War Bonnet Region

WAR WHOOP

March - April 1990

PORSCHE *Club* OF AMERICA

On the Cover

For several years the Porsche factory has supplied an engineer as our principal guest speaker for War Bonnet Tech. This year Heinz Stehle Chief of Powertrain Development at Porsche AG was our special guest.

Mr. Stehle is demonstrating how the transmission parts actually fit together. The lucky few who particapated in the "Weissach" contest had five min. to assemble the parts. See pages 3, 5 & 7 for further details.

Editor : Glen Hoskins
3833 N.W. 32nd
Oklahoma City OK 73112
405/942-3743 Work; 405/947-6375 Home

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OFFICERS AND CHAIRMEN

President

Al Lang
P.O. Box 20766
Oklahoma City OK 73156
405/755-0208

Membership

Glen Hoskins
3833 N.W. 32nd St.
Oklahoma City OK 73112
405/942-3743

Vice President

Rob Lewis
10408 Ryecroft Rd.
Oklahoma City OK 73162
405/722-2050

Activities

Rob Lewis
10408 Ryecroft Rd.
Oklahoma City OK 73162
405/722-2050

Treasurer

Timothy Ashcraft
12408 Jersey Road
Midwest City OK 73130
405/769-8303

Secretary

Don Scott
2631 Cedric Circle
Lawton, OK 73505
405/355-7144

Past President

Kai Gerkey
2645 NW 14th
Oklahoma City OK 73107
405/525-8577

Historian

Greg Hack
3890 Whispring Hts.
Edmond, OK 73034
405/340-0000

Autocross Chairman

Kai Gerkey
2645 NW 14th
Oklahoma City OK 73107
405/525-8577

Tech Registrar

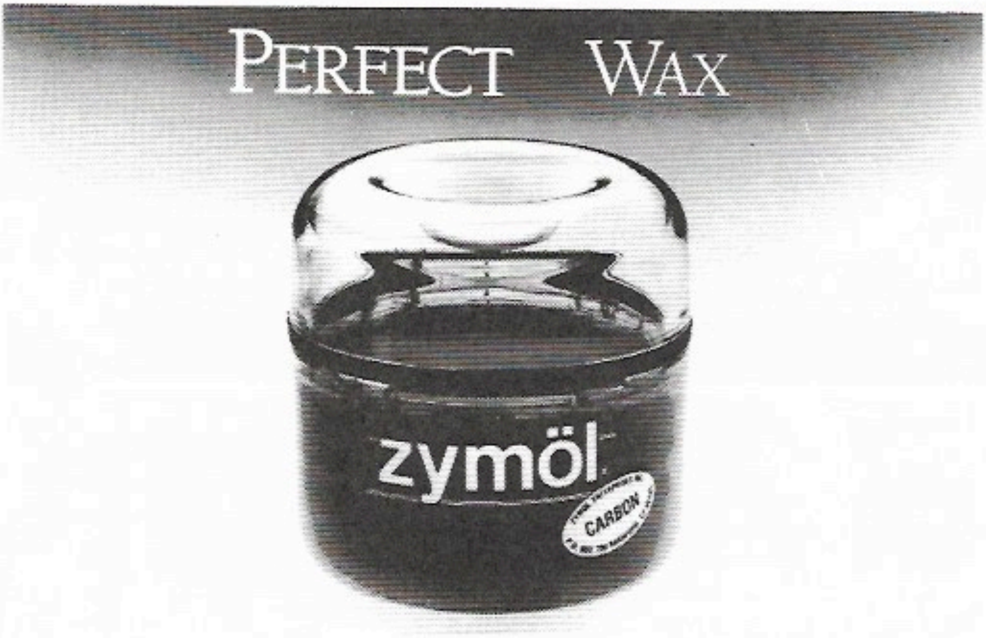
Cathy Trapp
315 NW 15th
Oklahoma City, OK 73103
405/524-6262

Tech 90

Tech 90 was a great success. We had two visitors travel all the way from Australia. They received the long distance award. They spent more time in a airplane than the other attendees spent in a car to get to Oklahoma City. They promised to bring more Australians with them next year.

Mr. Brian Bowler, President of Porsche Cars North America was a special speaker at the banquet dinner Saturday night. He announced the new 911 Turbo. 3.3 liter (201 cu. in.) 320 bhp (DIN) at 5750 rpm and 332 ft. lbs. Torque at 4500 rpm. Five speed transmission, 0-62 mph in 5.0 seconds, top speed of 168 mph.

