Bright Science results in the world's first high heat plastic AIM/CAC combination

DSM's portfolio of high-performance plastics helps to revolutionize the design of air intake manifolds

New legislation places very tight limits on car emissions, with strict targets on CO_2 emissions. DSM focuses on driving forward solutions that significantly decrease environmental impact, leading to the development of a complete portfolio of thermoplastic products that answer the changing needs of the automotive industry.

One of the latest developments in turbo systems is to integrate the charge air cooler (CAC) into the air intake manifold (AIM), using liquid to more effectively cool the air instead of air-to-air systems. This drives up the temperature in the AIM (currently up to 230°C), as well as the mechanical requirements for the materials used. Integrating the CAC into the AIM reduces the length of piping previously needed to reach the air-to-air cooler in the front of the car, leading to increased engine responsiveness. For car manufacturers, this makes it possible to deliver higher performing engines while still meeting the new emission limits.

DSM offers a complete portfolio of high-performance materials for air intake manifolds whether they have an air-to-air CAC or an integrated liquid-cooled CAC. This includes Akulon® polyamide 6, Akulon Diablo polyamide 66, Stanyl® and Stanyl Diablo polyamide 46. The Diablo technology is engineered specifically for elevated continuous-use temperatures of 180-230°C.

AIM with integrated liquid-cooled CAC

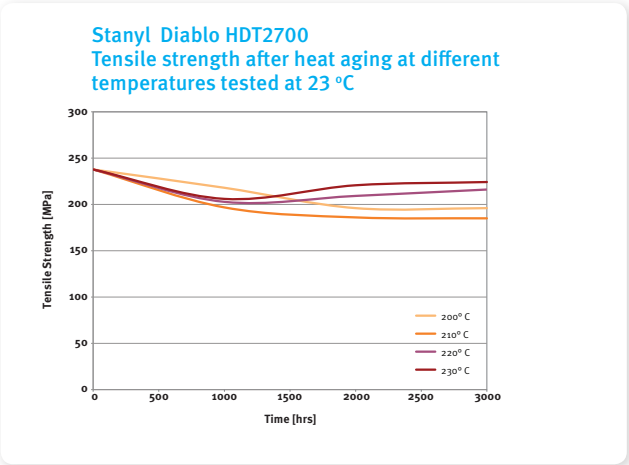
Air intake manifolds with integrated liquid-cooled CACs achieve a giant step forward in improving engine responsiveness and reducing turbo lag, yet they require a great deal more from the plastic materials used to create them. Integrating the cooler into the AIM drastically changes the geometry of the manifold in a way that could cause a loss of stiffness and strength, which are critical at higher temperatures.The new geometry also requires materials with high weldability and weld line-aging resistance to maintain the part's integrity. At the same time, the material must withstand exhaust gas recirculation (EGR) and blow-by.

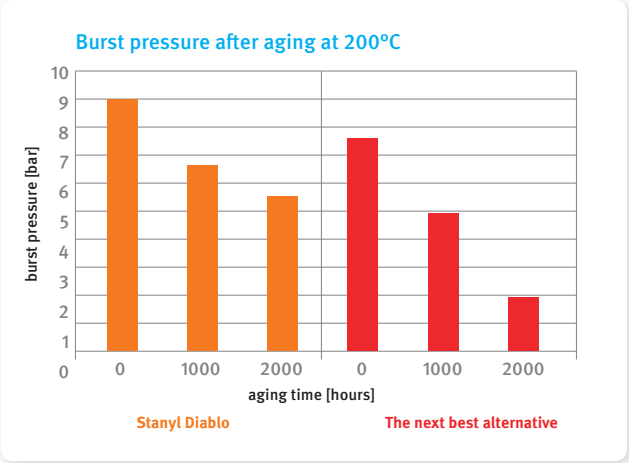
Outperforming the competition: Stanyl Diablo

DSM's solutions for high temperature and high pressure applications are Stanyl Diablo OCD 2100 and our latest innovation Stanyl Diablo HDT2700. These high-heat thermoplastics outperform competitive materials in thermal oxidative stability, maintaining high stiffness at elevated temperatures and pressure loads.

Our Diablo materials eliminate the need to return to metals due to the increasing temperature requirements under the hood, and enlarges the possibility to integrate functions and be more flexible in designing efficient parts. Stanyl provides a weight reduction of up to 40% over aluminum, and its optimized processing characteristics reduce material and production costs.

