

Disclaimer: The author does not represent a professional head porting service, nor is the author well versed in head porting procedures and techniques. The following information is provided just to help give a basic understanding to consumers and enthusiasts, plus hopefully stimulate future studies.

Harley-Davidson Twin Cam Heads Flow Bench Study

Harley-Davidson began manufacturing the 88 cubic inch Twin Cam engine for the 1999 model year of some of their “Big Twin” motorcycles. By the 2000 model year, all the “Big Twin” line was converted to the Twin Cam (except CVO FXR’s). The Twin Cam engine platform is still being offered by HD today, only now the engine is factory available as a 96 cubic inch.

This study will provide basic reference to flow bench data and the cause affect relationship between the additions of necessary components to the over all flow potential of the TC cylinder head. Please note: the study is about flow potential on a flow measuring bench, not necessarily the power or performance potential of those same components on another test fixture (dynometer) although the relation may be there (but that’s another study).

Another important note is not all flow bench tests will correspond with one another when comparing flow sheets. The intake inlet apparatus for the intake port and the pipe apparatus used for the exhaust port can greatly affect readings. Some information provided in this study was borrowed from other published sources to give a “relative” reading to correspond to actual tested data performed by Dwight Barry of Syke Performance. All the comparison testing by components was tested courtesy by Dwight Barry of Syke Performance (HTT tag: panheadred) and shared with the author for the benefit of the reader.

Direct conclusions should not be made in respect to valve size and flow potential rates based on the information provided in this study of non-stock configurations. Port sizes and diameters are not specified in this study, and can greatly affect the potential flow rates of the heads in general.

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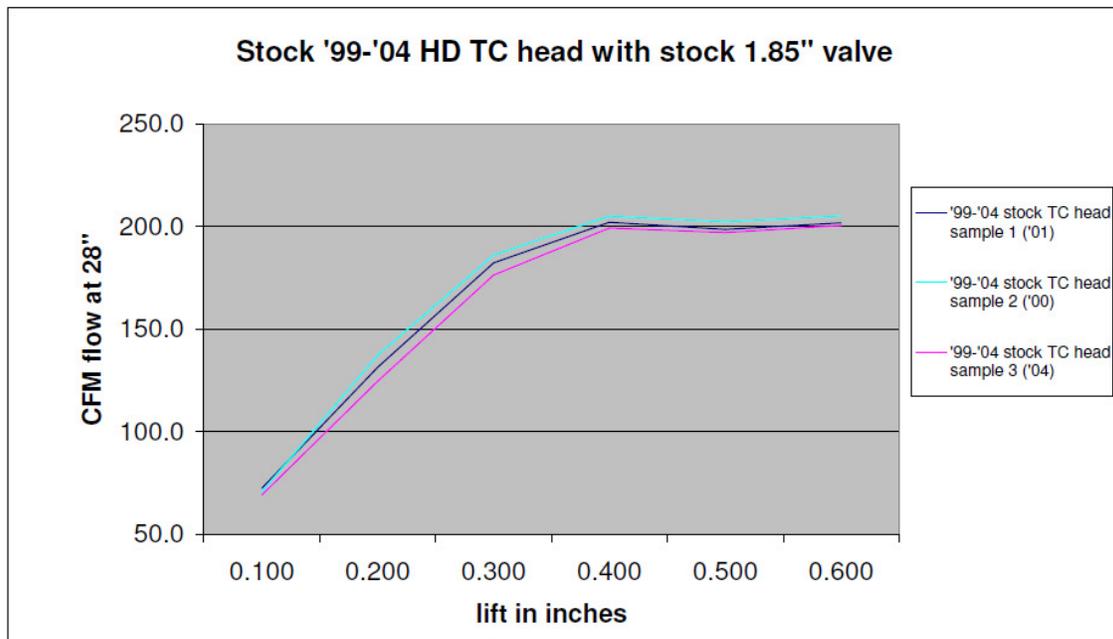
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Section 1: Stock TC heads

'99-'04 TC Head

The heads on TC engines from 1999 to 2004 were from the same casting. These heads came with 5/16" valve stems with 1.85" intake valves and 1.565" exhaust valves controlled by coil springs with about a .510" cam lift limit when using stock rockers. The last digit of the casting number for these casting heads is -99.

'99-'04 TC Head Flow



graph 1

Syke Performance '01		
	28"	10"
	1.85"	
Lift		
0.100	72.5	43.36
0.200	131.5	78.64
0.300	182.3	109.02
0.400	202.1	120.86
0.500	198.6	118.76
0.600	201.8	120.68

Syke Performance '00		
	28"	10"
	1.85" int	
Lift		
0.100	70.7	42.28
0.200	137.4	82.17
0.300	186.1	111.29
0.400	205.1	122.65
0.500	202.3	120.98
0.600	205.2	122.71

Syke Performance '04		
	28"	10"
	1.85" int	
Lift		
0.100	69.2	41.38
0.200	124.7	74.57
0.300	176.4	105.49
0.400	199.3	119.18
0.500	197.1	117.87
0.600	200.6	119.96

table 1

The above data was collected from three different -99 casting heads of different year vintages. All of this data was tested on the same flow bench by the same operator. One can expect variances from head to head due to casting variations.

'05 TC Head

The heads were from the same casting as the previous years, but they came with smaller 7mm valve stem with 1.805" intake valves and 1.575" exhaust valves controlled by beehive springs which could accommodate higher than .510" cams. Although, there is no additional flow potential as cast with the greater lift ability. Since these were only available one model year and availability is limited, we did not include flow data in this study.

'06 and up TC Head

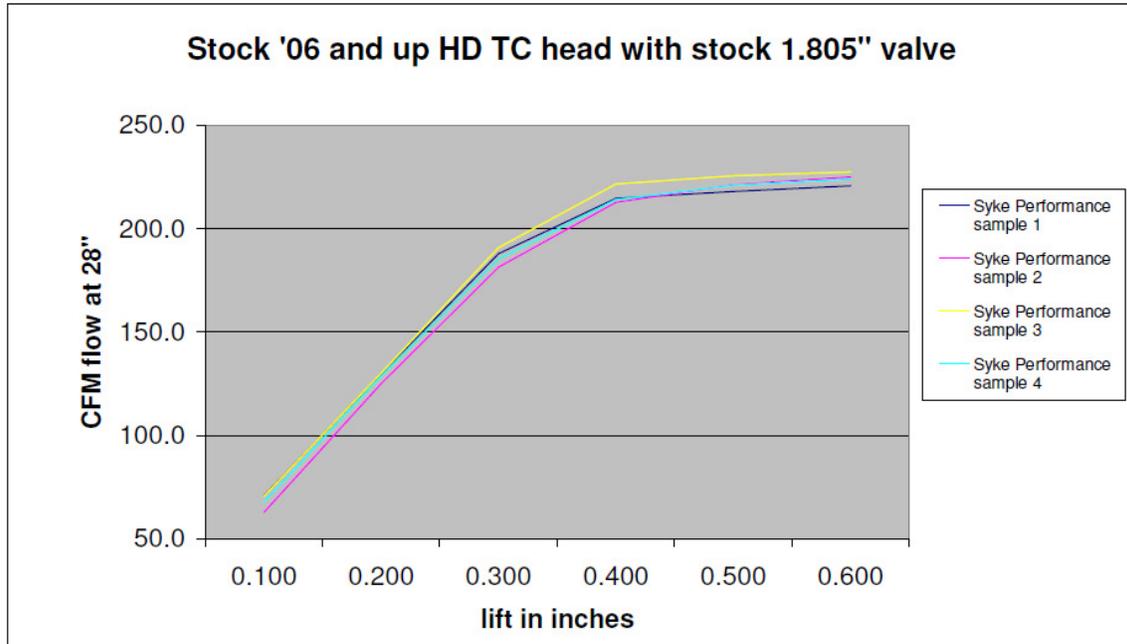
Starting the 2006 model year, the head casting changed. The intake and exhaust ports were re-shaped and the stock head flow potential was improved from the earlier -99 castings. These new castings were paired up with the smaller 7mm valve stems and beehive springs introduced the previous model year. The intake manifold mounting area also changed between the -06 castings and earlier. To use these heads on pre-2006 Twin Cams newer style manifold clamps must be purchased.



Picture 1: Flange on the left is old style; flange on the right is new symmetric style.

With the exception replacing the old style intake manifold flange to the newer symmetric flange **26993-06**, the -06 casting heads are a direct bolt on as a replacement for the previous castings.

