BY TONY CALLAS & TOM PRINE

Pre-purchase Inspections 101

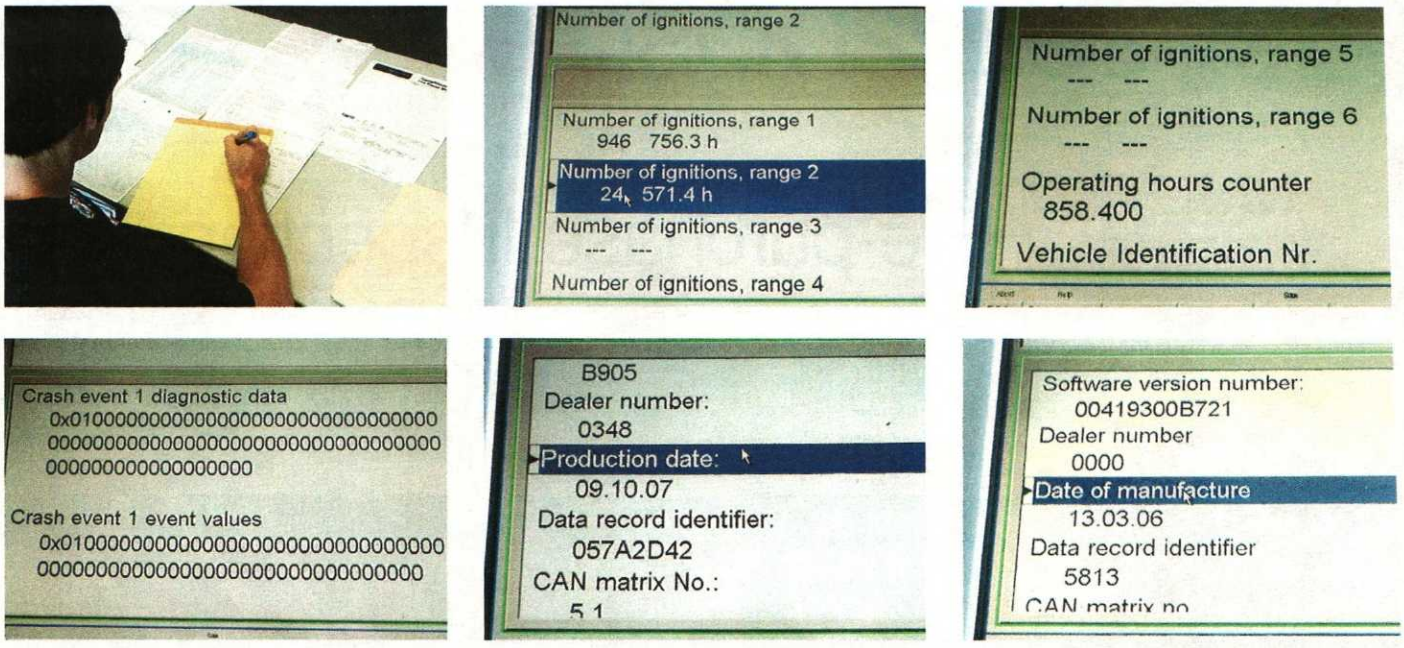
Part 2: Save big money by spending a little for a thorough examination.

Buying a used Porsche can be financially risky. However, a rigorous Pre-Purchase Inspection (PPI) can discover undisclosed or unknown problems and save you from making a poor investment. We began our report of a comprehensive PPI in last month's "Tech Forum" with basic suggestions on how to properly investigate the car's service and repair history, and how the PPI should be your first line of defense against buying a car with expensive issues.

The PPI should be performed at a Porsche repair facility with a good reputation and by a technician experienced with the year and model being considered. A PPI will range from a basic visual check all the way to a thorough, forensic-type assessment of the car's systems. The visual inspection should identify the more obvious issues, but don't let a pristine car fool you into avoiding a complete examination of the mechanical systems.

To review part 1, we discussed the start of the PPI process, which included checking the engine oil level and tire pressures, searching for illuminated warning lights, smoke from the tailpipe(s) and other obvious issues. Then the car is driven mildly until the engine reaches full operating temperature. Finally, the technician should take a four- to six-mile test drive to observe all aspects of the car's systems and operation, including performance.

If major issues are revealed by the road test, determine whether it's time to pull out of the deal and start looking for another car, or whether you want to continue with the second part of the PPI, the shop evaluation.