We "roasted" Bob Jones of Jones Autowerks. Bob has been a valued speaker at Tech for many years. This year we thanked him in the War Bonnet Tech method, public embarrassment. Bob was presented "the bird" in honor of his meritorious service. The chicken is getting old and incontinent, so it has a diaper now. Thanks Bob, Nobody does it better.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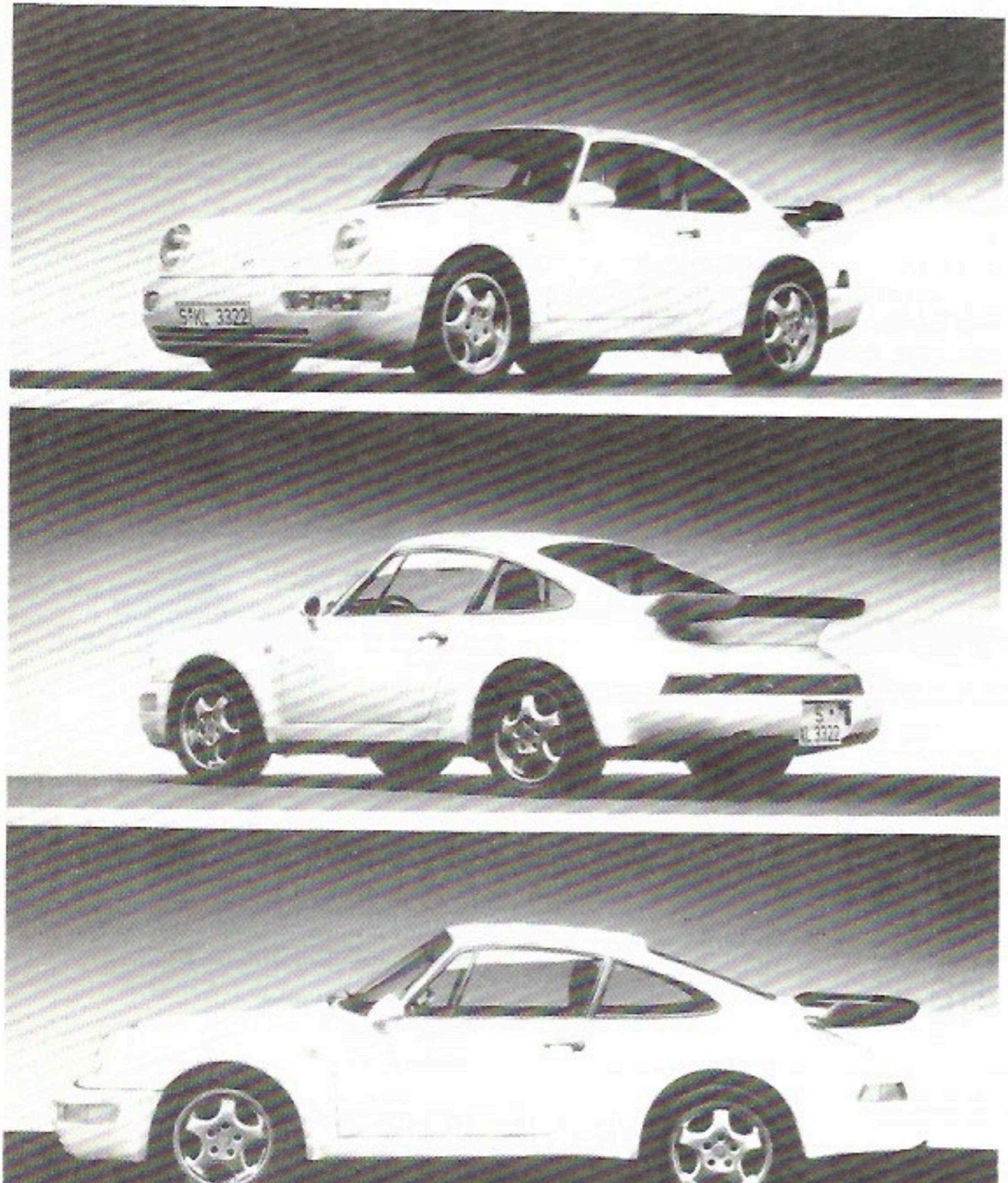


1991 PORSCHE 911 TURBO

Please tick whichever is applicable:

1. Which are the two measuring variables which - for the first time worldwide - are used for transmission management in the Porsche Tiptronic?