'06 and up TC Head Flow



graph 2

Syke Performance sample 28" 10" stock 1.805" int		
Lift		
0.100	70.8	42.34
0.200	129.7	77.56
0.300	187.9	112.36
0.400	214.7	128.39
0.500	218.0	130.36
0.600	220.7	131.98

Syke Performance sample 28" 10" stock 1.805" int		
Lift		
0.100	62.8	37.55
0.200	125.1	74.81
0.300	181.4	108.48
0.400	212.7	127.19
0.500	221.3	132.34
0.600	225	134.55

Syke Performance sample : 28" 10" stock 1.805" int		
Lift		
0.100	70.5	42.16
0.200	130.1	77.80
0.300	190.8	114.10
0.400	221.6	132.52
0.500	225.6	134.91
0.600	227.4	135.99

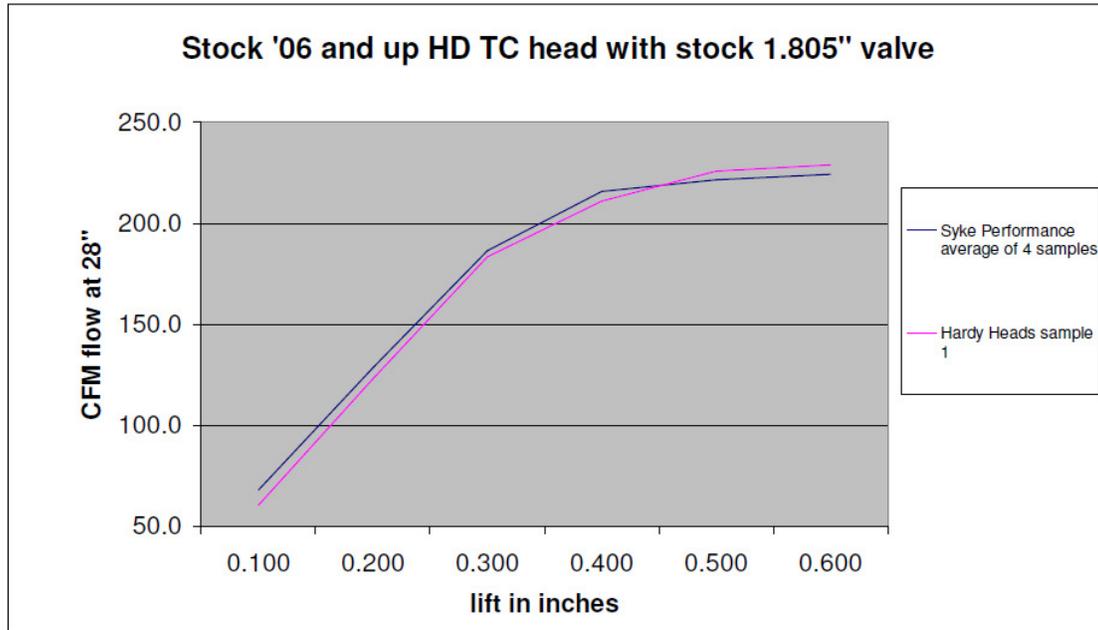
Syke Performance sample 28" 10" stock 1.805" int		
Lift		
0.100	67.7	40.48
0.200	128.8	77.02
0.300	185.3	110.81
0.400	214.1	128.03
0.500	221.0	132.16
0.600	223.9	133.89

table 2

All the data in table 2 was obtained through testing by Syke Performance. The data is four separate tests of four separate castings. Since all the tests were done on the same machine using the same fixtures, any variant in CFM flow can probably be attributed to casting variations.

Despite the limited variations between these four samples, no assumptions should be made that all casting variations will be this limited.

'06 and up TC Head Flow: Comparison



graph 3

Syke Performance			
AVG	28"	10"	
stock	1.805"		
Lift			
0.100	68.0	40.63	
0.200	128.4	76.80	
0.300	186.4	111.44	
0.400	215.8	129.03	
0.500	221.5	132.44	
0.600	224.3	134.10	

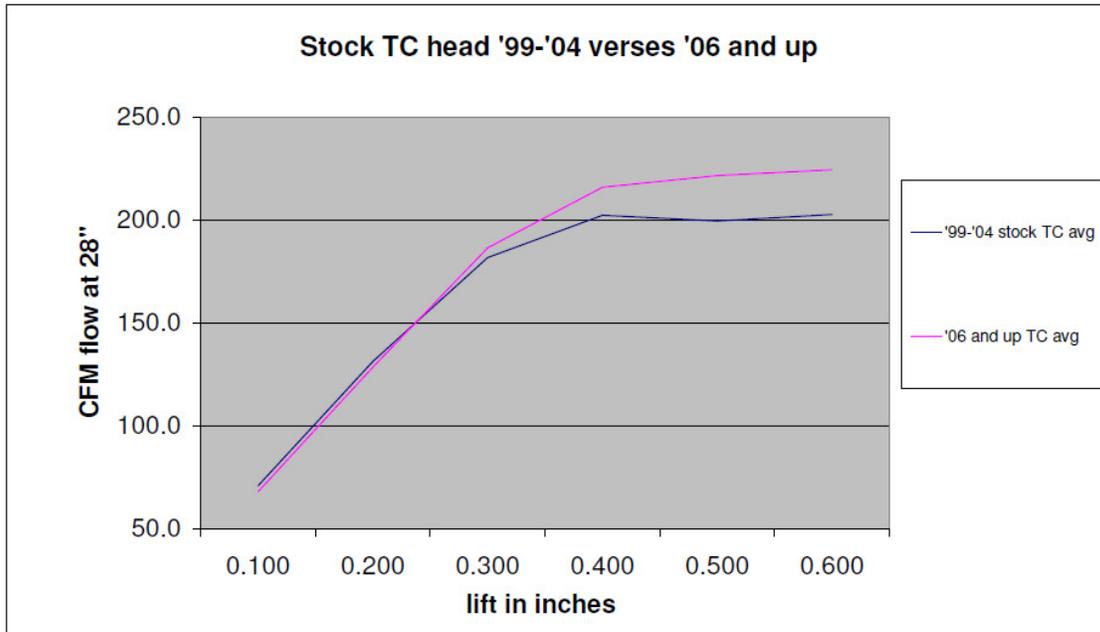
Hardy Heads stock			
	28"	25"	10"
stock	1.805" int		
Lift			
0.100	60.4	57	36.13
0.200	123.0	116	73.53
0.300	183.4	173	109.66
0.400	210.9	199	126.14
0.500	225.8	213	135.02
0.600	229.0	216	136.92

table 3

In table 3 two separate flow rates are compared from two different operators on two different flow benches. The Syke Performance data was the average of the rates in table 2. The data in the Hardy Heads column was obtained from information that Larry Hardy posted on MSN: *Harley Tech Talk* on 2/21/2008. The data on the original work sheet that Larry posted was obtained at 25" of water. This information was converted to 28" based on a rate of 25" data multiplied by 1.06.

Graph 3 demonstrates a noticeable difference between the Syke information and the Hardy information. The difference could possibly be attributed to casting variations, but it's the author's uneducated opinion that this is probably a result in differences between intake fixtures since the basic flow rates are +/- about the same CFM's on the extremes. Does this make either flow bench inaccurate? No, since the common practice is for the head porter to check their own work with their own equipment. The data then becomes relative to the tester. Despite the noticeable difference in min and max values, the overall shape of the curve is indication enough that both testers were using similar techniques.

Conclusion: Old Casting verses New



graph 4

99-'04 stock TC head			06 stock TC head flow		
AVG	28"	10"	AVG	28"	10"
	1.85" int		stock	1.805"	
Lift			Lift		
0.100	70.8	42.34	0.100	68.0	39.86
0.200	131.2	78.46	0.200	128.4	76.35
0.300	181.6	108.60	0.300	186.4	109.75
0.400	202.2	120.90	0.400	215.8	127.36
0.500	199.3	119.20	0.500	221.5	132.10
0.600	202.5	121.11	0.600	224.3	134.12

table 4

* all testing was done by Syke Performance and was tested at 28"

The data in table 4 is a flow rate comparison between the old TC casting and the newer - 06 castings. The data in the old casting column was the average of the data in table 1. The data in the 06 casting was the average of the data in table 2. These tests were performed by the same operator on the same machine. Therefore this should be a relatively fair comparison of the two different castings. As apparent by the chart, the newer castings do show a somewhat significant flow advantage over the old castings. The old casting seemed to plateau at .400" of valve lift, where the newer castings don't plateau until after .500" of valve lift. The other interesting note is the newer casting heads have a greater flow potential over the old casting heads despite the newer heads having a .045" smaller intake valve.

The reader should also be careful not to draw the conclusion from this study that the newer heads are an all around better head regarding further head work. The new castings may make it easier, and sometimes cheaper, for head porting professionals to reach suitable levels for most mild performance upgrades, but many head porters still prefer the old style when high performance results are desired. This author recommends discussing options with your head porting professional before buying cores.

Section 2: Flow Potential Based on Component

In 2008, Dwight and I lent a couple of carburetors and manifolds to Bruce Woltz (MSN HTT tag: monkeywithlobo; new HTT tag: maxheadflow) for continuation of his “**Carb Shoot-Out**” series, namely the third in that series. This particular section can possibly be viewed as a continuation of that study, since this study also involves carburetors. The complete three part series of the “**Carb Shoot-Out**” can be downloaded here: <http://www.box.net/shared/fvrk3fyhww> (hosted courtesy of FSG) or each series can be viewed individually on www.harleytechtalk.net in the *Tech Tip & Links* section.

The majority of this study’s series of tests involved the stock CV40 and the popular upgrade SE CV44 which is commonly used for 95” TC carburetor builds.