The computer interrogation is vital to understanding the internal health of the potential purchase. Porsche's factory diagnostic computer stores such important data as number of miles versus number of hours driven, helping determine how the car was driven, and any crash events.

Service Records Review

The reason people keep the receipts and records for their Porsche, or any car for that matter, is to validate that it has been properly maintained and repaired. Without this documented history, you're facing a big red flag: If there is little or no documentation for work done, can you trust the seller?

A PPI can identify a lot about the wear and tear of the Porsche, but it is not realistic to dismantle the major mechanical systems to determine if they were in fact serviced. If the vehicle you are considering does not have any or very little documented history for its age and mileage, then you need to decide if it is worth taking a chance or to move on in your search for the right Porsche.

The owner should have all service and repair records for the car dating back to when it was purchased new from the dealer. Any documented history should accompany the car to the PPI for review. The technician will look through the records to identify issues the previous owner(s) may have experienced, which could include major repairs, accident damage and any recurring issues that might indicate improper repair. It is also important to note any recommendations for future work on the repair receipts. A repair shop is not doing its job if it fails to inform the owner of any pending issues. The technician also should calculate the time and mileage between the service and maintenance intervals, a critical measurement for discovering if the car has been serviced properly. The PPI tech should write appropriate notes in the PPI report based on review of the documentation.

What, though, of those Porsche owners who perform their own service and maintenance. If you're not sure these home mechanics had the right tools, and the right knowledge, to do the work, then insist on a detailed log of everything done to the car. It should include the dates and mileage plus a description of the work performed. To validate this information, the log should also include receipts for any parts that were purchased to perform the job. Be wary if there are no receipts: Anybody can write a log.

Some less honorable used-car dealers purge the car's service documentation to avoid the possibility the information may contain something that potentially makes the car undesirable. There are, of course, situations where the dealer did not receive the service documentation when it bought the car. Sometimes the documentation is discarded due to so-called privacy issues. If protecting a previous owner's identity is the issue, this can be easily skirted with a permanent marker and a copy machine. We always encourage owners and dealers to retain the documented history of a car, but any copies should have the previous owner's name and contact information marked out.

Some independent automobile dealers acquire their vehicles from questionable sources or auctions. Unfortunately, it's sometimes difficult to chart the history of these cars. Groups of dishonorable used-car dealers have been known to work together wiping clean the records of cars that could have come from out of state, suffered flood damage (Watch out: The great northeast storm of 2012 guarantees lots of these cars will come up for sale!), or even were previously "totaled" by an insurance company. Vehicle history reports from online companies like CARFAX may identify these and other problems, such as accidents, but be aware that sometimes their information sources are incomplete or incorrect.

There are, thankfully, many quality used-car dealers that specialize in Porsche and other fine automobiles. These companies offer consignment sales of cars they have purchased from totally legitimate sources. If you need help getting a recommendation on a quality used-car dealer, contact your Porsche repair facility, the local chapter of the Porsche Club of America, or reputable online social media sites and forums.

Far too often people buy cars with little or no service documentation and without obtaining a PPI, trusting that the seller is honest, the car is great, and "It won't happen to me," when in fact the car has underlying problems. This is

A thorough PPI should involve a factory Porsche Integrated Workshop and Information System diagnostic computer.

why it is best to keep emotion out of a used-car purchase.

The Computer Interrogation

Porsche has been using an Electronic Control Unit (ECU) in its 911 series cars since the 1980 911SC. As subsequent models were designed and released, the electronic management systems have continued to evolve, but for this article all discussion of the ECU capabilities will be that of the 9X6 or 9X7 cars unless otherwise noted.

Part of a thorough PPI of any computer-controlled Porsche should involve the use of a factory Porsche Integrated Workshop and Information System (PIWIS) diagnostic computer, or the diagnostic computer available to that repair facility to access and interrogate the vehicle's onboard computers. Not all non-factory automotive diagnostic computers have the same capabilities or access to the onboard data of every year and model Porsche. Check with the shop that will perform your PPI and find out which diagnostic computer they use. If it is not the factory PIWIS, inquire about the specific information provided by the onboard computer interrogation.

