

TECHNICAL ANALYSIS

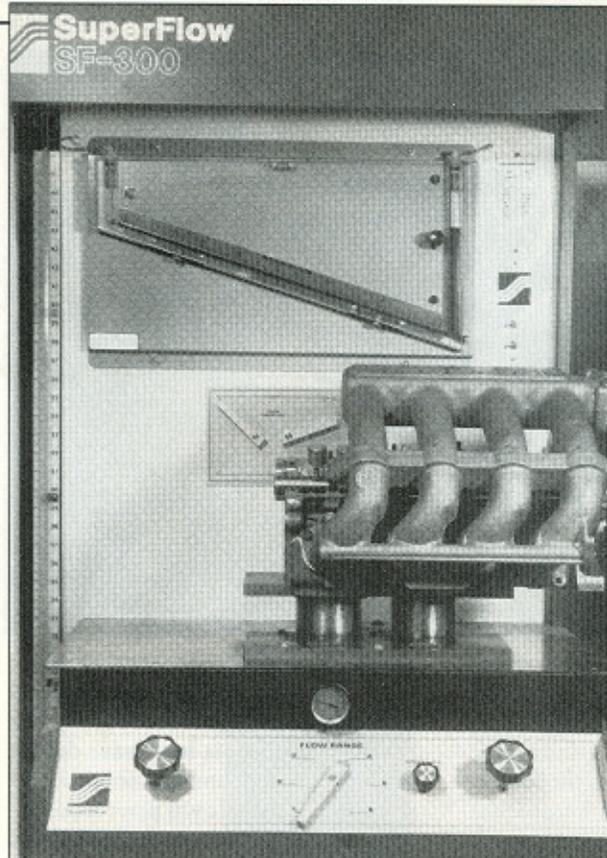
StreetPort 16

A hot tip for VW multi-valve cylinder head performance

The latest hot tip from the Techtonics tuning shop in the coastal beauty of Oregon is a new StreetPort16 cylinder head for 1.8- and 2.0-liter VW 16-valve engines. The new port design yields a peak gain of 17.5 hp at 6500 rpm on the dynamometer and flow improvements of up to 18 percent, yet it retains good low-end torque. Like the StreetPort8 Stage 1 and Stage II cylinder heads, the port work on these 16-valvers is the result of extensive flow bench testing and, very importantly, dynamometer testing. The grind-flow-test cycle is time consuming, but it yields impressive real-world results. Darrel Vittone and ace grinder Colin feel there's really no other way to attack cylinder head work except by measuring and testing each step of the way.

When VW's 1.8 16V engine first came out, the deep breathing of that four-valve-per-cylinder head was an exciting topic of discussion for bench racers everywhere. When VW released a cross-sectional drawing of the head showing the free-flowing ports, it was pretty exotic, exciting stuff. In stock form the head added 24 hp over the 8V GTI motor, and in modified form it seemed that the sky was the limit. The high-revving motor was a bit soft on the bottom end, but the pull at high rpm was consolation enough for the lucky enthusiast.

As time went by, tuners applied their arts to the free-breathing 16V, and the horsepower numbers soared. Shops like Techtonics added a few cubic inches with a bigger bore and stroke, taking the motors out to 2.0L or slightly over. Tuners like Ron's Parts in Canada started selling new 2.0 16V short blocks as they became available. More and more 16V cars were sold and more motors became available, and the 16V was appearing in everything from early Rabbits and Cabriolets to



The SuperFlow bench is an integral part of determining proper cylinder head modifications.

Golfs. Our Project Cabriolet, as example, sports a Techtonics-massaged 1.8 16V pumped out to 2.0L with a Ron's Parts short block.

The usual tuning tricks apply to the 16V, of course—cams, exhaust systems, even larger intake manifolds became available. And the VW factory introduced its own 2.0-liter 16V in 1990, in both A2 chassis cars and the Passat. The cylinder head on the factory 2.0 isn't quite as good as the 1.8 16V head on the intake side but beats it on the exhaust. The finished StreetPort16 does a better job than either the stock 1.8- or 2.0-liter heads on both the intake and exhaust side, due to the improved valve seat cutting and extensive but subtle port reshaping on both the intake and exhaust ports. That added air-flow translates into added horsepower.

