start of this article, no one single "silver bullet" is the fix for these modern twin cylinder engines. A few horse here with porting, a few more with the pipe, some additional with a silencer and some jetting add up to **15HP over stock 800HO Rotax engines**. Patience is necessary when stage-tuning and these small individual "tuning pieces" would be difficult to detect without a fully-instrumented engine testing lab like Jim has at DynoTechResearch.

Our customers with older standard non-HO 800's should benefit similarly. For more information, please check our website ([www.thesledshop.com](http://www.thesledshop.com)) around January 1 for kit pricing and additional engine options for Ski-Doo 800 and 800HO models.













