'Ask Hanip'

VTTL-i & VVT-i

Q: Dear Hanip, I've been hearing so much about Toyota's impressive VVT-i and VVTL-i engines but I'm not sure what they do and what they mean. Also what's the difference between the both? Alex Tan

A:Hi Alex, Toyota's VVTL-i is the most sophisticated VVT design yet. Its powerful functions include: Continuous cam-phasing variable valve timing, 2-stage variable valve lift plus valve-opening duration, Applied to both intake and exhaust valves.

The system could be seen as a combination of the existing VVT-i and Honda's VTEC, although the mechanism for the variable lift is different from Honda. Like VVT-i, the variable valve timing is implemented by shifting the phase angle of the whole camshaft forward or reverse by means of a hydraulic actuator attached to the end of the camshaft.

The timing is calculated by the engine management system with engine speed, acceleration, going up hill or down hill etc. taking into consideration. Moreover, the variation is continuous across a wide range of up to 60°, therefore the variable timing alone is perhaps the most perfect design up to now.

What makes the VVTL-i superior to the ordinary VVT-i is the "L", which stands for Lift (valve lift) as everybody knows. Toyota's system uses a single rocker arm follower to actuate both intake valves (or exhaust valves). It also has 2 cam lobes acting on that rocker arm follower, the lobes have different profile - one with longer valve-opening duration profile (for high speed), another with shorter valve-opening duration profile (for low speed).

At low speed, the slow cam actuates the rocker arm follower via a roller bearing (to reduce friction). The high speed cam does not have any effect to the rocker follower because there is sufficient spacing underneath its hydraulic tappet. When speed has increased to the threshold point, the sliding pin is pushed by hydraulic pressure to fill the spacing. The high speed cam becomes effective. Note that the fast cam provides a longer valve-opening duration while the sliding pin adds valve lift. (for Honda VTEC, both the duration and lift are implemented by the cam lobes)

Obviously, the variable valve-opening duration is a 2-stage design. VVTL-i offers variable lift, which lifts its high speed power output a lot. Toyota's system has continuously variable valve timing which helps it to achieve far better low to medium speed flexibility. Therefore it is undoubtedly the best VVT today.