The factory 2.0-liter 16V has a 134 hp rating, yet a Techtonics 2.0-liter 16V, based on the stock 1.8 head, makes a minimum of 150 hp on the dyno test. With a StreetPort16, Schrick cams and a SuperSprint exhaust, expect closer to 178 hp from the Techtonics 2.0-liter.

Each StreetPort16 cylinder head is the result of a good deal of hand work. Colin carefully reshapes the ports on the 1.8 16V head, but he does not increase the volume by much. The goal is getting more air through the port, not just hogging things out. Careful porting means that the StreetPort head will have the horsepower

gains at high rpm without any loss in low-end power. Not surprisingly, it takes more skill and experience to make a port flow with a few perfect mods than by just enlarging the entire area without a plan of action.

A Techtonics StreetPort 16V head is \$1000, exchange. After porting, either the 1.8 or the 2.0 head meets the high Techtonics StreetPort16 performance specs. The reasonable price of the StreetPort16s reflects the 12-14 hours of intensive work (not to mention development time) required to produce the heads. That price also includes a flow-improving three-angle valve job, new OEM-quality silicon-bronze tapered valve guides, genuine German Elring Viton™ valve stem seals, and precision assembly. A certification sheet with the flow test numbers from the SuperFlow flow bench is available. Techtonics keeps a spec sheet record on file for each head they port. Quality German head gaskets and gasket sets and RaceTech high-performance cylinder head studs (highly recommended) are available at extra cost.

Techtonics does its flow testing on a SuperFlow SF-300 bench, good for up to 450 cu ft of air a minute. When testing a VW head, Techtonics uses less than half of the potential flow. Like the Pro Stock drag racers, Techtonics tests the flow at 28 in. of water, which The Serious Guys feel give the most accurate results. Flow bench data is no guarantee of added horsepower, but it is a very good indicator. And some head modifications may not show on a flow bench, but will reveal themselves on the dyno—for better or worse. Techtonics testing program has both ways covered.

When something is happening, it's real-

ly happening. That's the way it is with cylinder head development at Techtonics. Would you believe the old tried and true 1.8 8V dyno motor, with six years of dyno runs, is now making the kind of horsepower previously possible only from a 2.0? The reason for the magic? Colin's latest StreetPort8 cylinder head. We'll bring you the details next issue about this latest Techtonics magic.

But something wasn't exactly right...

The factory-rated horsepower for the 2.0-liter version of the 16V is only 134 hp, a mere 9 hp increase (7 percent) for an increase in engine size of about 10 percent. That's with the new CIS-Motronic engine management system. The stock 2.0-liter's power falls far short of the minimum 150 hp that every Techtonics-built stroked and bored 1.8-derived 2.0-liter

makes on the dyno.

The reason for the difference with the 2.0 cylinder head became apparent when Colin first took a look at the 2.0 16V head. The 2.0 port is visibly smaller. The divider between the ports is quite thick, and halfway down the port, the port floor is raised. The difference is measurable as well as visible, with the stock 2.0 16V intake port volume measuring an average of 11cc smaller than the typical 1.8 16V intake port, or about ten percent smaller. Volume isn't everything, of course: Flow is what it's all about. The 2.0 16V head falls down here on the intake side. Techtonics tested the head on their SuperFlow bench and found that an "out-of-the-box" 2.0 16V head measured 167.9 cfm at .350 in. of valve lift, in contrast to a factory 1.8 head with a flow of 181 cfm at the same lift. On the exhaust side, the 2.0's head flows better than the 1.8. At .350 in. of valve lift, the exhaust port of the 2.0 flows 138.3 cfm, while the 1.8 head flows only 125.3 cfm.

Why would VW downsize the ports? We really don't know. The typical reason for this kind of design change is to increase "elasticity" for more low-end

torque and driveability. Any number of other factors could have come into play, too. We do know that a 2.0-liter block with a 1.8 head has excellent low-end torque, and we certainly don't mind the added power at the top end! It's clear that adding a Techtonics Tuned StreetPort16 head will make a great engine even better.