Bruce’s study was tested reported at 10” H₂O, so to give relevance to this study the data was converted to 28” H₂O:

	Run #	CV40	Run #	CV44	Run #	HSR42	Run #	HSR45
Stock	21	131.7	22	NA	23	142.1	24	NA
SE	25	127.0	26	139.3	27	142.5	28	150.7
SE 1.70	29	130.8	30	139.3	31	147.8	32	154.4
G with adapter	33	137.4	34	154.4	35	151.6	36	163.9

Table 5 Carbs on Manifolds

* all flow data converted to 10" from 5"
 Table 5 data aquired from: B. Woltz, 2008, *Carb Shoot Out 3*

Converted 10" cfm to 28" cfm: using 10" data multiplied by 1.67	10"	28"	flow increase
Stock CV40 carb on stock manifold	131.7	219.9	
SE CV44 on SE manifold	139.3	232.6	5.77%
Mik HSR42 on stock manifold	142.1	237.3	7.90%

Table 6 Carbs on Manifolds converted to 28" H₂O

To summarize, based on the above table:

1. The stock CV40 carburetor has a max flow potential of 219.9 cfm on the manifold.
2. The SE CV44 carburetor on the SE manifold has almost a 6% increase in flow potential over the stock CV40 on the stock manifold.
3. The Mikuni HSR 42mm (Mik42) carburetor on the stock manifold had a greater flow potential than the SE CV44, and was almost 8% greater than the stock CV40 on the same stock manifold.

Section 2: Flow Potential Based on Component Test Procedures

For this study's series of tests the throttle control plates was wired open on the CV carburetors, but the slide was allowed to be lifted open by the flow bench. This will explain why the .100" lift numbers dropped on some of the tests with these carburetors, although the conditions are generally corrected by .200" lift as made apparent by the tables. This is the standard practice on the CV carburetors tested unless specified in a particular test.



Picture 2: Harley-Davidson Constant Velocity (CV) Carburetor

The Mik42 had the throttle slide wired open as well for these tests. The Mik42 has a mechanically controlled slide which does not need vacuum to be raised, therefore the results obtained when performing tests with this carburetor were relative to wide open throttle flow restrictions. For this study's tests, the Mik42 was only tested on the stock CV40 manifold. The results may have been higher if the SE manifold were used in the tests, but the common practice is for the use of the stock manifold when engine builders use this carburetor.

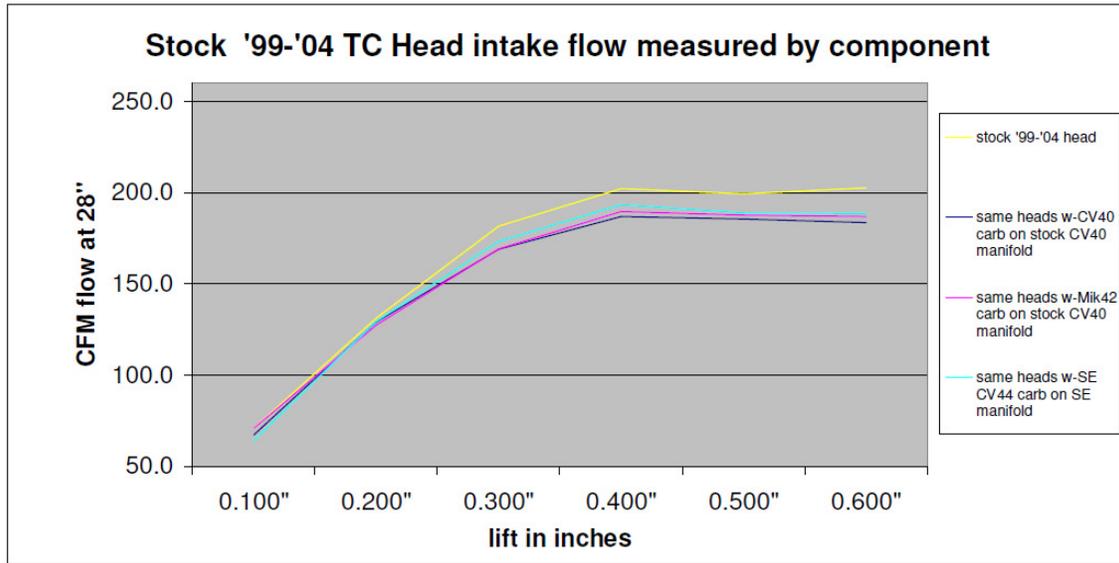


Picture 3: Mikuni HSR42 42mm Carburetor (shown with AC adapter)

The manifold that was used for the "stock" was the '99-'05 stock manifold, since the sock -06 manifold has limited availability since it was only available for one model year (2006). The SE manifold used this was the Screamin' Eagle TC manifold 29635-99. Originally the bare manifolds flow potentials were included in these tests, but the differences were so minimal that we decided to exclude the data from some of the graphs.

The ported heads listed in this section of the study have port sizes that are stock or close to stock (+1.5% or so). The purpose of this particular study is to illustrate the affect of flow potential of a particular set of heads on overall carburetor/manifold combination in flow potential. The reader should be careful not to draw conclusions that the potential listed in a particular test is the maximum potential for that particular combination.

Stock '99-'04 TC Head Flow Based on Component



graph 5

Lift	stock '99-'04 heads 1.85" int valve baseline	stock CV40 manifold - CV40 carb	stock CV40 manifold - w/Mik42mm carb	SE CV44 manifold - CV44 carb
0.100"	70.8	67.2	70.8	64.1
0.200"	131.2	129.0	127.4	129.5
0.300"	181.6	168.9	169.1	173.2
0.400"	202.2	186.9	189.7	193.3
0.500"	199.3	185.5	187.7	188.9
0.600"	202.5	183.55	186.9	188.4

table 7

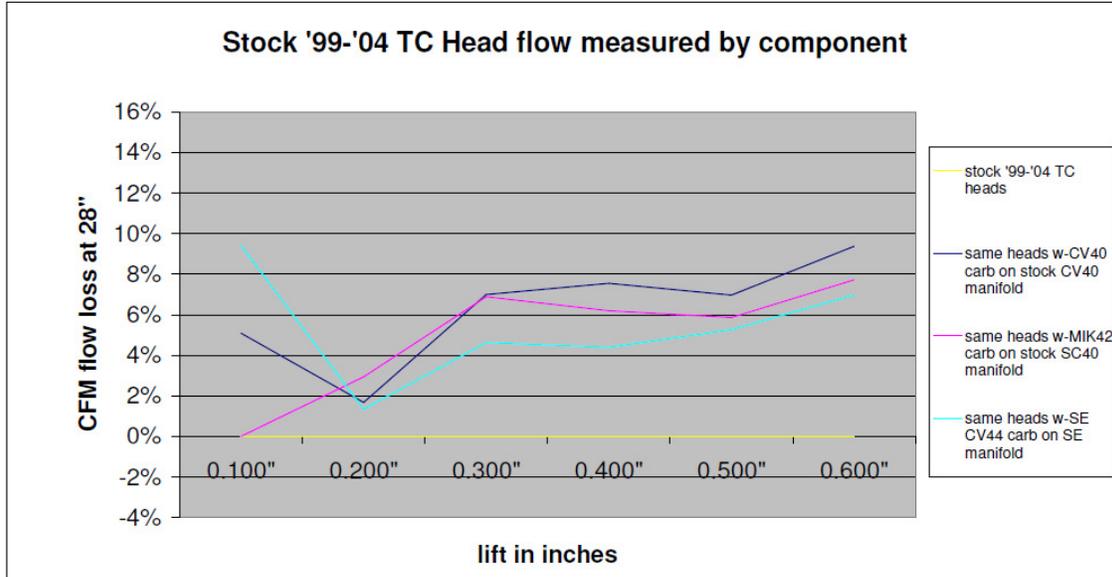
Test data was based on an average of the values between 3 same casting heads

* all testing was done by Syke Performance and was tested at 28"

Table 7 represents data collected from running three commonly used carburetor and manifold combinations on the stock -99 casting heads. For this test three separate heads were tested and the flow information was averaged per lift increment. These particular heads averaged a maximum flow potential of 202.5 cfm at .600" and according to Bruce's study the stock CV40 on the stock manifold had a maximum flow potential of 219.9 cfm. When the two were combined the maximum flow potential at .600" dropped to 183.5 cfm. The drop in CFM can easily be explained by the longer intake track and the breaks in direct flow that the carburetor mount being perpendicular to the port opening caused.

All three carburetor/manifold combinations were very close in the flow potential based on the various lifts on these particular casting heads. This supports the suggestion that the carburetor choice has little bearing on actual performance of a stock head of this casting, since the two performance carburetors (Mik42 and SE44) showed only a marginal improvement over the stock CV40 carburetor.