Best-in-class: Thermal stability





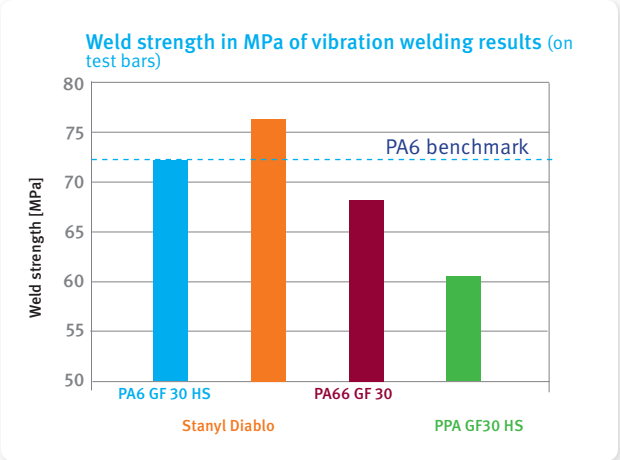
Stanyl Diablo performance after 2000 h is 189% higher than performance of the next best alternatives

Best-in-class: Heat Deflection Temperature under load (HDT)

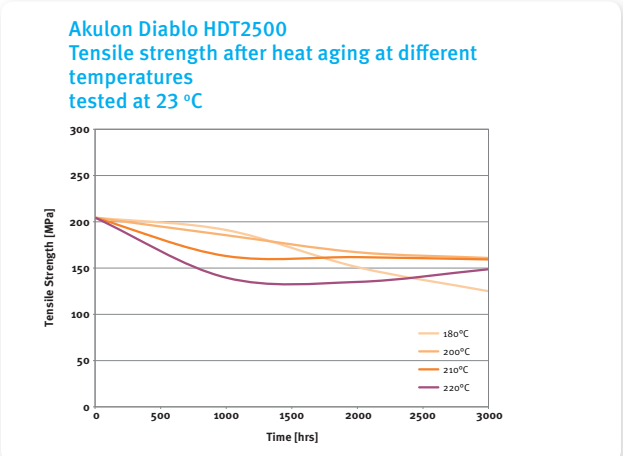
The new Stanyl Diablo HDT2700 has an improved HDT. The melting point in combination with the Heat Deflection Temperature (HDT) gives a good impression of the peak temperature resistance under a certain load.

Meet the new Akulon Diablo polyamide 66

The new Akulon Diablo HDT2500 withstands a 220°C continuous-use temperature and has a HDT of 245°C. Looking at long term heat aging, this new grade has a stable performance up to 220°C.



Stanyl and Akulon offer excellent weldability for injection molded ducts.



Both Stanyl Diablo HDT2700 and Stanyl Diablo OCD2100 have excellent mechanical strength to provide best-in-class weld strength and ensure part integrity under pressure pulsation loads. Stanyl Diablo, like our other grades for intake systems, withstands the current exhaust gas recirculation (EGR) and blow-by requirements. It maintains high stiffness, even while exposed to continuous-use temperatures up to 230°C.

Akulon Diablo fills the gap between Akulon PA6 and Stanyl Diablo by combining long term heat aging performance and mechanical properties at 180-200°C.

Akulon® polyamide 6, the proven solution

For lower temperature AIM applications, Akulon polyamide 6 glass-filled, provides an optimal balance between density and mechanical properties. For increased safety and flexibility in manifold design, we also offer grades with improved burst pressure or laser weldability.

Case: Award-winning air intake manifold design

Volkswagen's TSI engine provides customers with both the joy of driving, and the joy of saving – on fuel and emissions. Working together with Röchling Automotive AG & Co. KG, DSM helped to develop the automotive industry's first serially produced air intake manifold with an integrated liquid charge air cooler, one of the key advanced engine technologies used in the TSI engine. The new design led the two companies to win the 2012 Automotive Innovation Award (Powertrain Segment) from the Society of Plastics Engineers – Europe.

Created in DSM's Akulon polyamide 6, this pioneering advance achieves a 20% reduction in the number of parts, weight and costs over similar turbo systems with air-to-air charge air coolers. The compact solution also realizes a 40% reduction in engine compartment package space and air volume, improving engine responsiveness and virtually eliminating turbo lag, while also creating more design possibilities under the hood. This new design paves the way for the future of air intake manifolds, making a significant contribution to cost-effective, high-performance and reliable engines with high torque, low fuel consumption and minimal CO2 emissions.

"This is a real breakthrough," says Marco Barbolini, Product Manager at Röchling Automotive. "Realization of the fully integrated air intake manifold was a challenge, however the trend toward this basic design is gaining momentum throughout the industry. Integrating the heat exchanger into the intake manifold reduces air volume to give the engines more punch, and eliminates a number of rather expensive parts."

Inventor of the Diablo technology

DSM is a market leader in the development of high temperature resistant thermoplastics for automotive engines. Diablo technology, ivented and patented by DSM, improves the long term temperature resistance of materials such as Stanyl PA46 and Akulon PA6 that already has better high temperature performance than standard polyamides; and DSM is also using it to upgrade performance in its Akulon polaymide 6. DSM licenses the Diablo technology to other high temperature thermoplastics suppliers.

Contact us today to discuss how DSM can help redesign your air intake manifolds to integrate a liquid charge air cooler, and create lighter and more efficient air induction systems.

DSM Engineering Plastics

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