

Vario Cam Plus

By Pedro Bonilla

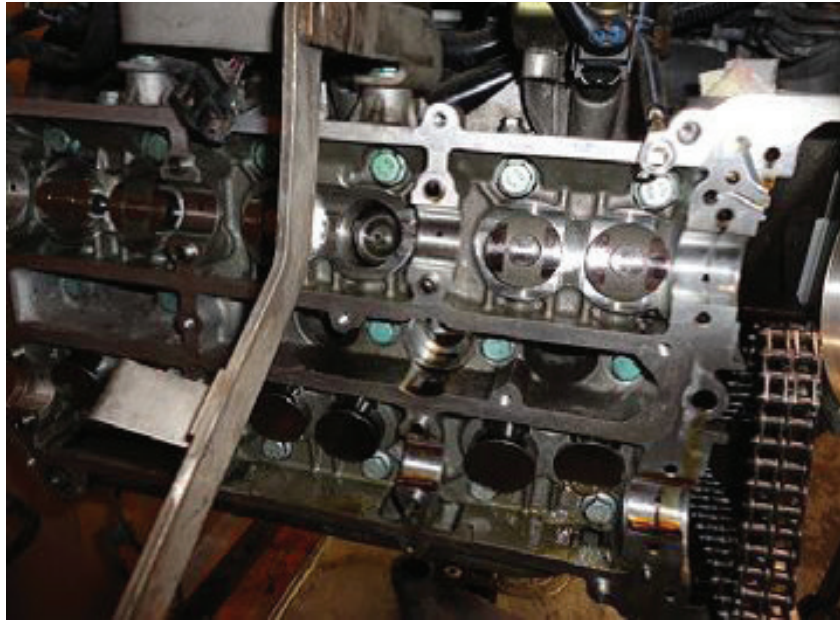
In 2001, Porsche introduced the new water-cooled 911 twin turbo. Based off the traditional GT1 case, Porsche added a few new tricks to give the engine a new level of power and drivability. Part of this was made possible using a variable valve timing system called Vario Cam Plus (VCP). VCP uses a combination of variable valve timing, as well as variable valve lift on the intake camshaft to increase power and torque while decreasing fuel consumption. You can think of it as having two engines in one. The first, a mild mannered and drivable engine for getting groceries, and the second, an engine that allows for maximum performance. The best part is that VCP allows the engine management system to switch seamlessly between the two. How is this done you ask? The variable lift system is accomplished by a multi piece tappet, activated by an electronic solenoid. A low lift configuration is used at partial throttle along with timing advance, whereas a high valve lift and timing advance configuration is used on full throttle applications. This combination of valve lift, as well as the ability to adjust the valve timing, allows for a tremendous amount of power from a small displacement engine, while still maintaining a very drivable car on the street.

Now, on to the bad news. As the engines age, the multi piece tappets are starting to come apart inside the engines. We have seen tappets come apart at as little as 30k miles. The result can be sluggish performance, or an engine that goes into a limp mode trying to protect itself. When the tappets come apart, you essentially can have different valve lift on different cylinders/valves, which is not a good thing. Not only this, but you have parts of the tappets that get demolished to a microscopic pulp that then go through the engine. You aren't likely to find metal shavings in your oil filter, but would rather see metal content slowly rising through an oil analysis as the tappets come apart. To see this though, you need to have a baseline done when the engine is still in good shape so you have something to compare to. When the tappets start to come apart, the engine harmonics are altered and it puts stress on the camshaft and the vario cam actuators that sit on the end of both intake camshafts. The intake camshafts have rings on the ends, which will then disintegrate, and start taking out the actuators. These actuators provide the variable valve timing to the engine.

Now on to the fun stuff. Here is a 996TT engine exposed. The intake camshaft is the top camshaft, with the exhaust camshaft on bottom. We are looking at bank 2, or the passenger side. The vario cam actuator sits on the end of the intake camshaft, and is driven by the timing chain.



With the camshafts removed, we can see the intake tappets, which provide the variable lift to the intake valves based off which portion, or lobe of the camshaft, is in contact with the tappet. (Ignore the one missing tappet, we will get to that).



The following picture shows how the tappet rides on the intake camshaft. The center section of the tappet can rise and make contact with the center lobe of the camshaft to provide the lift.



Alternatively, the center section will retract, allowing the outer section of the tappet to come in contact with the outer lobes of the camshaft, allowing a different lift.



Removed from the cam housing, the intake tappets should be a contained unit as seen here.



Unfortunately, this picture shows a tappet that has come apart. When it comes apart, the center section is not able to provide any lift.



Next up, is the vario cam actuator. The vario cam actuator is attached to each intake camshaft, and allows the position of the camshaft timing to change as needed (allows the camshaft to rotate slightly to advance or retard timing).



Notice the center section of the actuator has a spiraled section. As the actuator moves in and out, the camshaft that is attached to it rotates, thus changing the timing.



Here the actuator is in its retracted position.



Use your imagination to visualize the rotation of the camshaft as the center section of the actuator moves inward and outward. And that is how the vario cam actuator works! All of this is accomplished through hydraulic pressures...pretty cool!

I know what the next question is. How can I prevent this from happening? Some experts reprogram the engine management system to lock the tappets in place. The result is slightly lower torque down low, but you can pick up some boost response. One thing most of the experts do agree on is the most important thing you can do is to change your oil often. Some experts will tell you to only use 5w40 in these engines, while others will continue to contend 0w40 is fine. As we are seeing issues with the M96 IMS bearings, the research is pointing towards the thin 0w40 oil as one of the culprits. Some experts in the 996TT engines are claiming the same thing. The best thing you can do is order an oil analysis kit from Blackstone laboratories, get a baseline sample of your oil, and spend the extra \$20.00 every oil change to have a sample sent to Blackstone. They will provide you with a complete breakdown of the contaminants in the oil. If you see these values change over time, then it is best to get into the engine and inspect the components.