The typical safe cam lift limit for these heads is slightly more than .510", so keep in mind any gains (or losses) above that in flow potential are mute points.



graph 6

Lift	stock '99-'04 heads 1.85" int valve baseline	base line	stock CV40 manifold - w/40mm carb	loss %	stock CV40 manifold - w/Mik42mm carb	loss %	SE CV44 manifold - w/44mm carb	loss %
0.100"	70.8	0%	67.2	5%	70.8	0%	64.1	9%
0.200"	131.2	0%	129.0	2%	127.4	3%	129.5	1%
0.300"	181.6	0%	168.9	7%	169.1	7%	173.2	5%
0.400"	202.2	0%	186.9	8%	189.7	6%	193.3	4%
0.500"	199.3	0%	185.5	7%	187.7	6%	188.9	5%
0.600"	202.5	0%	183.55	9%	186.9	8%	188.4	7%

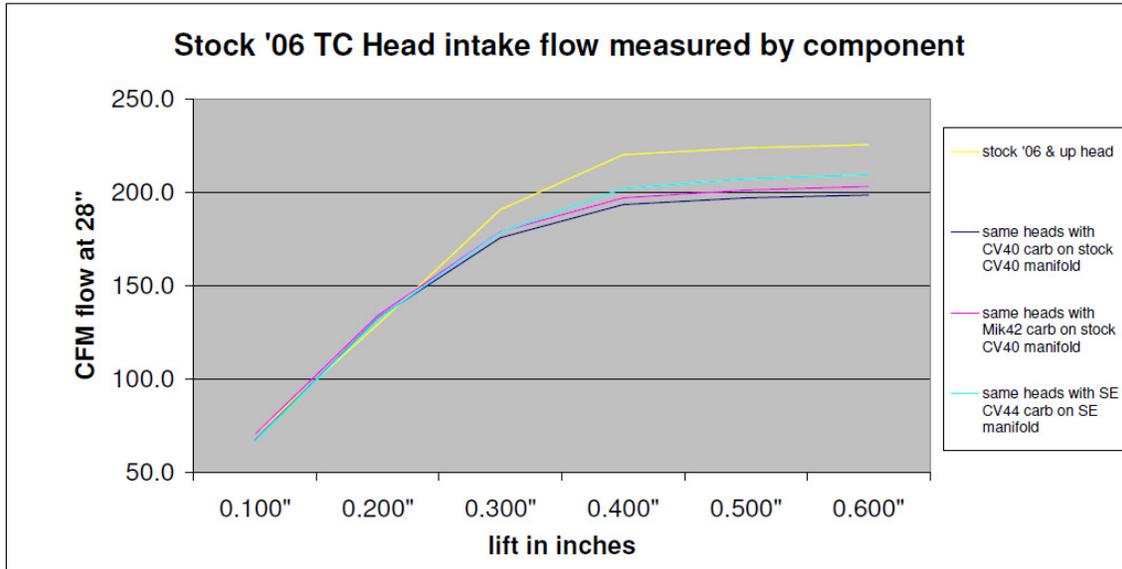
table 8

Table 8 corresponds to the data in table 7, with the only difference being a reference to the percent of flow lost at each .100" valve lift increment based on the original bare head flow data. As mentioned on the test procedures page, the slide was being lifted by the vacuum created by the bench so that explains the greater low lift loss of the CV carburetors compared to the Mik42.

When comparing what's left of the maximum potential from the starting point: the CV44 combination retained 93% of the maximum flow potential of the bare head, the Mik42 retained 92%, and the CV40 combination retained 91%.

The data would suggest that there is far less than the 6%-8% improvement in flow potential that Bruce tested when comparing the performance carburetors to the CV40 on these stock -99 casting heads. The more interesting note is that the CV44 had a greater flow potential than the Mik42, which does not coincide with Bruce's data. The test results not matching Bruce's findings are probably a good indication that the stock carburetor was more than adequate for the flow capabilities of these particular casting of heads.

Stock '06 and up TC Head Flow Based on Component



graph 7

Lift	stock '06 heads 1.805" int valve baseline	stock CV40 manifold - w/40mm carb	stock CV40 manifold - w/Mik42mm carb	SE CV44 manifold - w/44mm carb
0.100"	70.4	67.2	70.5	66.9
0.200"	129.2	132.7	134.0	132.2
0.300"	190.7	175.7	178.8	178.6
0.400"	220.1	193.4	197.0	202.0
0.500"	223.7	196.9	201.1	207.2
0.600"	225.4	198.5	203.15	209.3

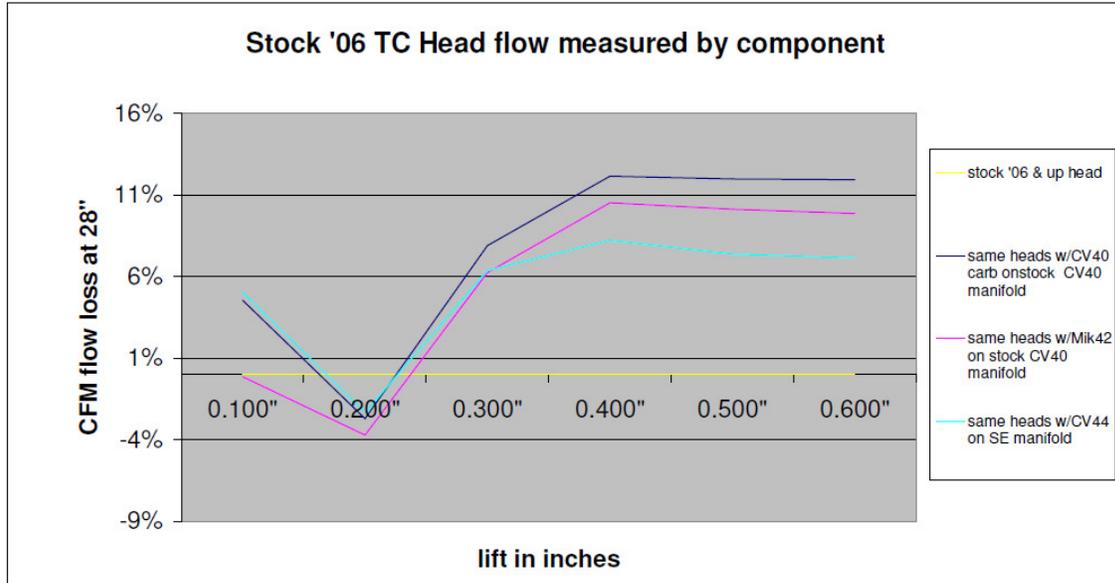
table 9

Test data was based on an average of the values between front and rear heads

* all testing was done by Syke Performance and was tested at 28"

The above data in table 9 was tested on a stock -06 casting head, and all the testing in this table were performed on the same head. As summarized in table 4, this particular casting has a greater flow potential than the -99 casting heads tested in table 7. Since the heads have a greater flow potential, we might expect to start seeing a little more variation in potential created by the carburetor choice. Based on table 9, we are seeing slightly more separation in flow potential than we did with table 7.

This test continues the trend of the CV44 having a greater flow potential than the Mik42. Please note that the Mik42 on the SE manifold may have produced similar results as the CV44 on the SE manifold, but most builders use the stock manifold for the Mik42 so that's how the tests were performed. The SE CV44 on the manifold had a maximum flow potential of 209.3 cfm at .600". The increase in flow potential of the SE CV44 compared to the CV40 as tested on the stock -06 casting heads was 5.2% which is very consistent with Bruce's findings on the bare card/manifold tests. The Mik42 only allowed slightly more than a 2% greater flow potential with these castings compared to the CV40. This may indicate that the CV40 does not create enough of a bottle neck with heads of this flow potential to create a significant need for the Mik42 carburetor in this application.



graph 8

Lift	stock '06 heads 1.805" int valve baseline	base line	stock CV40 manifold - w/40mm carb	% loss	stock CV40 manifold - w/Mik42mm carb	% loss	SE CV44 manifold - w/44mm carb	% loss
0.100"	70.4	0%	67.2	5%	70.5	0%	66.9	5%
0.200"	129.2	0%	132.7	-3%	134.0	-4%	132.2	-2%
0.300"	190.7	0%	175.7	8%	178.8	6%	178.6	6%
0.400"	220.1	0%	193.4	12%	197.0	11%	202.0	8%
0.500"	223.7	0%	196.9	12%	201.1	10%	207.2	7%
0.600"	225.4	0%	198.5	12%	203.15	10%	209.3	7%

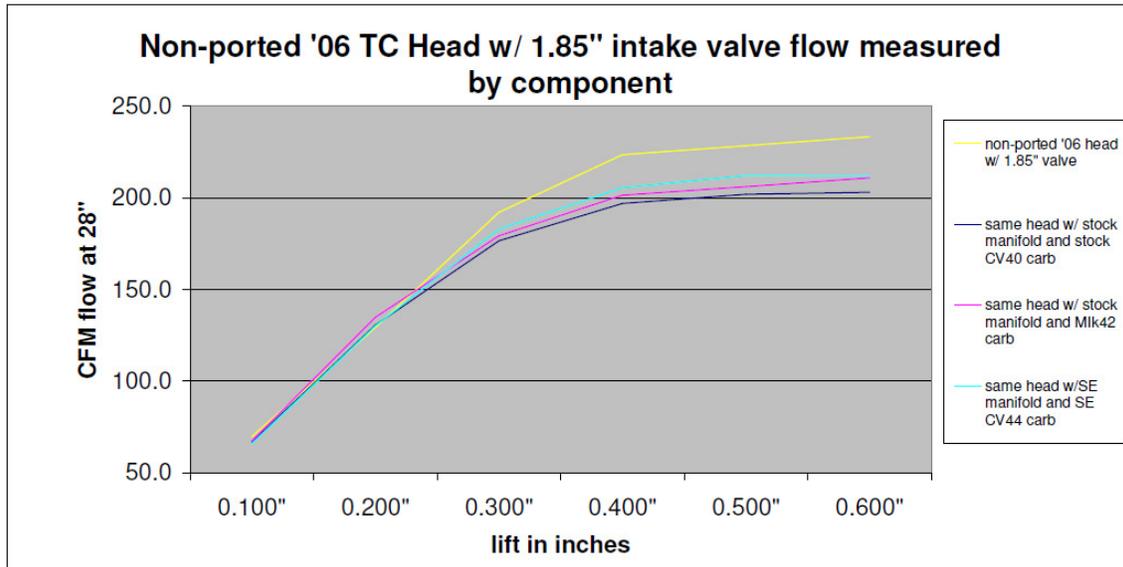
table 10

Test data was based on an average of the values between front and rear heads

Table 10 corresponds to the data in table 9, with the only difference being a reference to the percent of flow lost at each .100" valve lift increment based on the original bare head flow data.

