As engine designers are challenged to create smaller, lighter and more powerful systems, DSM is innovating the materials to make it possible. DSM’s portfolio of high-performance plastics provides efficient solutions for every duct in air induction systems.

For blow molded flexible ducts, OEM’s and TI’s are searching for high performance materials with excellent mechanical performance after heat aging combined with high chemical resistance. DSM offers Arnitel® thermoplastic copolyester (TPC), the most reliable and cost efficient solution compared to metal and rubber. The heat aging performance of Arnitel, in combination with the best proven chemical resistance minimizes the risk of failure. Arnitel has proven performance for clean air ducts, cold charge air ducts, and in the near future also in hot charge air ducts.

**Our portfolio for flexible airducts:**

<table>
<thead>
<tr>
<th></th>
<th>Arnitel PB500-H</th>
<th>Arnitel PB582-H</th>
<th>Arnitel HT</th>
<th>Next best TPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical resistance</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Heat aging</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td>-</td>
</tr>
<tr>
<td>Welding</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>0</td>
</tr>
</tbody>
</table>

**Clean air ducts**

Rubber and TPEs are commonly used for clean air ducts. Clean air ducts made from DSM’s Arnitel offer reduced weight and wall thicknesses up to 50% compared to rubber, resulting in a significant cost advantage and an improved environmental profile.

Arnitel outperforms competitive materials with elongation retention after heat aging that is up to four times better than other TPC materials.

The Arnitel PB500-H and PB582-H have a proven track record in air ducts with superior heat aging performance versus competitive TPC materials confirmed by multiple OEMs.

With high-performance grades that can operate at prolonged temperatures up to 150°C it offers robust elongation retention, as well as superior strength, flexibility, weldability performance and chemical resistance.
Used with 3D blow molding techniques, Arnitel offers the freedom to incorporate multiple components into one complex part design. In addition, it’s easy to recycle during processing to ensure minimal waste and substantially reduce material costs.

For peak temperatures up to 170-175°C, Arnitel PB582-H is an ideal material candidate. The PB582-H material delivers higher stiffness at 175°C as compared to rubber and competitive TPC materials, while rubber and competitive TPC materials reach this stiffness at temperatures up to 110-140°C. This higher stiffness can be used to reduce wall thickness or ensure higher mechanical performance for a given design.

**Best-in-class: Lowest weight increase in EGR liquid**

With low pressure exhaust gas recirculation (EGR) systems and increased EGR rates, stable mechanical performance in clean air ducts has grown even more important. After exposure to EGR condensate, Arnitel shows low weight increase and very little drop in elongation at break after 2000 hours. Competitive TPC materials experience a significant weight increase, a compromised appearance, and an associated drop in mechanical properties as a result of the same exposure.

**Case: Blow molding grade for Fiat’s clean air ducts**

Working together with Fiat Group Automobiles and leading Tier 1 systems supplier Mecaplast, DSM developed the Arnitel® PB500-H for use in clean air ducts at a continuous use temperature of 130°C. The material is used in the 1.3 JTD engines for the Fiat Minicargo and Lancia Ypsilon (Euro V), as well as the award-winning engine for the New Ypsilon, which achieves the lowest CO2 emissions in the segment at 97 g/km.

“This grade meets Fiat’s technical requirements while also offering a cost advantage over current solutions,” says Marco Foresti, who is responsible for Engineering Material Application for Fiat Group Automobiles. “The material’s hardness offers new design freedom and a range of material properties that facilitate easy assembly and higher tolerances on the final design layout.”

“Arnitel PB500-H offers good and stable processing while achieving very complex shapes,” says Ludovic Poix, Fiat Project Manager at Mecaplast. “The material is very flexible across its entire temperature range of -40 to 150°C, while delivering a superior smooth inner surface and good weld strength with PBT/Arnitel fittings and couplings.”

**Cold charge air ducts**

DSM offers Arnitel for cold charge air ducts with operating temperatures up to 150°C (in this case under the hood temperature) and high pressure loads. Traditionally designed in stainless steel or aluminum, cold charge air ducts made from these materials enable metal to plastic conversion using both blow molding and injection molding techniques. The materials enable reductions in part count, weight, and processing costs while delivering the necessary durability for demanding under-the-hood applications. Arnitel leaves no residual deposit on machine heads, in contrast to competitive materials, resulting in an increase in productivity up to 5%.
Hot charge air ducts
In hot charge air ducts you see the request for a single material solution, replacing the combined metal ducts with rubber ends.

The current standard practice is to assemble separate elements in hard thermoplastics or metal and soft thermosetting rubbers, which need to be produced in diverse operations.

Arnitel HT in a single material duct outperforms rubber in many aspects:
• Weight saving up to 40%
• Cost saving up to 50%
• Reduced risk of leakage
• One part solution
• Single step production and assembly
• Improved environmental impact

Arnitel HT can withstand continuous operating temperatures of up to 180°C and peaks of up to 190°C and has good resistance to the sorts of oils and chemicals found in automobile engine environments.

25 years’ experience in air induction systems
DSM, inventor of Diablo technology, has more than 25 years of experience supplying material for air induction systems. Combining our application development expertise with the extensive knowledge base of our fundamental research team, we help to determine which material properties are needed for air induction applications. Contact us today to discuss how DSM can help redesign your air induction ducts to create lighter and more efficient air induction systems.

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