   - o Throttle angle
   - o Engine speed
   - o Driving speed
   - o Lateral acceleration
   - o Longitudinal acceleration

2. How many shift or operation levels does the Tiptronic include?

   - o 1
   - o 2
   - o 3
   - o 4

3. Which of the 5 shift maps does the computer choose for an extremely economic and comfortable vehicle response?

   - o SK1
   - o SK2
   - o SK3
   - o SK4
   - o SK5

4. Which is the simplest method of preventing upshifting during coasting before entering a curve?

   - o Accelerate slowly
   - o Apply the brakes
   - o Rapidly release the accelerator pedal
   - o Use the shift lever

5. Which shift map does the computer choose during active shifting (rapid application of the accelerator pedal without using kick-down)?

   - o SK1
   - o SK2
   - o SK3
   - o SK4
   - o SK5

6. Which is the minimum throttle angle required for the Tiptronic to shift into 1st gear for starting up in position D?

   - o Greater than 10°
   - o Greater than 20°
   - o Greater than 30°
   - o Greater than 40°
   - o Greater than 50°

7. In which gear does the Tiptronic - for the first time in passenger car transmission history - provide for converter lock-up?

   - o 1st gear
   - o 2nd gear
   - o 3rd gear
   - o 4th gear

8. Which is the maximum 0 to 100 km/h acceleration speed of the Carrera 2 with Tiptronic?

   - o 5,7 sec
   - o 6,0 sec
   - o 6,3 sec
   - o 6,6 sec
   - o 6,9 sec

9. Where does the Tiptronic always offer fuel economy benefits?

   - o In the city
   - o On country roads
   - o On the highway

10. Which is the maximum lap time difference between a Carrera 2 with manual 5-speed transmission and a Carrera 2 with Tiptronic in tip-mode on the Northern loop of the Nurburgring?

    - o 2 sec
    - o 3 sec
    - o 4 sec
    - o 5 sec
    - o 6 sec

11. Which of the following cars are fitted with a power-shift transmission (power-shifting without tractive force interruption)?

    - o Ferrari Formula 1/89
    - o Porsche 962/PDK - Group C - 87
    - o Porsche Tiptronic/Carrera 2

12. Which is the percentage of Porsche 928S with automatic transmissions sold in the USA?

    - o 50 p.c.
    - o 60 p.c.
    - o 70 p.c.
    - o 80 p.c.

13. From which shift position is it possible to shift the lever into the manual tip-mode gate with a lateral movement?

    - o P
    - o R
    - o N
    - o D
    - o 3
    - o 2
    - o 1

14. By which criterium is the Sportomatic disqualified?

    - o Excessively high price
    - o No more than three (forward) gears
    - o Lacking operational reliability

15. What does 'spread' mean?

    - o Quotient of max. ratio in 1st gear and minimum ratio in the uppermost gear $\frac{i_{max}}{i_{min}}$
    - o Ratio distribution
    - o Expansion of toothed gears and shafts

16. How was the (Tiptronic) transmission called in its development phase?

    - o PTO - Porsche Two in One
    - o PDF - Porsche Dual Function
    - o Funmatic

17. Which gears can be shifted after a restart by the emergency program in case of failures in the electronic transmission control unit?

    - o Reverse gear
    - o 1st gear
    - o 2nd gear
    - o 3rd gear
    - o 4th gear

18. Which are the components connected by the converter lockup clutch?

    - o Pump wheel and turbine wheel
    - o Pump wheel and impeller
    - o Turbine wheel and impeller
    - o Pump wheel and flywheel

19. What will happen if you coast down to a standstill at a traffic light in tip-mode 3rd gear without shifting down?

    - o The engine is stalled
    - o Tiptronic automatically shifts into 1st gear
    - o Tiptronic automatically shifts into 2nd gear

20. When was the Berlin wall opened?

    - o October 12, 1989
    - o October 24, 1989
    - o November 9, 1989
    - o December 10, 1989

21. Which birthday did our dear Professor Ferry Porsche celebrate on November 19, 1989?

    - o 70th
    - o 75th
    - o 80th
    - o 85th

Thank you for your efforts in filling in this questionnaire.

