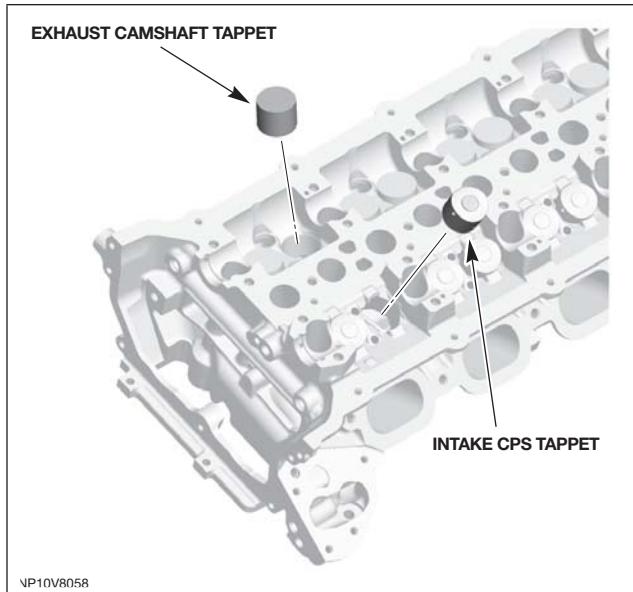
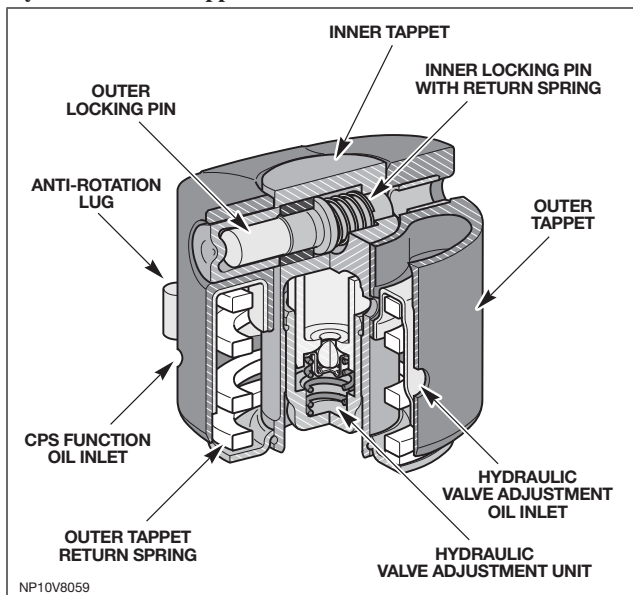


The tappets for the intake and exhaust camshafts differ from each other in their design and function. The exhaust tappets are mechanical with an adjustable valve clearance that is set using graded tappets. The intake camshaft tappets are hydraulic, which compensates for any wear – therefore the valve clearance is 0.



The intake tappets also feature a two-piece design which allows switching between the two intake valve lifting heights using an internal tappet locking mechanism.

Hydraulic Intake Tappet



CPS Operation

Varying the point at which the intake valve opens relative to the point at which the exhaust valve closes can yield a number of benefits. A high level of overlap (during which the exhaust and intake valves are both open simultaneously) encourages good cylinder charging at high engine loads as the incoming rush of air purges the cylinder of any residual exhaust gas.

While high overlap is good at high engine loads, the minimal cylinder charge and high intake vacuum at very low loads can lead to poor and unpredictable cylinder charging, as exhaust back-pressure means the cylinder will find it much easier to charge from the exhaust manifold than the intake system. This causes combustion instability, which manifests itself as uneven idle and hesitation under very light load conditions.

At moderate loads, overlap is beneficial, though for different reasons. Although the lower gas velocity eliminates any tendency for the incoming rush of charge air to purge the cylinder, the modest charge volumes and reduced manifold depression mean that a small volume of exhaust gas is drawn back into the cylinder. However, higher intake gas speeds ensure good mixing of this exhaust gas with the fresh charge, so combustion stability is not jeopardized.

This effect, known as internal exhaust gas recirculation (EGR), actually improves both the volumetric efficiency of the engine by reducing the work the engine has to do pumping a fresh air charge into the cylinder as well as its part-load emissions performance because the exhaust gas is inert, and does not interfere with the combustion process.

This conflict between low load stability and high power output means engines with fixed valve timing must operate compromised valve timing. This compromise attempts to balance the need for smooth and refined idle performance (demanding little or no overlap) with good high speed power and torque output (requiring significant overlap).