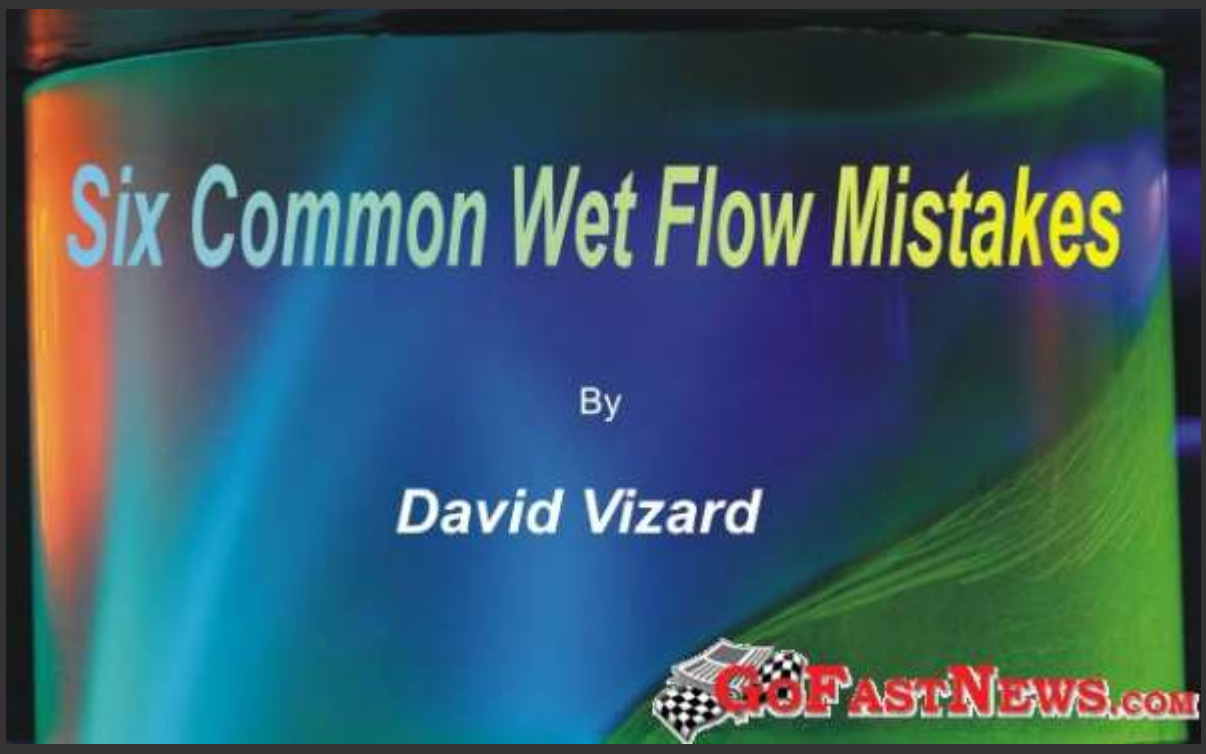
08-18-2007, 08:51 PM #1 (permalink)

DavidVizard-GFN OFF
Pit Crew

Join Date: Apr 2007
Posts: 840

Six Wet Flow Mistakes



Not an experiment I would recommend or for that matter is even needed but it takes very little to imagine what happens when you throw a lighted match onto a rag soaked in gasoline. It lights off so easy that it is hard imaging why there would ever be a problem lighting it off in the cylinders of a hot high compression engine. The reality here though is that we have all the time in the world to wait for a burning rag to exhaust it's fuel through combustion. In a well developed engine turning 9000 rpm the time for 90% of the charge to burn is one and a half thousandths of second! With so little time

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The first concrete realization that power output can be dramatically affected by the fuel droplet size and the state of the mixture quality (or lack of it) came during my Mini Cooper era back in the late 1950's and early 60's. I learned a lot on the 'A' Series engine that powered this car – all of it totally contradictory to what you might expect. If the engine that powered these race dominating roller skates were fed with fuel even a little too finely atomized the power dropped like a rock. **The valuable lesson I learned here was never to take anything for granted.** This paid off handsomely a few years later when I ended up developing a dominantly competitive 4 cylinder Chrysler engine for the British Touring Car Championship series in England. With the engine concerned the route to success was exactly the reverse of that for the Mini Cooper's engine. Very finely atomized fuel and good dispersion along with very low re-aggregation were the key factors which allowed me to produce a carb/intake manifold and head combination that substantially out horsepowered (by about 20 hp) the two Formula one manufactures also competing for the job (not bad I thought for a guy who had a full time job filling magazine pages). In the late 90's I was also involved in some similar work on six cylinder Aston Martin race engines. This involved a study of mixture quality from the carb to the cylinder side of the intake valve to ascertain how the fuel mixture behaved. Achieving certain goals here netted well over 20 hp.