POINTS

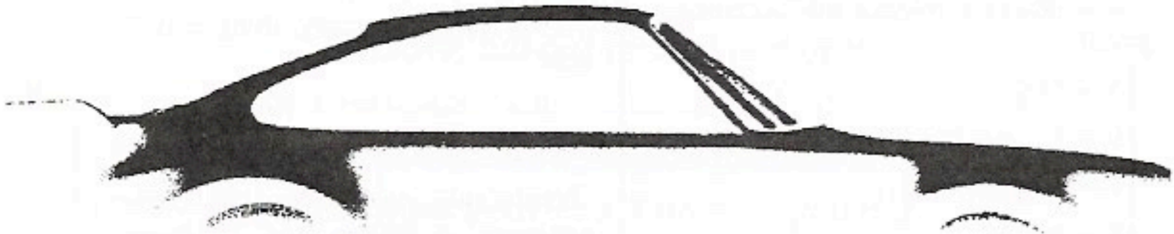
PLACE

Alfa Romeo

B R I IMPORTS

Alfa Romeo

Since 1970 **BRI Imports** has offered quality maintenance on Porsches to War Bonnet Region Members. For the Performance Edge or hard to find parts for earlier cars we are the source. If you are looking for another Porsche or another speciality car such as Alfa Romeo, Mercedes Benz or BMW, **BRI Imports** always has a quality selection, or, we can find what you are looking for through our nation wide locator service.



March and April is the time of year to get the winter accumulation of dirt and salt off of the bottom of your car, and, to take care of annual maintenance on brake fluid, brake pads and belts. Preserve and protect your investment, call for an appointment today!

6920 N. Broadway Ext.

Oklahoma City, Ok. 73116

405 / 848–1961

The Weissach Contest

Our visitor for the Porsche factory this year was Heinz Stehle, Chief of the Powertrain Development Department at Porsche A.G. His talk was about the Porsche Tiptronic transmission. Page 6 is a reproduction of the test given by Heinz Stehle. The answers are:

1. = Lateral Acceleration

2. = 3

3. = SK1

4. = Rapidly release the accelerator pedal

5. = SK5

6. = Greater than 30 deg.

7. = 2nd gear

8. = 6.6 sec

9. = In the city

10. = 3 sec

11. = 962/PDK - Group C -87 & Tiptronic/Carrera 2

12. = 70%

13. = D

14. = No more than 3 (forward) gears

15. = Quotient of max. ratio in 1st gear & minimum ratio in uppermost gear

16. = PDF

17. = Reverse Gear

18. = Pump wheel & turbine wheel

19. = Automatically shifts into 2nd gear

20. = November 9, 1989

21. = 80th

Only one person had 18 correct answers. A dozen had 17 correct answers. All of the Winners were allowed to enter the contest to assemble a transmission part in under 5 min.

Bob Miller the "Master Guru of Tech gets ready for Tech '90

THE ROCKIES ARE GOING TO ROAR

TEXACO/HAVOLINE GRAND PRIX OF DENVER

AUGUST 24 - 26, 1990

The Rocky Mountain Region of the Porsche Club of America invites you to treat yourself to the most exciting international gala of the year - the Texaco/Havoline Grand Prix of Denver. See living legends of auto racing, like Fittipaldi, Unser, Sullivan, Mario and Michael Andretti and of course Teo Fabi and John Andretti for Porsche Quaker State flying through the streets of Denver in the fastest street rockets on earth. It's also an admission ticket to a world class event that includes concerts, mouth-watering food and non-stop action.

PCA members will be treated to a special Saturday night affair at the Landmark Hotel. A delicious buffet, door prizes and hopefully your favorite Porsche Indy Driver and other Porsche Factory and Porsche Cars North America dignitaries will stop by.

Your reservation will include reserved seating in a premium grandstand area (near the start-finish line) for all three days, admission to the races: SCCA Trans-Am Championship race and hopefully a Celebrity Grand Prix Challenge race, paddock pass for the entire event, a special commemorative gift, shuttle transportation to and from the Landmark Hotel, and a PCA Bash Saturday night with all the fixings. All this for only $110 per person.

Special rates have been secured at the Landmark Hotel for a reduced rate of $34 for two (additional dollars for more people per room). Further information regarding hotel reservations will be sent to you after acceptance.

As a current or past member of your region's Board of Directors, I know you and other active members of your region won't want to miss one of the most exciting events of the year.

Registration is limited, so send the enclosed form by March 15, 1990.

For more information, contact me at (303) 530-3151 (between 6 and 9 P.M. M.S.T.) or Norm Martin at (303) 237-2428.

The Texaco/Havoline Grand Prix of Denver. Be there when the Rockies start to roar.

JoAnn Barnum

JoAnn Barnum, Registrar

Air/Fuel Ratios for the 90's

Any modification which increases engine horsepower also increases the engine's air flow and fuel requirement. A larger and/or more efficient intercooler, a larger and/or more efficient turbo, a camshaft with more duration and lift, and a free flowing exhaust are some examples of modifications which increase the air flow. Any one of these changes could easily increase the air flow by at least 10% and that is at the stock boost level. Raise the boost or use some combination of these modifications and the air flow could easily increase by 20-30% or more.