When it comes to Porsche's 9X6 or 9X7 models, the control units provide a significant amount of information relevant to the PPI. We are primarily interested in the engine DME (Digital Motor Electronics) ECU and the Porsche Side Impact Protection (POSIP) ECU that controls the airbags. Once the PIWIS has been connected to the car through the OBD II port in the driver's footwell, the technician should scan all the car's control units.

General DME Information

The technician should interrogate the DME and identify the age of the unit, which should be fairly close to the build date of the car. The DME should be checked for the presence of any faults, including fuel trim and misfire adaptations to ensure there are no underlying running issues being compensated for by the DME system. Also, the OBD II monitors should be set. If they are not, this could mean that the car's battery recently went dead, was disconnected or, possibly, all faults were erased. If faults in the DME were erased, they will come back, and the technician should be looking for any sign of tampering.

The DME will provide the total number of hours the engine has operated. This can be useful when trying to confirm the accuracy of the miles on the odometer. This is done by taking the miles on the odometer and dividing by the number of operating hours recorded by the DME. The resulting sum is the average miles per hour driven over the lifetime of the car. The answer should be about 30 mph, because the number takes into account highway speeds, urban traffic and idling at traffic lights. If the total miles on the

Callas Rennsport on Potential Issues with the Porsche 993

Any technician undertaking a PPI on a Porsche 993 would do well to use the following checklist as a guide for determining the wisdom of purchasing a particular used car:

ENGINE

Secondary air injection codes,1996-98 with OBD-II ('95s did not have OBD-II so avoided the air injection/emissions problems). Check valves for secondary air injection. Valve guides wearing out. Valve cover gaskets leaking. Distributor caps, rotors (cylinder misfire fault codes). Vacuum distribution port: Drive belt tension sensor. Alternator pulley update. Spark plug wires cracking. Engine pan removal due to high engine temperatures. Chain tensioner bridges leaking. Distributor drive belt. Engine wiring harness service. Chain tensioner's condition.

TURBO ENGINE

Extreme smoking on startup. Flywheel seal leaking. Flywheel faulty (misfire codes). Gearbox selector-shaft seal leaking. Slave cylinder creaking. Slave cylinder leaking hose. Steering rack boots tearing. Steering rack leaks. Front brake ducts (Callas modification). Rear control-arm-mounted CV joint boot protection covers.

ALL MODELS

Monroe shocks not desirable due to softness and leakage. Recommend lowering to European ride height. Add steering rack update bracket when 18-inch (or larger) rims are added to 1994-96 cars. Front control arm bushings cracking. Rear castor adjustors in correct position. A/C condenser-oil cooler fan resistors.

Alarm remote faulty/updated. Oil and A/C cooling fan relays. Oil and A/C cooling fan resistors. DME relay age. OBD-II Trip completion with smog test. Headlight bulb retaining clip update. Third (center) brake light wiring through rear window. Front bumper lower protection bar. Outer windshield shields creaking. Rear wing accordion torn. Noisy rear wing cable/drive mechanism. Rear wing mechanism (Callas update w/O-rings). Driver's door-stop mounting on A-pillar. Delaminating windshield at antenna entry. Rear fender rock guards fading. Airbag/horn retaining pad bracket. Cabriolet top service action. Inside temperature sensor motor (computer fault #45). Center console rubber pad missing. Door pocket rubber pads missing. Cracking door pockets (Callas repair). Climate control computer/control unit. Ashtray stays open. Fuel cap seal update.

Have a Porsche mechanic do a pre-purchase inspection of any Porsche you are considering. Do it before you buy the car — and before you're tempted to buy someone else's problems that could be really expensive.

odometer are very low in comparison to total operating hours, say the average speed is around 20 mph, then the car either was driven very slowly around town all the time, the odometer has been inoperative or replaced, or the mileage may have been rolled back.

Engine Ignition Over-Revs

The DME also should be checked for any recorded history of Engine Over-Rev/Range Information. Certain over-revs are totally harmless; however, others that exceeded specified limits could have caused internal mechanical damage. Engine over-revs are always caused by a driver error, and therefore Porsche will not warranty engine damage in cars that display certain over-rev history, claiming the car has been abused.

The most common over-rev events take place when the driver continues to accelerate (throttle on) past the engine RPM redline. This usually happens when accelerating hard in first or second gear because the engine will rev quickly and effortlessly up to and past the engine redline. As the rpm exceed redline, the DME activates a rev-limiter, at which point the DME starts recording over-rev information. Over-rev ignitions taking place within the control of the rev limiter will not damage the engine in any way, as long as the engine is at operating temperature and has the proper oil level.