When comparing what's left with from the starting point: the CV44 combination retained 93% of the maximum flow potential of the bare head, the Mik42 combination retained 90%, and the CV40 combination retained 88%.

'06 and up Non-ported w/ 1.85" Valve TC Head Flow Based on Component



graph 9

Lift	non-ported '06 head 1.85" R.I. int valve baseline	stock CV40 manifold - w/40mm carb	stock manifold - w/ MIK HSR42mm carb	SE CV44 manifold - w/44mm carb
0.100"	69.7	66.7	67.3	65.7
0.200"	129.2	130.6	134.8	130.1
0.300"	192.1	176.6	179.3	183.0
0.400"	223.5	196.9	201.5	205.5
0.500"	228.4	202.0	206.1	212.2
0.600"	233.4	203.1	210.9	212

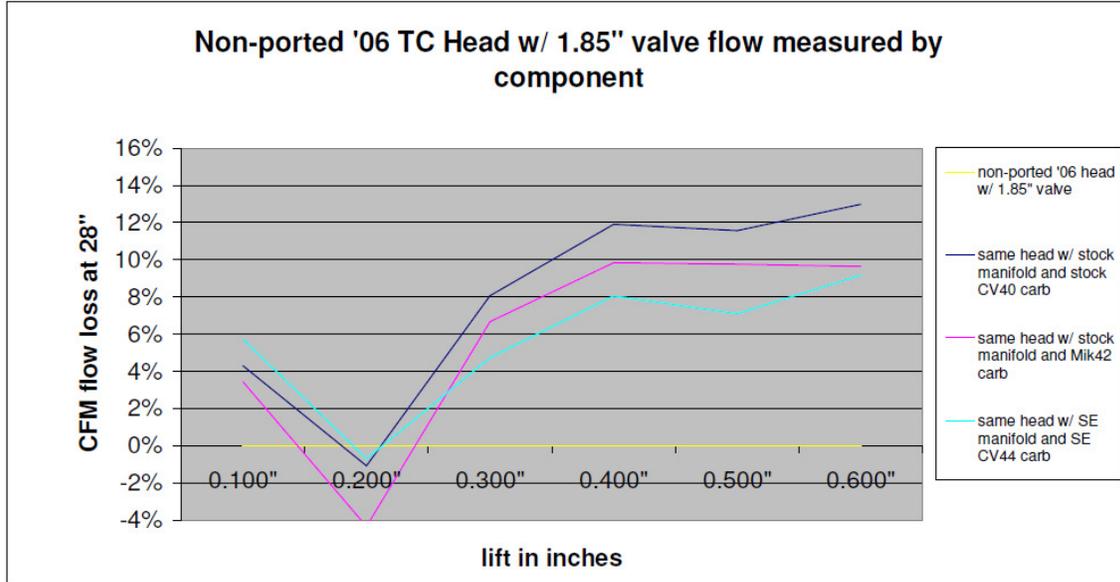
table 11

* all testing was done by Syke Performance and was tested at 28"

This next test is of a head with a slightly more flow potential than the previous test (table 9). The data on table 11 is from an "as cast" port with a 1.85" intake valve installed. The test is to see if trends that developed from the first two tests can be applied to this one. The reader should be careful not to draw conclusions from this example that all -06 head castings or all 1.85" valves installed in those castings will respond with the same flow potential.

Based on Bruce's findings the Mik42 on a stock manifold had a greater flow potential than the CV44 on the SE manifold. In this particular test the two finished out at about the same flow potential at .600" lift, but the Mik42 lagged the CV44 in flow between .400" and .500" openings.

The increase in flow potential of the SE CV44 compared to the CV40 as tested on this test was 4.4% which is somewhat consistent with Bruce's findings on the bare card/manifold tests. The increase in flow potential of the Mik42 was less than 4%, which was not very consistent with Bruce's findings, but seem to follow the trend of the previous tests on this report. The interesting part of the Mik42 flow results was that the Mikuni started out flowing greater than the CV44, but by .300" lift was trailing the CV44 in flow until the valve was fully opened at .600" lift.



graph 10

Lift	non-ported '06 head 1.85" R.I. int valve baseline	base line	stock CV40 manifold - w/40mm carb	% loss	stock manifold - w/ MIK HSR42mm carb	% loss	SE CV44 manifold - w/44mm carb	% loss
0.100"	69.7	0%	66.7	4%	67.3	3%	65.7	6%
0.200"	129.2	0%	130.6	-1%	134.8	-4%	130.1	-1%
0.300"	192.1	0%	176.6	8%	179.3	7%	183.0	5%
0.400"	223.5	0%	196.9	12%	201.5	10%	205.5	8%
0.500"	228.4	0%	202.0	12%	206.1	10%	212.2	7%
0.600"	233.4	0%	203.1	13%	210.9	10%	212	9%

table 12

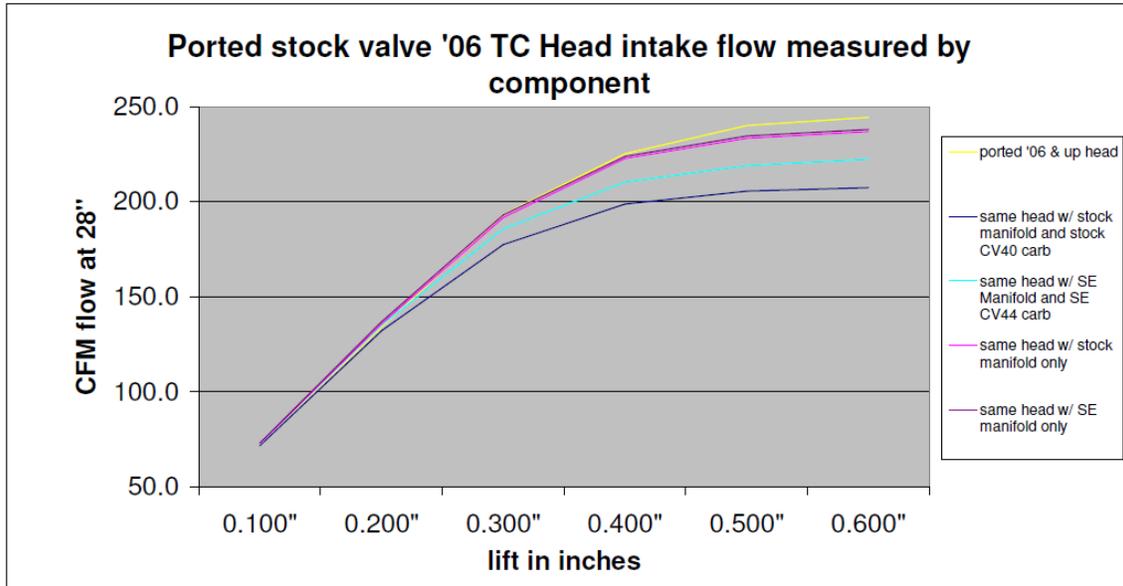
Table 12 corresponds to the data in table 11, with the only difference being a reference to the percent of flow lost at each .100" valve lift increment based on the original bare head flow data. A quick comparison to table 10 and table 8, indicates that the findings are following the previous trends.

When comparing what's left with from the starting point: the CV44 combination retained about 91% of the maximum flow potential of the bare head which is only slightly worse than table 10's findings. This may indicate that the CV44 has yet to be creating a bottleneck in flow.

The CV40 retained 87% of the maximum flow potential of the bare head, which is almost the retention allowed by the CV40 on the stock -06 head.

The Mik42 retained 90% of the maximum flow potential which is consistent with the data obtained from the stock -06 head, but lost a greater % of flow through the .400"-.500" ranges compared to the CV44.