There are several reasons why an engine modified for extra horse power needs a fuel enrichment system. To better understand them it is best to start with a basic understanding of supplying fuel to an engine and to then cover some of the characteristics of stock fuel injection systems.

Under all operating conditions a specific amount of fuel is injected into the engine in proportion to the amount of air entering the engine. The ratio of the mass of air to the mass of fuel is known as the air/fuel ratio (AF). A chemically correct ratio, known as the stoichiometric ratio, is 14.7 to 1. A ratio greater than that is considered lean (more air for the same amount of fuel), a lower number is considered to be rich (less air for the same amount of fuel).

When the engine power output is high, the AF (air/fuel ratio) should typically be in the range of 12 to 13 pounds of air for every pound of fuel. Although this is fairly rich, the excess fuel does several beneficial things when trying to produce as much horsepower as possible. First of all, the extra fuel cools the combustion chamber and piston surfaces preventing the incoming air from being heated as much. This allows more air to get into combustion chamber, which in turn means more fuel must go in also. This translates into more horsepower. Secondly, the excess fuel ensures that all of the air in the combustion chamber is used to burn gasoline. This guarantees that the most energy is released by combustion thus giving the greatest horsepower output.

Herein lies a critical balance as the amount of gasoline in the intake mixture also controls the relative combustion rate. Too much fuel will slow down the combustion process, reducing the combustion energy and horsepower output. With too little fuel the combustion process speeds up, sometimes uncontrollably. And without the cooling effect of the excess fuel, the combustion chamber heats up often causing engine damaging detonation. So as the AF decreases from the best power AF (a richer mixture), horsepower output drops and eventually the cylinder walls are washed with gasoline. As the AF increases from the best power AF (a leaner mixture), horsepower output drops, operating temperatures go up, and detonation becomes very probable. Thus there is an ideal air/fuel ratio (best power AF) which will provide the highest horsepower output. This is shown in Figure 1.

Reviewing these concepts, the air entering the engine must be mixed in a strict proportion with fuel. The optimum air/fuel ratio for best power is typically in the range of 12 to 13 to 1. More air mixed in the proper proportion with fuel in the combustion chamber results in a greater horsepower output. Thus, the amount of air, the amount of fuel, and the resultant horsepower output are interrelated.

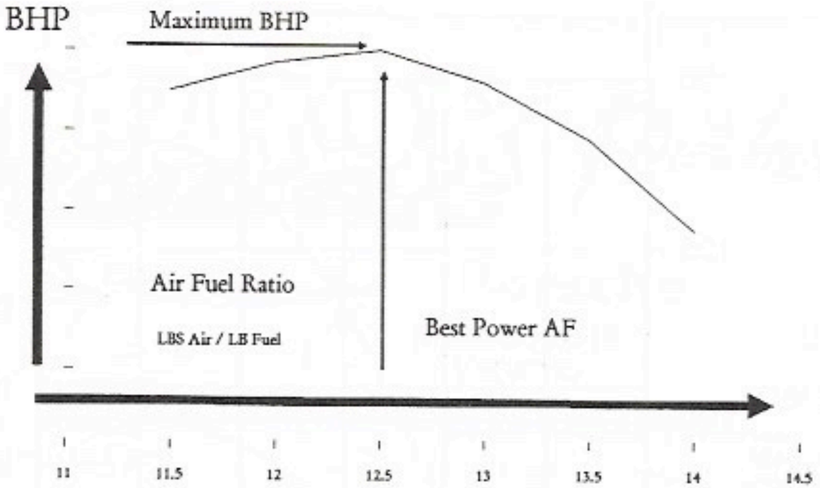


Fig. 1

Running a leaner air/fuel ratio can cause the engine to run hotter which will make the engine more prone to detonate or cause engine damaging detonation.

Now consider the production fuel injection system. Whether naturally aspirated or turbo/supercharged, it is designed to maintain an appropriate air/fuel ratio throughout the normal driving cycle, shifting the air/fuel ratio as indicated by the driver's demand for power. It is also designed make the engine meet emissions and CAFE (Corporate Average Fuel Economy) standards legislated by the federal and state governments. This means that it must precisely supply very small amounts of fuel to the engine under light load and idle conditions. To accomplish this the fuel injectors must have a fairly small flow rate. Unfortunately this restricts the amount of fuel that is available for performance demands. The result is that engine performance is limited by the fuel system instead of the engine design and construction.