About 1985'ish the late Ken Sperling, (boss at AFR) got into wet flow testing big time. The subject of his research was Chevy heads for NASCAR use. Although I did not know Ken that well at the time we had a mutual friend and air-flow fanatic - Roger "Dr. Air' Helgesen. One day, after a big wet flow session with Ken, he turns up at my California shop with half a car full of gear to do wet flow testing and, is hot to trot. This, along with some of the late (and corny as it sounds –great) Smokey Yunick's preaching's, (you have just got to get that guy's autobiography - go to smokeyunick.com) was, so to speak, my baptismal into the world of how fuel air mixes react in the induction tract of a single 4 barreled carbureted high performance V8 engine.

Since the Ken Sperling wet flow era of the mid and late eighties wet flow seemed, for all practical purposes, editorially dead. That is until Joe Mondello and his new and innovative wet flow bench hit the speed headlines in 2002. At that point the whole wet flow debate re-ignited big time but with Joe Mondello involved what else could we have expected.

Between way back and now I've learned a lot and one thing is for sure, whatever you thought might happen probably doesn't and what you never suspected probably does. That said, wet flow tests done without sufficiently taking into account what is going on in the real intake tract are a lot less effective as an aid to power development than might otherwise be. For many this is a new science. Here's my ten cents worth gleaned over a long time span.

Mistake #1 – Less Than Optimal Test Pressure Differentials.

A lot of wet flow testing is done with a fixed test pressure differential of between 28 and 50 inches of water. Since our main focus here is a racing engine then what is needed is to emulate the depression curve that occurs in a running engine. This means drawing about 100 to 130 inches of depression at low lift (0.050 -0.100) and about 15 inches at high lift. A fuel wetting problem that exists at even 50 inches of depression at low lift can completely vanish at 120 inches. A problem that does not exist on the bench at 50 inches and high lift can easily show at 15 inches.

Mistake #2 – Inappropriate Liquid to Air Ratio

If the amount of liquid put through the system is sufficient the wet flow characteristics shown will be bad no matter what you do. The key here is to take into account that about 15% of the liquid fuel will vaporize by the time it passes through the intake valve. The best fluid to air ratio to use to get meaningful results is a mixture by volume that represents a fuel/air ratio about 15% lean.

Mistake #3 - Inappropriate Surface Tension.

Water has a much higher surface tension as well as a density some 30% more. These two factors can upset the spread and shear patterns seen. Adding alcohol and small amounts of soap can cut the surface tension to the point where water based test fluids more closely emulate gasoline.

Mistake #4 - Inappropriate Temperature.

Running the test fluid and the intake valve hot made a difference in the way the streams and shear area's reacted. This area might need more research to get a better correlation but as of now I would recommend a fluid temperature of at least 150 degrees F.

Mistake #5 – Inappropriate Interpretation of Results.

I don't quite know how to address this section as there are so many aspects to consider. Many wet flow tests reveal problems that are self evident but some issues are looked upon as a problem when in fact they are an asset. Fuel shearing off chamber edges into vortices is often OK but what is not is when they migrate to the cylinder wall side of the widest part of the quench pad. As the combustion cycle takes place raw fuel can end up in the ring land volume and contribute absolutely nothing to the game. Obvious problems are just that – obvious. It's the more subtle issues that require an experienced eye and that just takes time.

Mistake #6 Inappropriate Flow Model Setup.

Guess what – the intake port on those heads is fed via an intake manifold and this in turn by a carburetor. Each modifies the characteristics of the fuel/air flowing out of the base of the carb. Sure we can start any tests with just a bare head and valves. But from there the quest for better wet flow needs to have in intake introduced and then a carb. As for the carb itself it should have the same boosters as will be used by the end product if you want to get real fussy about results.

Now it may seem easy enough to just flow one cylinder through the carb and intake and on through the cylinder head itself. This is often how manifolds are tested. Unfortunately it's the wrong way to do it. On a single plane intake when the piston of the test cylinder is near max velocity and the valve wide open the valve on the next cylinder to draw is as much as a ¼ of an inch off the seat and (assuming a race engine) drawing air at a rate of about 20-25% of the test cylinder. If that cylinder is not hooked up to a depression that simulates this two runner flow the wet flow seen in the intake will not be what is seen in a running engine.