Ported '06 and up Stock Valve TC Head Flow Based on Component



graph 11

Lift	ported '06 head 1.805" int valve baseline	stock CV40 manifold - no carb	SE CV44 manifold - no carb	stock CV40 manifold - w/40mm carb	SE CV44 manifold - w/44mm carb
0.100"	72.3	72.7	72.9	71.5	72.6
0.200"	133.8	135.6	136.8	132.0	134.9
0.300"	193.2	191.6	193.0	177.4	185.6
0.400"	225.2	222.7	223.7	198.7	210.3
0.500"	240.0	233.3	234.5	205.5	218.9
0.600"	244.3	236.8	238.0	207.3	222.3

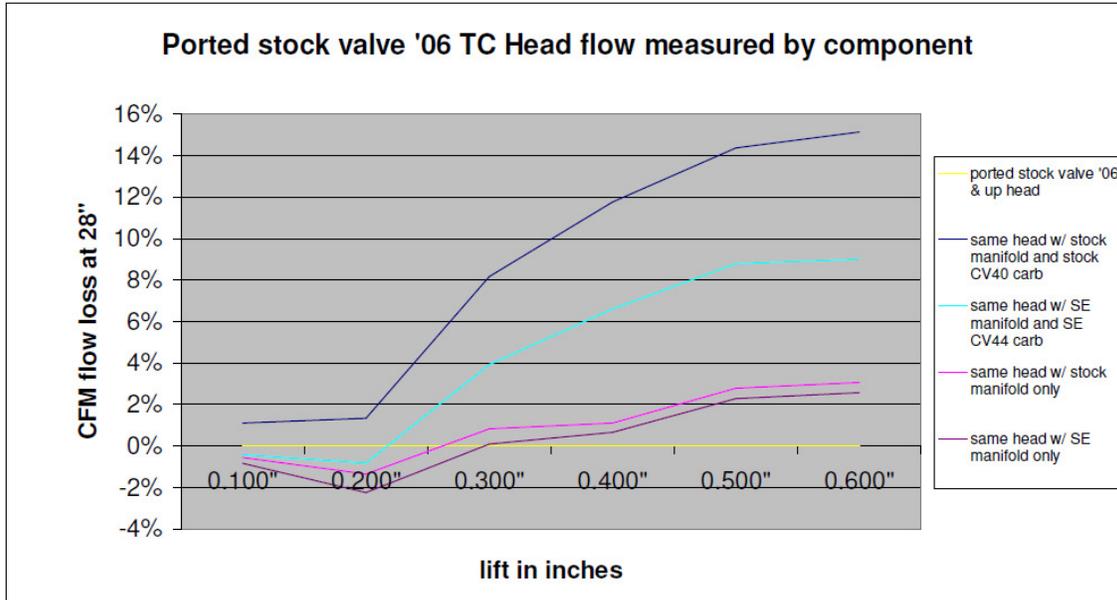
table 13

* all testing was done by Syke Performance and was tested at 28"

The next test is to determine whether the carburetor and manifold combination had an absolute maximum flow potential regardless of head flow potential or if the carburetor and manifold combination's flow potential became relative to head flow potential. Table 13 represents information obtained from a ported set of factory valve size (1.805") -06 casting heads with slightly more flow potential than the previous valve change only test (table 11). The maximum flow potential increased about 19 CFM at .600" compared to the heads tested in table 9.

The Mikuni HSR42 was unavailable for this particular set of tests. The CV40 carburetor on the manifold tested at a flow potential of 207.3 cfm at .600", which was almost 9 cfm greater than this combination's flow potential on the stock heads. The CV44 and SE manifold tested at 13 cfm more flow potential at .600" than that combination did previously in the stock heads.

The increase in flow potential of the SE CV44 compared to the CV40 as tested on this test was 7% which is somewhat consistent with Bruce's findings on the bare card/manifold tests.



graph 12

Lift	ported '06 head 1.805" int valve baseline	base line	stock CV40 manifold - no carb	% loss	SE CV44 manifold - no carb	% loss	stock CV40 manifold - w/40mm carb	% loss	SE CV44 manifold - w/44mm carb	% loss
0.100"	72.3	0%	72.7	-1%	72.9	-1%	71.5	1%	72.6	0%
0.200"	133.8	0%	135.6	-1%	136.8	-2%	132.0	1%	134.9	-1%
0.300"	193.2	0%	191.6	1%	193.0	0%	177.4	8%	185.6	4%
0.400"	225.2	0%	222.7	1%	223.7	1%	198.7	12%	210.3	7%
0.500"	240.0	0%	233.3	3%	234.5	2%	205.5	14%	218.9	9%
0.600"	244.3	0%	236.8	3%	238.0	3%	207.3	15%	222.3	9%

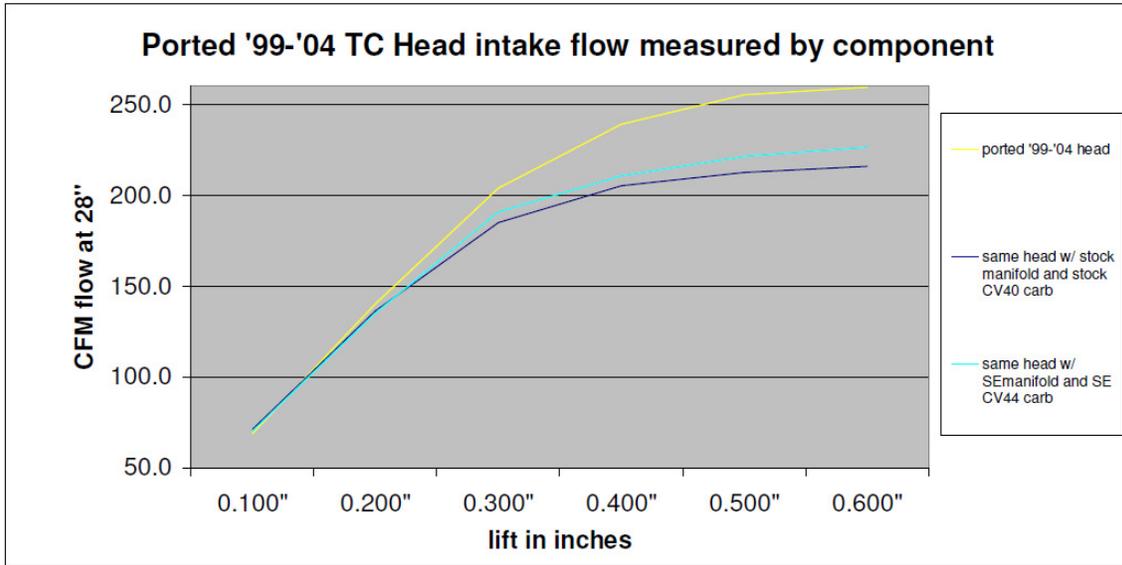
table 14

Table 14 corresponds to the data in table 13, with the only difference being a reference to the percent of flow lost at each .100" valve lift increment based on the original bare head flow data. A quick comparison to table 12 indicates that the percent of flow potential lost is increasing for the CV40 and manifold combination, which may indicate that this combination is creating a bottleneck in the system.

The CV44 and SE manifold has about the same percent of peak loss indicated in table 12. This may indicate that the CV44 combination is capable supporting a set of higher flow potential heads before creating a bottle neck.

When comparing what's left with from the starting point: the CV44 combination retained 91% of the maximum flow potential of the bare head which is only a slight loss from the stock head test and the previous test, but the CV40 combination retained more than 3% less compared to the stock head and finished at 84.8% of the maximum potential of these heads. The increasing rate of loss is a sure indicator of the CV40 creating a bottle neck with heads of this flow potential.

Ported '02 TC Head with 1.9" Intake Valve Flow Based on Component



graph 13

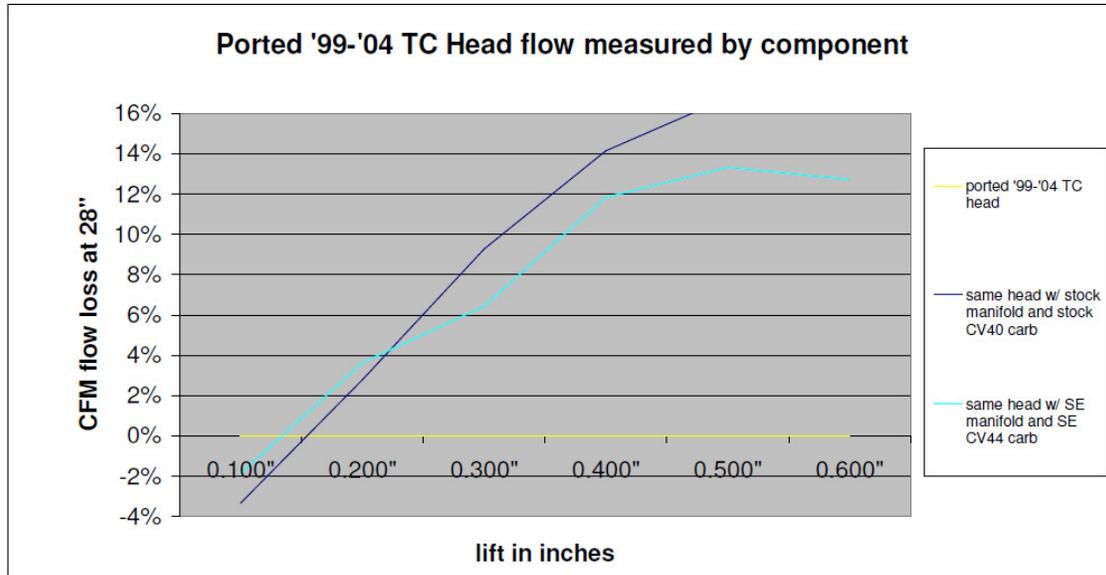
Lift	ported '02 head 1.9" int valve baseline	stock CV40 manifold - CV40 carb	SE CV44 manifold - CV44 carb
0.100"	68.9	71.2	70.2
0.200"	140.2	136.3	135.1
0.300"	203.8	184.9	190.7
0.400"	238.9	205.1	210.6
0.500"	255.2	212.4	221.2
0.600"	259.3	215.8	226.3

table 15

* all testing was done by Syke Performance and was tested at 28"

The data on table 15 is from a ported '02 TC head (-99 casting) with a 1.9" intake valve. This test is of a head with higher flow potential than the previous tests. The CV40 was used in this test, although most builders would not recommend using the stock CV40 carburetor with heads of this potential. The Mikuni 42 was not available for this test, and the manifold portion of the tests were also dropped since all previous manifold tests confirmed that the manifold was not a significant source of obstruction in flow.

