Case Study

Durethan® DP AKV 50 HR H2.0 for cooling water manifold

Material: Durethan® DP AKV 50 HR H2.0

Manufacturer: Eaton, England

Figure 1 Cooling water manifold

Highly reinforced polyamide 66 (PA 66) is becoming increasingly popular in the automotive industry for the production of components for the cooling system. One example is the cooling water manifold shown in Fig. 1, which is used in various Ford Sigma engines in some of the company's new models like the Fiesta. The part is made of Durethan® DP AKV 50 HR H2.0, a PA 66 from LANXESS reinforced with 50 percent glass fibers. The high stiffness of this material means that the ignition coil can be fixed to the cooling water manifold via an integrated support. This compact design enables the space required for the engine to be reduced.

The fully assembled cooling water manifold is produced by the systems supplier Eaton at its Brierley Hill plant in England.

Through the fixing of the ignition coil to the cooling water manifold, high leverage forces act on the fairly long subassembly due to engine vibrations and jarring caused by potholes, etc. Despite this, the part must not show any signs of deformation, otherwise the flanges and outlet connections may begin to leak. The PA 66, with its high stiffness and strength and above all its excellent impact strength, complies with the manufacturer's stringent demands, and also allows the part to be designed with lower weight. At room temperature in the conditioned state, this material has a very high elasticity modulus of 10,600 MPa and is around one third stiffer than a comparable standard PA 66 with 30 percent glass reinforcement. Because the fibers in the polyamide matrix are evenly distributed, the material properties show only minimal scattering.

Screw threads for other add-on components such as a temperature sensor are integrated directly into the molded part with the aid of inserts, facilitating subsequent assembly. When injection molding the part, the PA 66 has the advantage that it can be demolded at an early stage because of its high thermal conductivity and elasticity modulus at high temperatures. This ensures cost-effective manufacture with short cycle times.

In view of the ever higher temperatures encountered in the cooling circuit, a further advantage of this hydrolysis-resistant and heat-stabilized PA 66 is its good long-term resistance to hot cooling media. This

is also confirmed by comparative tests using the standard Durethan® AKV 50 material as a reference. Specimens of both materials were immersed for over 500 hours in a water-glycol mixture (1:1) at 130 °C and a pressure of 2 bar, and their mechanical properties subsequently determined. After immersion, Durethan® DP AKV 50 HR H2.0 exhibits over 50 percent better values for flexural modulus and flexural strain, and 70 percent better impact strength than the standard material.