The severe and potentially damaging type of engine over-revs are those that cannot be controlled by the rev-limiter. These are considered mechanical over-revs. This situation generally takes place when the driver shifts a manual gearbox into a low gear at high speed. An example of a mechanical over-rev might be if the driver is intending to quickly downshift from fifth to fourth gear at 80 mph and inadvertently shifts into second, releases the clutch and the engine revs immediately accelerate to over 9000 rpm. Under these circumstances, the possibility for mechanical engine damage is high. However, the problem is not caused by the engine turning such high rpm; the damage is caused by the engine accelerating into this rev range so abruptly. Note that Porsche models equipped with Tiptronic cannot suffer a mechanical over-rev because the electronic shift mapping will not allow catastrophic downshifts.

The engine over-rev information is broken down by a number of elements. First is the total number of spark plug ignitions that take place within or above the engine's limited rev range. These over-rev ignitions are then broken down into multiple (more than one) ranges. Each range has its own upper and lower rpm limit based on the specific model. Ultimately, the range defines the severity of the engine over-rev. When the DME records an over-rev event, it also records the hour of operation when the last over-rev event took place in a specific rpm range. Over-rev history cannot be erased or altered; it is recorded permanently into the DME and can only be removed from the car by changing out the DME.

Porsche's 9X6 models will record over-revs in two ranges, Range 1 and Range 2. Range 1 indicates the number of ignitions that have taken place within the control of the rev-limiter. Range 2 is considered a mechanical over-rev, because the engine rpm exceeded the control of the rev-limiter. Keep in mind that the rpm spread for each range differs by specific model.

For example, for the 996 Carrera, Range 1 = 7300-7900 rpm; Range 2 = 7901+ rpm.

For the 996 GT3, Range 1 = 8200 to 8800 rpm; Range 2 = 8801+ rpm.

Porsche expanded the visibility of ignition over-rev monitoring for the 9X7 models, which records events in Ranges 1-6. Over-revs that are within the control of the rev-limiter are recorded in Ranges 1-3, and over-revs that exceed the rev-limiter are recorded in Ranges 4-6. Again, the spread for each range is model specific.

For the 997 Carrera: Range 1 = 7300-7500 rpm; Range 2 = 7501-7700 rpm; Range 3 = 7701-7900 rpm; Range 4 = 7900-8400 rpm; Range 5 = 8401-9500 RPM ; Range 6 = 9501+ rpm.

For the 997 GT3: Range 1 = 9000-9200 rpm; Range 2 = 9201-9400 rpm; Range 3 = 9401-9600 rpm; Range 4 = 9601 to 10,000 rpm; Range 5 = 10,001-11,000 rpm; Range 6 = 11,001+ rpm.

As mentioned, Porsche has a history of denying warranty support for damaged engines with severe ignition over-revs such as those encountered within Range 2 for a 9X6 or Ranges 4-6 for a 9X7. It is generally not advisable to purchase a car that presents a history of ignition over-revs in these ranges due to the possibility of engine damage and the potential for this data to impact your ability to sell the car in the future. That said, we have seen cases where the total number of ignition over-revs in Range 2 was very low, say around 20; this is likely a computer anomaly in the system, because a 911 engine spinning at 7900 rpm will yield 395 ignitions per second.

Main Air Bag/POSIP ECU

The technician should interrogate the ECU for the airbag system/POSIP and should also identify the VIN number of the car in question, which can easily be verified. Additionally, the age of the POSIP ECU will be identified, and this should be fairly close to the build date of the car. The technician will be looking for any history of "events" and, unfortunately, having ANY is not desirable. Utilizing the actual values data, the technician can identify if the car has been in an accident where the airbags were deployed. The POSIP ECU is designed to be replaced after three accidents where the airbags were deployed.

Yet to Come

The next Tech Forum will focus on the in-shop paint/body/chassis and mechanical checklist. These areas sometimes yield unexpected surprises that can leave the owner of an even beautiful car shaking his head. Finding the right car can, and usually does, take time and a lot of patience. For those who know what they want and stick to the strategy of buying a well-maintained car, finding the right Porsche can a great experience.

Have a technical question? Email us at: **techforum@excellence-mag.com**

When the DME records an over-rev, it also records the hour of operation when the last over-rev took place in a specific rpm range.