David Vizard

Last edited by DavidVizard-GFN; 08-18-2008 at 09:12 AM.

QUOTE

08-19-2007, 09:48 AM #2 (permalink)

Daniel Haught OFF
Garage Sweeper

Join Date: Aug 2007
Posts: 17

Excellent points.
It seems it would be a daunting task at best to get accurate and useful results from the average wet flow rig.
The first person I knew that had done any wet flow testing was a head porter in the Houston area who made his own wet flow rig using a manifold and a carburetor. Even as limited as this was I felt if was a somewhat more accurate representation since it at least took into account the intake manifold but the point of cross flow within the manifold seems valid as well.

I believe after a while he abandoned the rig, having observed many trends in improving wet flow. A relatively less sophisticated means of very basic wet flow testing would involve introducing a dye or ink into the airstream using a syringe and needle at areas around the entry. Seeing where this dye impacts the chamber or port areas can give you some hints towards wet flow trends.
For instance if the dye heavily stains the plugs that would be bad. Seeing the results of altering the port and chamber somewhat to move the point of impact away from the plug resulted in substantial performance improvements.
While this is very basic, it can show positive results.

QUOTE

08-19-2007, 04:48 PM #3 (permalink)

MaxRaceSoftware OFF
Garage Sweeper

Join Date: Aug 2007
Location: Abbeville , Louisiana
Posts: 58

Great Points !!

and a great many Thanks for all the Technical Articles, etc.
you've written and to come !

You have made a tremendous difference and contribution
to great number of People in this Industry !!

Keep them coming !!!

Meaux Racing Heads
http://www.maxracesoftware.com/

QUOTE

08-24-2007, 09:53 PM #4 (permalink)

Cammer OFF
Oil Changer

Join Date: Aug 2007
Posts: 290

David,

Do you have a wetflow bench at your disposal?

I would like to see you wetflow test heads with the proper setup and report to GoFastNews members.

The results would prove interesting to forum members.

Forum members will understand not testing at 130 inches of water!

QUOTE

08-28-2007, 02:43 AM #5 (permalink)

Troy Patterson OFF
Garage Sweeper

Join Date: Aug 2007
Posts: 1

Six wet flow mistakes

Hi David, it's been a while since I met you at your California shop - back in 2000, I think.

I'm the Weber Power Plate guy, Troy Patterson of TMP Carbs.

I'm glad to see you are still sharing your knowledge and that you are easily accessible, via the world wide internet.

Troy Patterson TMPCarbs.net TMP Carbs

QUOTE

09-17-2007, 02:13 AM #6 (permalink)

Stan Weiss OFF
Tire Changer

Join Date: Sep 2007
Location: Philadelphia, PA
Posts: 189

Hi David,
Have you tried using N-Heptane (Which Bosch uses to flow EFI) or 16B Calibration Fluid (Which some

other people use to flow EFI)?
Stan

09-21-2007, 10:33 PM #7 (permalink)

DavidVizard-GFN OFF
Pit Crew

Join Date: Apr 2007
Posts: 840

Yes Troy,
it was 1999. tell us all what you are up to in the carb business.
DV

09-21-2007, 10:37 PM #8 (permalink)

DavidVizard-GFN OFF
Pit Crew

Join Date: Apr 2007
Posts: 840

Cammer,
Watch out for an extensive article coming soon on Darts BB Chevy heads. Lots of wet flow stuff and I think you guys will like the tech shots I got showing what goes on in the cylinders.

DV

09-22-2007, 06:39 PM #9 (permalink)

MadBill OFF
Garage Sweeper

Join Date: Sep 2007
Posts: 76

Six Wet Flow Mistakes

Speaking of upcoming articles David, you would be doing both us here on the forum and the magazines for which you write a huge favour if you could keep us appraised of where and when your work will be appearing! After renewing my Popular Hot Rodding subscription a few months back strictly because of your regular contributions, I was dismayed to find them absent for several months. More recently they have returned, but I'm sure there are many others I am missing. Knowing a little of the business, I expect they don't trouble themselves to give you much advance warning, but any crumbs you could send our way would help...

11-18-2007, 02:06 PM #10 (permalink)

DavidVizard-GFN OFF
Pit Crew

Join Date: Apr 2007
Posts: 840

MadBill,

sorry it took a while to get to you here. The truth of the matter is that often I do not know when a story

is coming out so cannot advise on susch i never really chase this though because i havce already read most if not all my stories!!!

It has been suggested that here at GFN we list the most iminent 10-15 stories we are working on and let you guys prioritize them. How doea that sound? Input please fella's.
DV

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