The increase in flow potential of the SE CV44 compared to the CV40 as tested on this test was 4.8% which is somewhat consistent with Bruce's findings on the bare card/manifold tests.



graph 14

Lift	ported '02 head 1.9" int valve baseline	base line	stock CV40 manifold - w/40mm carb	% loss	SE CV44 manifold - w/44mm carb	% loss
0.100"	68.9	0%	71.2	-3%	70.2	-2%
0.200"	140.2	0%	136.3	3%	135.1	4%
0.300"	203.8	0%	184.9	9%	190.7	6%
0.400"	238.9	0%	205.1	14%	210.6	12%
0.500"	255.2	0%	212.4	17%	221.2	13%
0.600"	259.3	0%	215.8	17%	226.3	13%

table 16

* all testing was done by Syke Performance and was tested at 28"

Table 16 corresponds to the data in table 15, with the only difference being a reference to the percent of flow lost at each .100" valve lift increment based on the original bare head flow data. A quick comparison to the previous percent of loss graphs indicates that the flow loss percentage is increasing for both carburetors.

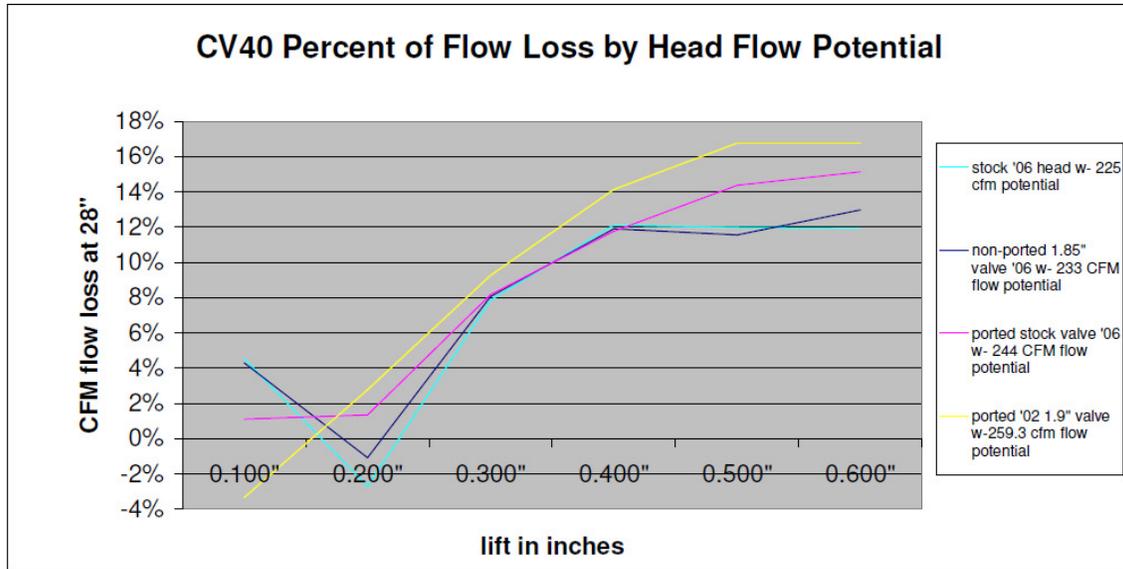
When comparing what's left with from the starting point: the CV44 combination retained the same 87% of the maximum flow potential of the bare head which is over a 4% drop from the lower flow potential heads. This may indicate that the CV44 is becoming a bottleneck in the system with these higher flowing heads. The CV40 retained only 83% of the maximum flow potential of the bare head.

Section 2: Conclusion

Based on the findings of this study, the carburetor choice becomes much more critical as the head flow potential increases. This isn't meant to suggest that cam choice isn't going to factor into the equation. The CV40 carburetor may be suitable for mild most builds, but this particular carburetor limits the flow potential of the higher flow potential heads substantially. The Mik42 and CV44 are more suitable choices for increased performance applications than the CV40, but they also have their limits as well. As with any performance build, the safe advisement is to match the components with build expectations. These components include fuel delivery system, exhaust, cam grind, and head flow potential.

Section 3: Carburetor Comparison

CV40 flow loss based on head flow potential:



graph 15

Lift	stock '06 heads 1.805" int valve	stock CV40 manifold - w/40mm carb	% Loss	non-ported '06 head 1.85" int valve baseline	stock CV40 manifold - w/40mm carb	% Loss	ported '06 head 1.805" int valve baseline	stock CV40 manifold - w/40mm carb	% Loss	ported '02 head 1.9" int valve baseline	stock CV40 manifold - w/40mm carb	% Loss
0.100"	70.4	67.2	5%	69.7	66.7	4%	72.3	71.5	1%	68.9	71.2	-3%
0.200"	129.2	132.7	-3%	129.2	130.6	-1%	133.8	132.0	1%	140.2	136.3	3%
0.300"	190.7	175.7	8%	192.1	176.6	8%	193.2	177.4	8%	203.8	184.9	9%
0.400"	220.1	193.4	12%	223.5	196.9	12%	225.2	198.7	12%	238.9	205.1	14%
0.500"	223.7	196.9	12%	228.4	202.0	12%	240.0	205.5	14%	255.2	212.4	17%
0.600"	225.4	198.5	12%	233.4	203.1	13%	244.3	207.3	15%	259.3	215.8	17%

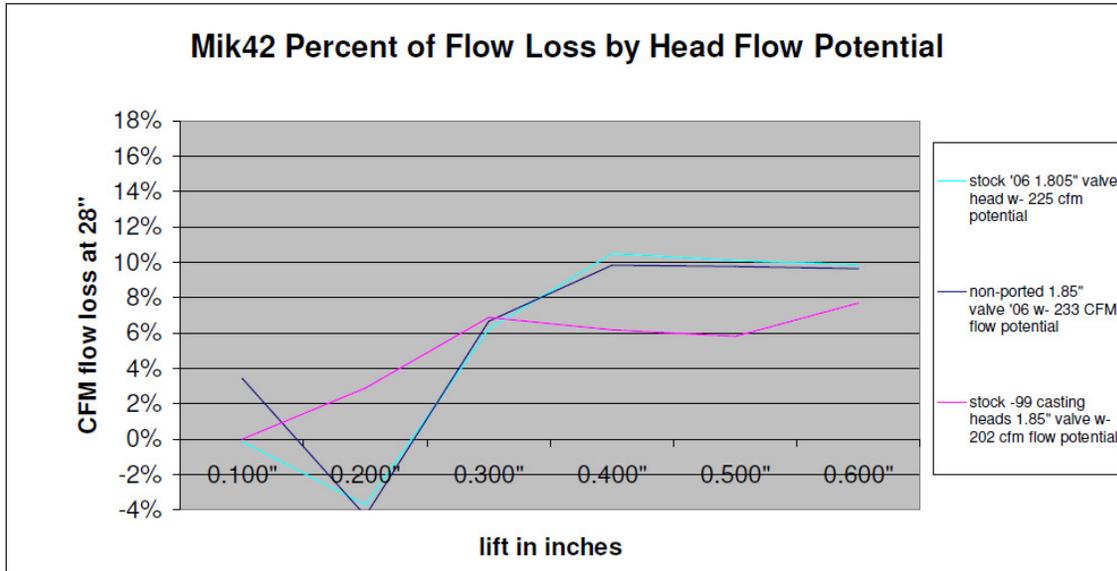
table 17

* all testing was done by Syke Performance and was tested at 28"

The data in table 17 is indicating that as the flow increases through the intake port the percent of loss is becoming greater because of the restriction created by the CV40 carburetor. The data supports is also indicating that the heads with the greatest flow potential is experiencing the greater percentage of loss.

The test procedure was slightly different with the ported '06 heads than the rest of the heads being tested. The slide was held up during this test, for the other tests the vacuum created by the flow bench was used to raise the slide. There generally was enough draw by .200" lift to raise the slide completely. Therefore the low lift numbers will be slightly skewed with the ported '06 heads compared to the rest, but from .300" lift and up there should be no issues with direct comparisons.

