

Chair comfort

Humanscale (www.humanscale.com) aims to bring a new level of comfort to stackable chairs that are able to withstand the rigours of everyday use at the same time. The American firm first entered the task seating market in 1999 and as part of a product portfolio extension, Humanscale turned its attention to stackable chairs, having already produced a number of award-winning office chairs.

Because stackable chairs need to be strong, they are often made of steel or from a hard, strong plastic, such as nylon or glass-filled polypropylene (PP), typically combined with vinyl or fabric to provide a level of comfort. But as the materials used allow little or no movement, the chair user tires easily.

"One of the most important aspects of designing a comfortable chair is to ensure there is adequate support and flex for the lower back. Combining the required strength with a high level of comfort in a stackable chair can be a problem because flexible materials often aren't strong enough," says Humanscale senior designer Lachezar Tsvetanov.

Ergonomic concept

Humanscale's conceptual objective was to produce an attractive, ergonomic design with a flexible back for comfort. It included a wide belt attached to the lower back of the chair to support the lumbar region.

Humanscale sent its designs to processor L&P Plastics, suggesting PP for the back and seat of the chair and an elastomer for the lower-back support belt. Together, L&P Plastics and Humanscale designers worked to develop a chair that met both the physical and aesthetic requirements.

From a performance perspective, the chair had to pass the Business and Institutional Furniture Manufacturers Association (BIFMA) testing and CAL133 flame retardant tests. The material used for the support belt needed to withstand up to 90kg in weight, be UV resistant, offer good creep resistance and adhere to the structural PP.

Jason Peters, L&P Plastics programme manager, says: "While Santoprene brand TPVs were high on the list of elastomers considered, their ability to bond tightly with PP, plus the technical support and depth of resource available from ExxonMobil



The stackable Humanscale Cinto chair includes a wide belt of Santoprene TPV that provides support to the lower back

Chemical convinced us we could rely on them."

The ExxonMobil Chemical specialty elastomer technical support team provided advice regarding belt thickness and also recommended a reduction in the side post attachment areas to alleviate sink marks. Mould flow analysis were undertaken to confirm that Santoprene TPV (www.santoprene.com) would flow well enough to fill the part. Finite element analysis (FEA) tests were done to identify areas of stress concentration.

Sample materials were then provided for prototype testing at the L&P facility in Brownsville, Texas. On reviewing the results, ExxonMobil undertook further FEA analysis which resulted in a slight, but important, change in the elastomer's durometer.

From an aesthetic viewpoint, the surface of the chair had to look good — the ability to colour the chairs to suit office environments

The use of flexible, elastomeric elements in furniture has always been one of the material options explored by manufacturers to achieve ergonomic design, as exemplified by Santoprene's TPV solution for the new Cinto stackable chair

was important, as was being able to incorporate the Humanscale logo.

ExxonMobil Chemical provided L&P with connections to suppliers of compatible colourant materials to meet the requirements of the application. With long flow lengths, non-uniform thicknesses and the complexity of the part, there were many opportunities for halos and flow marks. Texturing was promoted, and sample parts and test plaques were shared with Humanscale to demonstrate the potential for aesthetic improvement.

End result

Designed to move with the body, the Cinto chair offers comfort and ergonomic features for a chair in its class. Made of steel, polypropylene and TPV materials, the chair is also fully recyclable — an important consideration for Humanscale.

"Humanscale has always been committed to environmental sustainability, continually striving to design, engineer and manufacture products that consume less of the Earth's resources," says Mike Buhmann, Humanscale national director of seating and training. "By creating products that use less material, that have fewer assembly processes, and which contain a high percentage of recyclable or recycled content help us to accomplish this goal."

The chair is currently available in ten colours, and the logo is tastefully moulded into the back of the lower belt. The lower back support belt, weighing about 0.3kg and measuring 508mm long by 14mm wide by up to 25mm thick, is manufactured by injection overmoulding Santoprene TPV onto the PP chair back. In the overmoulding process, the Santoprene TPV and PP chemically adhere to create a very strong cohesive bond.

"Santoprene TPV provided the mechanical advantage that we were looking for. It enabled us to design a comfortable stackable chair by providing lower back support that could flex while retaining its structural integrity," says Tsvetanov.