What happens is that all of the injectors can only flow so much gasoline. This maximum flow rate is represented by the Stock System Capacity line in the graph below.

This line equates to the amount of air that the stock fuel system will measure and still properly meter fuel (remember that air, fuel, and horsepower are all interrelated). As long as the fuel demands of the engine stay below this level the stock fuel system can usually supply enough fuel. When the engine is modified for better performance, more air is flowing into the engine and more fuel is required. As the performance level is increased the fuel requirement will eventually exceed the capacity of the stock system, the air/fuel ratio will get lean and the engine will no longer produce its best horsepower.

As an example, consider the effect of increasing the boost pressure in small steps in order to increase horsepower. The first increase raises the engine horsepower by 10%. This in turn requires 10% more air and fuel. Since the curve only goes slightly above the system capacity line, the stock system can still handle the fuel requirement fairly well. Where the curve does exceed the system capacity (above 5000 RPM), the stock fuel system cannot maintain the best power air/fuel ratio so horsepower will not be as great as it could be but it may not be lean enough to cause detonation. The next in-

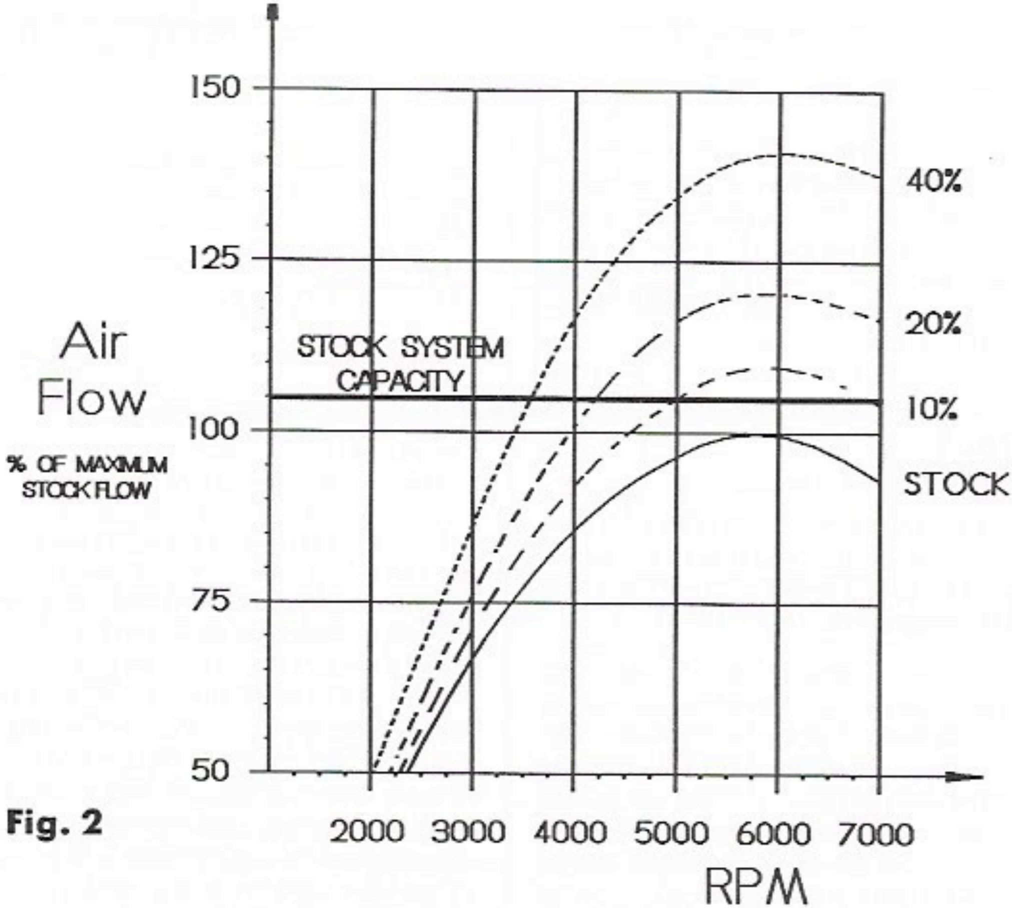


Fig. 2

crease raises the horsepower to a 20% increase over stock. Now the curve clearly crosses and extends well above the system capacity line around 4250 RPM and the air/fuel ratio is going to be pretty lean by 4500 RPM. The engine will start to detonate around 5000 RPM. The next increase raises the horsepower to 40% above the stock level. The curve crosses the line around 3600 RPM and by 4200 the air/fuel ratio will be so lean that the engine is almost guaranteed to self destruct.