Mik42 flow loss based on head flow potential:



graph 16

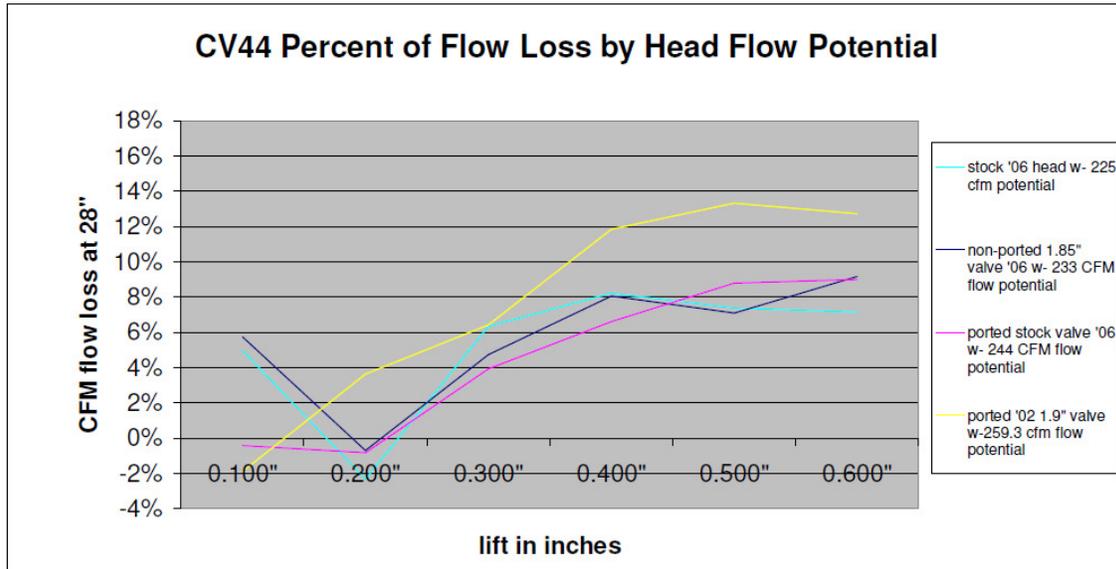
Lift	stock '99-04 heads 1.85" int valve baseline	stock manifold w/Mik 42 carb	% loss	stock '06 heads 1.805" int valve baseline	stock manifold w/Mik 42 carb	% loss	non-ported '06 head 1.85" int valve baseline	stock manifold w/Mik 42 carb	% loss
0.100"	70.8	70.8	0%	70.4	70.5	0%	69.7	67.3	3%
0.200"	131.2	127.4	3%	129.2	134.0	-4%	129.2	134.8	-4%
0.300"	181.6	169.1	7%	190.7	178.8	6%	192.1	179.3	7%
0.400"	202.2	189.7	6%	220.1	197.0	10%	223.5	201.5	10%
0.500"	199.3	187.7	6%	223.7	201.1	10%	228.4	206.1	10%
0.600"	202.5	186.9	8%	225.4	203.15	10%	233.4	210.9	10%

table 18

* all testing was done by Syke Performance and was tested at 28"

The Mikuni HSR42 was not available for all the tests performed, so there is limited data to report for this table. The stock -99 casting information was added to this comparison, although switching from the stock CV40 to the Mik42 for those castings may only improve throttle response and not necessarily peak performance since the CV40 was comparable in flow potential in these castings.

CV44 flow loss based on head flow potential:



graph 17

Lift	stock '06 heads 1.805" int valve	SE CV44 manifold - w/44mm carb	loss %	non-ported '06 head 1.85" int valve baseline	SE CV44 manifold - w/44mm carb	loss %	ported '06 head 1.805" int valve baseline	SE CV44 manifold - w/44mm carb	loss %	ported '02 head 1.9" int valve baseline	SE CV44 manifold - w/44mm carb	loss %
0.100"	70.4	66.9	5%	69.7	65.7	6%	72.3	72.6	0%	68.9	70.2	-2%
0.200"	129.2	132.2	-2%	129.2	130.1	-1%	133.8	134.9	-1%	140.2	135.1	4%
0.300"	190.7	178.6	6%	192.1	183.0	5%	193.2	185.6	4%	203.8	190.7	6%
0.400"	220.1	202.0	8%	223.5	205.5	8%	225.2	210.3	7%	238.9	210.6	12%
0.500"	223.7	207.2	7%	228.4	212.2	7%	240.0	218.9	9%	255.2	221.2	13%
0.600"	225.4	209.3	7%	233.4	212	9%	244.3	222.3	9%	259.3	226.3	13%

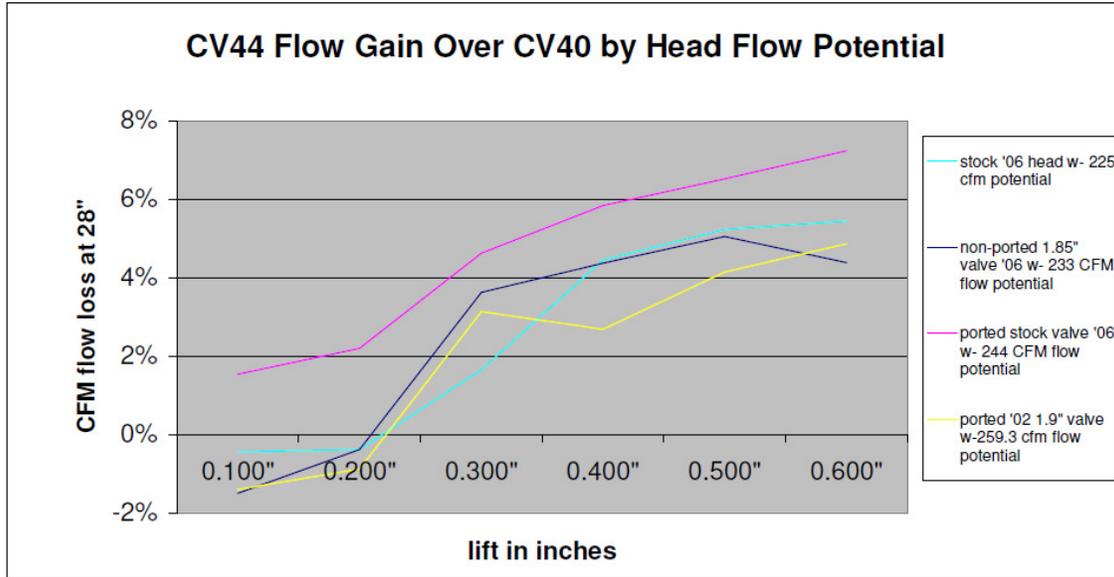
table 19

* all testing was done by Syke Performance and was tested at 28"

As indicated in table 19, the CV44 is acting similar to the CV40 in that as the flow increases through the intake port the percent of loss is becoming greater because of the restriction created by the carburetor. Although, the rate of loss is considerably less for the CV44 compared to the CV40. The data is also indicating that the CV44 is creating a bottle neck for the heads with the greatest flow potential.

As in the table 17, the test procedure was slightly different with the ported '06 heads than the rest of the heads being tested. The slide was held up during this test, for the other tests the vacuum created by the flow bench was used to raise the slide. There generally was enough draw by .200" lift to raise the slide completely. Therefore the low lift numbers will be slightly skewed with the ported '06 heads compared to the rest, but from .300" lift and up there should be no issues with direct comparisons.

CV40 to CV44 Flow Improvement:



graph 18

Lift	Peak Flow at .500" '06 Stock '223.7 CFM			'06 larger valve 228.4			'06 ported 240 CFM			'02 ported 255.2 CFM		
	stock CV40 manifold -	SE CV44 manifold - w/44mm	Cv44 from Cv40 flow increase	stock CV40 manifold -	SE CV44 manifold - w/44mm	Cv44 from Cv40 flow increase	stock CV40 manifold -	SE CV44 manifold - w/44mm	Cv44 from Cv40 flow increase	stock CV40 manifold -	SE CV44 manifold - no carb	Cv44 from Cv40 flow increase
0.100"	67.2	66.9	0%	66.7	65.7	-1%	71.5	72.6	2%	71.2	70.2	-1%
0.200"	132.7	132.2	0%	130.6	130.1	0%	132.0	134.9	2%	136.3	135.1	-1%
0.300"	175.7	178.6	2%	176.6	183.0	4%	177.4	185.6	5%	184.9	190.7	3%
0.400"	193.4	202.0	4%	196.9	205.5	4%	198.7	210.3	6%	205.1	210.6	3%
0.500"	196.9	207.2	5%	202.0	212.2	5%	205.5	218.9	7%	212.4	221.2	4%
0.600"	198.5	209.3	5%	203.1	212	4%	207.3	222.3	7%	215.8	226.3	5%

table 20

Table 18 represents a direct comparison on flow rate improvement from the CV40 to the CV44. The test procedure of the ported stock valve heads was slightly varied compared to the other tests. On that particular test the slide was held up, so no initial drop was recorded from the vacuum against the slide.

The data from the CV40 and CV44 flow rates from the -99 casting tests were not included in this report. It is the author's unprofessional opinion that the comparison was unwarranted since the CV40 was fully capable of supporting the max potential of those particular casting heads.

In name, the CV44 appears to be 10% larger than the CV40. Despite the stated size stated size difference being 10%, Bruce's flow potential on the respective manifolds showed only a 5.8% difference. That 5.8% flow advantage seems to be backed up with most of the tested data on various flow potential heads.

Section 3: Conclusion

The CV40 to CV44 comparison clearly shows that the CV44 has a greater flow potential than the CV40. In all reality, testing wasn't required to prove that the larger carburetor would flow more than the smaller one...since the laws of physics would have been in the larger carburetors favor. The more interesting note is the amount of flow advantage is much lower than one might expect.

The reader can determine for themselves the validity of this testing, but I would think that the testing confirms that the CV44 carburetor is not overkill on most 95" and up builds with head work when compared to the CV40. Although logically speaking, the cam choice and related build components will determine whether there is a gain in performance between the two carburetors on any given build.

Web site References (in order of reference):

<http://www.sykeperformance.com/>

<http://www.harleytechtalk.net/>

<http://larryhardysperformancetechniques.com/>