

Low-friction, low-wear

DuPont™ Vespel® thrust washers for Audi CVT drive



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Photo: DuPont

Highly abrasion-resistant DuPont™ Vespel® polyimide thrust washers take up the axial forces of the toothed gearwheel stage in Audi's Multitronic® CVT gearbox.

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Stevenage, August 2006. In its stepless VL300 Multitronic® CVT gearboxes, which are an option in certain models, Audi uses highly abrasion-resistant DuPont™ Vespel® polyimide thrust washers. These parts contribute to the reliable, low-maintenance operation of the gearbox, because they allow low-friction movement between rotating and stationary parts, even when highly loaded. For the designer they help to save costs, space and weight without any compromise in reliability.

In the starting phase, the thrust washers take up the axial forces of the toothed gearwheel stage, which forms part of the driven shaft assembly. Relative rotational speeds here can reach 3000 min^{-1} , depending on motor power. Closed oil recesses on both faces of the thrust washers stabilise the lubricating film, while flow channels guide the oil through to lubricate neighbouring bearings and to improve heat dissipation.

These features, developed jointly by Audi and DuPont, boost the already high pv limits (the product of pressure differential and relative velocity) which Vespel® SP thrust washers can withstand without significant wear. The result is that wear surfaces can be kept very small, so that small-diameter washers can be used; this in turn means that less space is needed for installation, the component weighs less and overall production costs are reduced.

DuPont™ Vespel® SP polyimides have no glass transition temperature and they do not melt. This means that they can be used from cryogenic temperatures to very high temperatures: up to 290°C in continuous operation or up to 480°C for short excursions. Vespel® SP-21 and SP-22 are the preferred types for thrust washers and sealing rings. DuPont fabricates these materials into high-precision parts with a direct-forming technique like that used in powder metallurgy. These parts generally need no finishing operations, but can be machined like brass if needed.

Where even more design freedom is needed, thermoplastic Vespel® TP types can offer further advantages. DuPont supplies finished parts of Vespel® TP fabricated to customer specifications by injection-moulding. Their glass-transition temperatures of about 250°C are substantially higher than current requirements in gearbox engineering. Depending on the application, DuPont offers types with high temperature and abrasion resistance combined with high strength or improved chemical resistance.

The **DuPont Engineering Polymers** business manufactures and sells Crastin® PBT and Rynite® PET thermoplastic polyester resins, Delrin® acetal resins, Hytrel® thermoplastic polyester elastomers, DuPont™ ETPV engineering thermoplastic vulcanizates, Minlon® mineral-reinforced nylon resins, Thermx® PCT polycyclohexylene dimethylterephthalates, Tynex® nylon filaments, Vespel® parts and shapes, Zenite® liquid crystal polymers and Zytel® nylon resins and Zytel® HTN high-performance polyamides. These products serve global markets in the aerospace, appliance, automotive, consumer, electrical, electronic, industrial, sporting goods and many other diversified industries.

DuPont is a science company. Founded in 1802, DuPont puts science to work by creating sustainable solutions essential to a better, safer, healthier life for people everywhere. Operating in more than 70 countries, DuPont offers a wide range of innovative products and services for markets including agriculture, nutrition, electronics, communications, safety and protection, home and construction, transportation and apparel.

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Press contact (UK, Benelux, Scandinavia)

Andrew Wilkins

Tel.: +44 (0)1353 663350

Fax: +44 (0)1353 663350

Email: dupont.press@btconnect.com

<http://uk.news.dupont.com>

DuPont press contact

Horst Ulrich Reimer

Tel.: +49 (0)6172 871297

Fax: +49 (0)6172 871266

Email: horst-ulrich.reimer@deu.dupont.com

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