As can be seen from any of the modified curves the fuel deficiency problem is worst at the maximum air flow of the engine. Depending upon the extent of the modifications, this will typically occur in the higher RPM range of the engine. Generally what the driver will feel is a sluggish tendency, the car's performance will seem to be a little flat compared to its capability in another speed range. This will be particularly noticeable at the higher RPMs and in the upper gears. Normally it is attributed to the horsepower falling off (it is) and a slower RPM acceleration through that vehicle speed range. In other words the car just won't accelerate as fast from 60-70 mph as it will from 20-30 mph.

It is also interesting to note that as the performance increase goes from stock to 10%, on to 20%, and finally up to 40%, the fuel demand reaches the stock system flow capacity at a lower and lower RPM. This is important. It means that the more the engine has been modified, the lower the RPM and boost pressure condition above which the engine horsepower and the overall performance will no longer be optimal.

One common misconception is that using a larger and more efficient intercooler or a more efficient turbocharger will correct the detonation problem created by running a higher boost pressure. Certainly either or both of these modifications can cool the air charge which in turn lowers operating temperatures throughout the engine. This is very good for an engine, particularly if it is run in boost very much and long term reliability is a concern. It also makes the engine less prone to detonation. The latter is particularly true when combining this with the use of a very high octane fuel. But since both modifications increase the amount of air flowing through the engine, they both strain the fuel system to supply an adequate amount of fuel, even at the stock boost level. It should be mentioned that even without the correct amount of fuel there should still be a noticeable improvement in performance. But without the correct amount of fuel the engine is not performing at its potential. The result is much of the reason for making these modifications and the potential that they offer is not being realized.

Perhaps it can best be said that if cold air made horsepower we would not need gasoline at all, just an air conditioner to get the intake air really cold. Obviously that will not work, but cooler intake air does improve performance. So what is the answer? It is looking at the total system, just like any manufacturer does when they design a car. When any modification is made it is really advisable to examine how that modification affects the rest of the engine systems. Is the engine getting enough fuel under all operating conditions? Is the ignition timing correct at the elevated boost pressures? Will I realize the full benefits of a free flow exhaust system if the intake path is too restrictive at the higher air flow rate? Take an overall systems approach and the results will be best.

Many of the later model, high boost engines incorporate knock detection and use electronic spark retard and/or boost reduction to eliminate any detected detonation. This allows quick acceleration through the lower gears until the engine heats up from being run hard. Then knock develops in the upper gears, the spark timing is retarded 10-20 and/or the boost is lowered, and the car's performance really feels flat. Much of the performance potential is lost. This is the reason that many say you should not raise the boost pressure by more than a few psi or tenths of bar. The fuel system will run dangerously lean, limit the performance, and destroy the engine.

Fortunately all is not lost. There are several products on the market which will safely permit raising the boost pressure and the use other engine modifications. Most of them fool the stock fuel system into flowing more fuel than designed. This will generally permit about a 10-15% increase in performance. If done correctly it will not affect the normal drivability of the vehicle. However, they all suffer the limitation that was present in the stock fuel system: the flow rate of the stock fuel injectors. The stock injectors can be changed to ones with a larger flow rate, but the fuel flow will also be increased under normal driving conditions as well as under the extreme conditions. This causes a poor idle, some loss of drivability, and fuel economy and emissions will suffer. All for a need that occurs only for about 5-10% of normal driving. However if that level of performance

increase is all that is desired and the system does not adversely affect the stock system, it will probably prove to be very satisfactory.

Another alternative is to add an auxiliary fuel system which uses its own injector(s) to supply the engine's additional fuel requirement. This leaves the stock fuel system controlling the engine during 90% of the normal driving cycle as it was designed to. There is no penalty for emissions, fuel economy, or drivability. When the engine needs additional fuel, the auxiliary system comes into play and keeps the fuel delivery in line with the engine's needs. This approach also permits a performance improvement which is limited only by what is done to the engine. The result is the greatest horsepower output possible.

