

Swirl flap

Swirl flaps are small butterfly valves fitted to the intake manifold just before the cylinder head intake ports of many modern automotive engines, including those from Mazda, Audi, BMW, Vauxhall and Alfa Romeo. The flaps are smaller than the intake runners and therefore allow air to pass around them even when "closed". The photo shows a cleaned swirl flap removed from the intake manifold of a BMW M47TU 2-litre diesel engine. The flap itself is made from stainless steel and secured to a spindle by two small Torx screws. The sealing O-ring and external actuating lever can be seen below the flap itself.



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Operation

Swirl flap position is adjusted by an electrical or vacuum-actuated servo mechanism which is under the control of the engine management system. In a typical implementation the flaps will be closed at idle speed, creating additional turbulence in the intake. As engine speed increases, the flaps are gradually opened until, at around 2,000 rpm, they are parallel to the airflow and present virtually no resistance. Their purpose is to ensure that the air entering the cylinder is sufficiently turbulent for good fuel-air mixing even at low engine speeds. This aids in reducing certain toxic emissions and may also improve low-end power and torque.

Disadvantages

The disadvantages of swirl flaps are mainly associated with fouling by exhaust gas recirculation, which leaves tarry deposits on the flaps and the inside of the intake manifold. Over time the flaps can begin to stick in one position and the engine management system may report an error code if the correct flap position cannot be achieved within a few percent of the design specification. More seriously, the flaps or their mountings can fracture under the strain and parts can enter the cylinder. The BMW M47TU 2-litre engine manufactured between 2001 and 2004, and the similar 3-litre engine,^[1] is mentioned for swirl flap failure, as the small screws used to secure the flaps to their spindle will fall into the intake ports if the spindle fractures; in 2004 the intake manifold was redesigned to eliminate these.

See also

- Tumble flap

References

1. "Swirl flap design fault on bmw 730d" (<http://www.honestjohn.co.uk/askhj/answer/28326/swirl-flap-design-fault-on-bmw-730d>). www.honestjohn.co.uk.
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