16V Port Volume Comparison

Stock 1.8 16V head

intake port volume: (120.0 cc)

Ported 1.8 16V head intake port

volume: 122.6 cc (2.6 cc larger)

Stock 2.0 16V head intake port

volume: 109.0 cc (11.0 cc smaller)

Techtonics Tuning Volkswagen 16V Cylinder Head Flow

Lift: Stock Cam: .355-inch 380-inch on Eurocam
Intake port flow testing on SuperFlow Flow bench at 28-inches

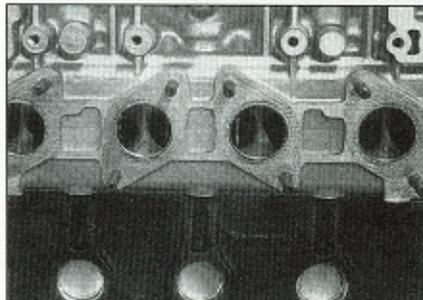
Valve Lift	.100-in	.150-in	.200-in	.250-in	.300-in	.350-in	.400-in
1.8 16V head	75.7	107.8	138.2	161.2	175.3	181.0	183.4
2.0 16V head	67.7	101.4	130.7	143.3	163.2	167.9	171.1
TechtonicsTuned StreetPort16	75.8	110.9	146.5	175.0	190.6	199.1	209.4
1.8 vs 2.0 16V	-8.0	-6.4	-7.5	-17.9	-12.1	-13.1	-12.3
	-12%	-6%	-6%	-12%	-7%	-8%	-7%
StreetPort16 vs 1.8	0.1	3.1	8.3	13.8	15.3	18.1	26.0
	+0%	+3%	+6%	+8%	+8%	+9%	+12%
StreetPort16 vs 2.0	8.1	9.5	15.8	31.7	27.4	31.2	38.3
	+11%	+9%	+11%	+18%	+14%	+16%	+18%

Exhaust port flow testing on SuperFlow Flow bench at 28-inches

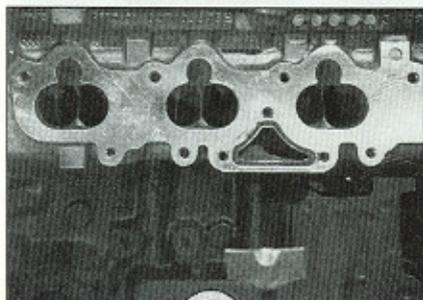
Valve Lift	.100-in	.150-in	.200-in	.250-in	.300-in	.350-in	.400-in
1.8 16V head	67.4	96.1	114.9	121.1	124.2	125.2	126.3
2.0 16V head	60.9	91.1	115.9	129.3	136.5	138.3	140.8
TechtonicsTuned StreetPort16	66.8	99.2	125.4	138.7	152.3	160.2	165.6
1.8 vs 2.0 16V	-6.5	-5.0	1.0	8.2	12.3	13.1	14.5
	-11%	-5%	+1%	+6%	+9%	+9%	+10%
StreetPort16 vs 1.8	-0.6	3.1	10.5	17.6	28.1	35.0	39.3
	-1%	+3%	+7%	+10%	+15%	+18%	+19%
StreetPort16 vs 2.0	5.9	8.1	9.5	9.4	15.8	21.9	24.8
	+8%	+7%	+6%	+5%	+8%	+11%	+12%

Ratio exhaust to intake

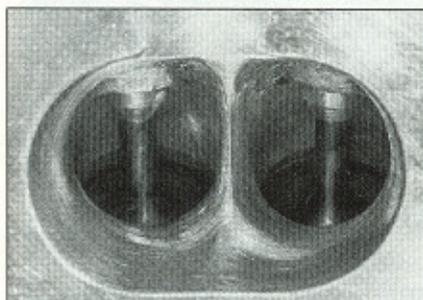
1.8 16V head	89%	89%	83%	75%	71%	69%	69%
2.0 16V head	90%	90%	89%	90%	84%	82%	82%
TechtonicsTuned StreetPort16	88%	89%	86%	79%	80%	80%	79%



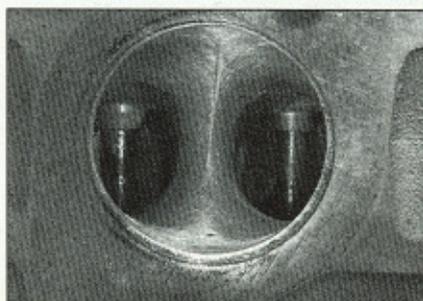
Exhaust ports after Techtonics technicians were through.



16V intake ports ready for some heavy breathing.



Goal was not to just increase port diameter but also to redirect flow.



Techtonic's attention to detail results in a smooth, clean surface.