The only system I am aware of which falls into the latter category is the TurboGroup Fueler™ which is manufactured by the Miller-Woods Corporation. It uses one or more additional fuel injectors mounted in the intake system after any intercooler. The injector begins to operate only above a preset boost level so there is no affect on normal driving as long as the boost pressure stays below the onset point. At higher boost pressures, the auxiliary fuel flow is proportioned to the boost pressure and to engine speed (RPM) so that fuel is entering the engine in proportion to the actual air flow. In this fashion it maintains a correct air/fuel ratio regardless of the extent of engine modifications or the maximum boost pressure. In addition, due to the location of the auxiliary fuel injector the extra fuel has time to impart a substantial cooling affect on the air charge. Since gasoline boils between 70F and 170F, the boiling action of the auxiliary fuel takes heat out of the air. At the higher boost pressures, even after passing through an intercooler the intake charge temperature can easily reach 150-200F. With the fuel injected into the intake path, temperature drops well in excess of 100F have been observed. The net result is the maximum performance benefit possible from the changes that have been made to the engine.

Naturally this representation is a general model of stock fuel injection systems and turbocharging. The actual values will vary with the individual application. However, the nature of what is occurring does not: if you increase the performance you have increased the air flow and put a greater demand on the fuel system. The major variable is the flow capacity of the stock fuel injection system. Typically the flow capacity of the injectors in a stock fuel system will permit between 9 and 13 psi (.6 -.9 bar) boost. Engines with a low factory boost level will sometimes be capable of larger increases without auxiliary fuel, engines with higher stock boost are almost always right at their limit. Unfortunately, this does not always apply, sometimes the stock boost level stresses the fuel system's limit.

To add a final note and bring this back into the proper perspective, all of this does not mean that once adequate fuel is being supplied to the engine the sky is the limit on boost. Keeping the air/fuel ratio correct just removes the performance limit of the stock fuel system. It merely keeps combustion process under control. It does nothing to correct the other limitations inherent in the engine. You still need to be concerned about the mechanical reliability of the drive-train components. Remember, take an overall system approach, the results will be much better. If you want your car to perform like a race car on demand, you had better consider building it like one. Raising the horsepower will put added strain on everything and the next weak link will surface sooner or later.

Charles Kuehnl

Lawton and Saturday Morning

WILMES PORSCHE, 4330 NW Cache Road in Lawton will be the site of coffee and donuts the second Saturday of each month. Bring your mirror glaze, wax, P-21S, Armor All, Hide Food, or whatever you please, and we will sit around and have good fellowship, tell war stories, have coffee and donuts, and spend a little time being productive with our Saturday morning. The wash rack will be open and there is plenty of shade for cleaning that "baby" of yours (and don't forget to include the spouse). This will be an excellent time to invite all of the Porsche owners you know to come on out and get to know each other. Starting time will be at 10:00 AM- BE THERE!!!

Contact Don Scott at 405/355-7144 if you have any questions.

Glen's Grumbles

I am happy to announce the addition of six new members of the War Bonnet Region. The McVay family and the Smittle family are both transferring in from the Weissach region. Welcome to the War Bonnet region.

Gregory T. Jackson, Sr.
Linda Jackson 9620 Beth Drive
Midwest City OK 73130 86
944 405/737-7117

Danny Kilgore
P.O. Box T-883
Tinker AFB OK 73145
81 924
405/630-5213

Edmund L. McVay
Dawn McVay
2801 Brixton Rd.
Edmond OK 73034
75 911S

Ronald W. Shreck, M.D.
Sallie R. Shreck
1429 E. Broadway
Enid, OK 73701
87 928 S4; 84 930

Darrell A Smittle
Shirley Smittle
P.O. Box 25608
Oklahoma City OK 71325
76 911S

Jeff Wonderly
3920 N.W. 29th
Oklahoma City OK 73107
78 930
405/947-4766

I was planning to discuss clutch replacement this month but I had so many other good stories I will delay the clutch story until a later issue. I had to add 4 pages to this issue of the War Whoop just to get everything in.

Tweeks Ltd. was a vendor at this years Tech, and they gave a catalog to all participants. If you did not attend Tech and you would like a catalog you can request a free catalog by calling 800-428-2200.

Porsche Cars North America has announced the new 911 Turbo. My article on Tech 90 in this issue has some of the details. PCNA has also announced a program to offer prospective customers an opportunity to drive all of the new Porsche models on racetracks and slalom courses. You must be invited by a Porsche dealer, to attend. Hint Hint - I would not mind being invited to participate in the "test drive" - Hint Hint.

Porsche's Indy-car racing season is off to a poor start. Teo Fabi did not finish the second lap. The TV coverage said transmission problems, Autoweek said engine problems stopped Fabi. Fabi has Robin Herd, co-founder of March Engineering as his race engineer. Things have to get better.

John Andretti lasted a little longer in the other Porsche engined car, but he did not finish the race either. Porsche will likely add a third car to the line up for Indy. No word as to who will be the third driver as yet.