Case Study

Oil module in Durethan® AKV 35 H2.0 SR1

Fig. 1 Oil module

Grade: Durethan AKV 35 H2.0 SR1

Manufacturer: MANN+HUMMEL, Germany

OEM: Volvo

System supplier MANN+HUMMEL has been producing oil modules in Durethan® AKV 35 H2.0 SR1, a polyamide 66 with 35 percent glass fiber, since 2003. The replacement of aluminum with plastics led not only to weight savings but also to cost advantages in production, finishing and assembly.

The oil module produced for Volvo shown in Fig. 1 is made up of four plastic components: the filter cap, filter body, oil separator and base plate.

The assembly has to meet considerable demands on its stiffness and strength. The module must pass a test in which it is subjected to a pulsating internal pressure of more than 10 bar over hundreds of thousands of cycles at 150 °C. To achieve this, it was necessary to establish the optimum part design at an early stage of the project. LANXESS employed state-of-the-art computer-aided engineering methods such as, including topology and design optimization, as well as “integrative simulation”, in which predicted fiber orientation is used to improve the accuracy of stress predictions in the part.

One of the areas to be optimized in co-operation with MANN+HUMMEL was the flange joining the filter body and the oil separator (Fig. 2).

Fig. 2 Flange

To ensure a tight connection, an elastomer seal located in a groove on the filter body flange is com-

pacted during assembly. To prevent any leaks, sufficient contact pressure must be maintained at all temperatures and oil pressures. The flange region was successfully stiffened with the aid of topology optimization, making allowance for the required demolding direction of the part.

At the side of the filter body is an oil line which joins the cylindrical wall below the thread, forming an opening there.

Fig. 3 Filter body (CAD model and part)

This opening was originally meant to be rectangular in shape. In the simulation, however, it was seen that excessively high stress peaks developed in the corners, which would have caused the part to fail. The contour of the opening and the lip-shaped thick sections were therefore modified in a design optimization step. The optimum shape that was determined by in the simulation (see Fig. 3) is similar to a window in a passenger aircraft. Here again, it was possible to considerably enhance the mechanical strength of the structure long before the first parts were injection molded and tested.

These properties of Durethan® AKV 35 H2.0 SR1 are particularly important for the use of this material in oil modules:

- high stiffness and toughness
- high temperature resistance
- good weld line strength
- excellent chemical resistance
- low warpage and high dimensional stability
- very good surface finish, particularly in the region of the sealing grooves

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Note:
The information contained in this publication is current as of September, 2010. Please contact LANXESS Corporation to determine if this publication has been revised.

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