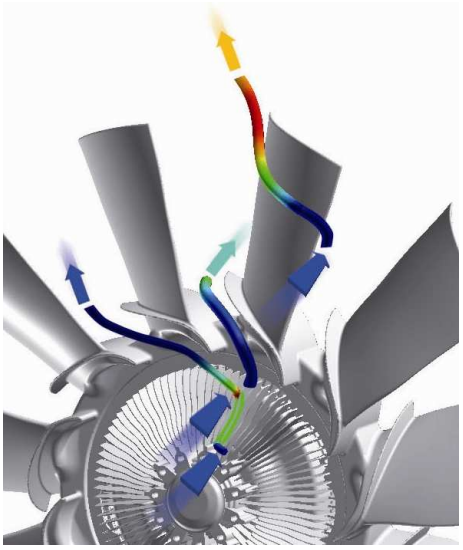
The electronically controlled Visco® fan clutch

Reason for the development

The type of cooling fan drive mainly used in the commercial vehicles sector with a Visco® clutch, as described in the TI “Visco® fan” has been extended by an electronic control. This map-controlled priority for fan control became necessary to meet the increased demands on engine cooling required by the exhaust standards Euro 5 and 6.

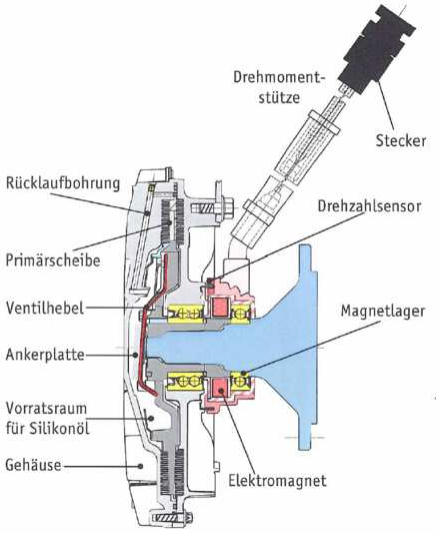
Advantages

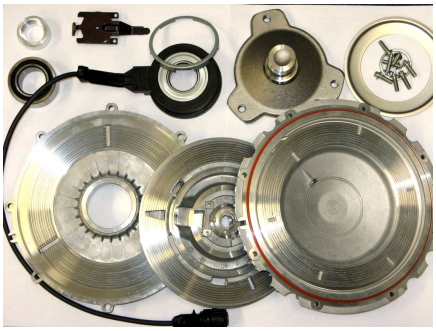
With comparable outer dimensions, 40% more torque can be transferred than with the fan clutches currently used. At the same time, clutch regulation and dynamic behaviour are significantly improved. Immediate switching at the start of the braking phase has improved the retarder function. The fan is activated even more precisely according to momentary requirements than is already the case, which means unnecessary fan noises are avoided completely. In order to cool the Visco® fan clutch sufficiently for the demanding area of application, the design of the fan hub has been optimally matched to the clutch. Flow dividers and flow stabilizers near the fan hub ensure that the cooling air flowing against the fan is guided through the cooling ribs of the clutch and into the flow of the blades without any problems. This results in better cooling of the silicone oil in the clutch and a greater reliable slip power.



Design

The schematic diagram shows all the relevant components in their position in the composite system. The individual parts of a clutch can be seen below.

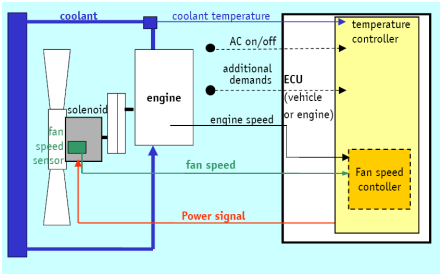




Function

The main difference to the bimetal-controlled Visco® clutch is that the silicone oil flow - and thus the fan speed - is not controlled through the bimetal (fan exhaust air) but through an electro-magnet.

The electro-magnet is seated on the clutch shaft and connected to an electronic control unit by a cable. The necessary fan speed is determined via various sensors in the cooling and air-conditioning circuit and through the engine electronics and triggered via the magnet. The defined magnetic field (PWM signal) regulates the valve via an armature to control the internal oil flow.
The actual fan speed is determined by a speed sensor and adapted to requirements if there is a deviation. The clutch is switched on in a dead-voltage state, which corresponds to a safety circuit. This means that there is maximum air flow through the fan even if the power supply is interrupted.

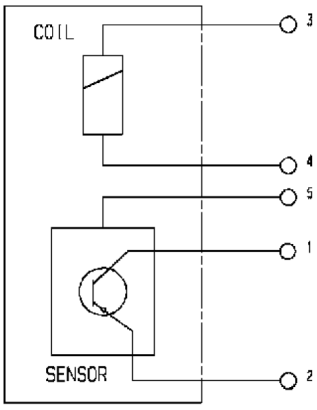


Armature plate

Functional test

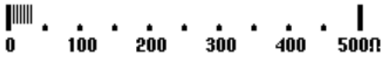
The functional test is possible using a diagnosis unit.

Manual testing of the Visco® fan clutch
can be carried out as follows, for example:
(Please heed the vehicle manufacturer's instructions!)



Connection diagram

- Determination of the coil resistance of the magnetic coil
  Between pin 3 and 4



- supply the Hall sensor with voltage, Pin 2 minus Pin 5 plus 5 Volt
  Turn the fan by hand and record the output signal using an oscilloscope at Pin 1

Effect of functional failure

The clutch is fully switched on in a dead-voltage state
which means that the fan is continually driven at maximum power.