



*Polymers
for
Performance!*

New Lightweight Powertrain & Transmission Components

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Vyncolit Engineering Polymers for Engine
Performance Enhancement

Content

- ❖ Introduction: Group & Company Overview
- ❖ Trends in Powertrain & Engine development
- ❖ A piece of history: Pulleys & Idlers
- ❖ Clutch Piston
- ❖ **NEW**: Valve Block
- ❖ Future

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Introduction: Group & company overview

Vyncolit N.V. group belongs to the vast subsidiary network of the Japanese group:

Sumitomo Bakelite Co., Ltd.

- ❖ Head Office, Tokyo
- ❖ Stock exchange, Tokyo
- ❖ Annual Consolidated Sales, JPY 255B (EUR 1.560 billion)
- ❖ Employees, 9,165 (worldwide)
- ❖ Subsidiary, 44 (Japan 16)

Figures as of March 31, 2007 (1,000 JPY = 6.122 EUR)



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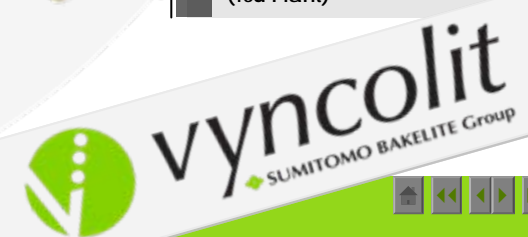
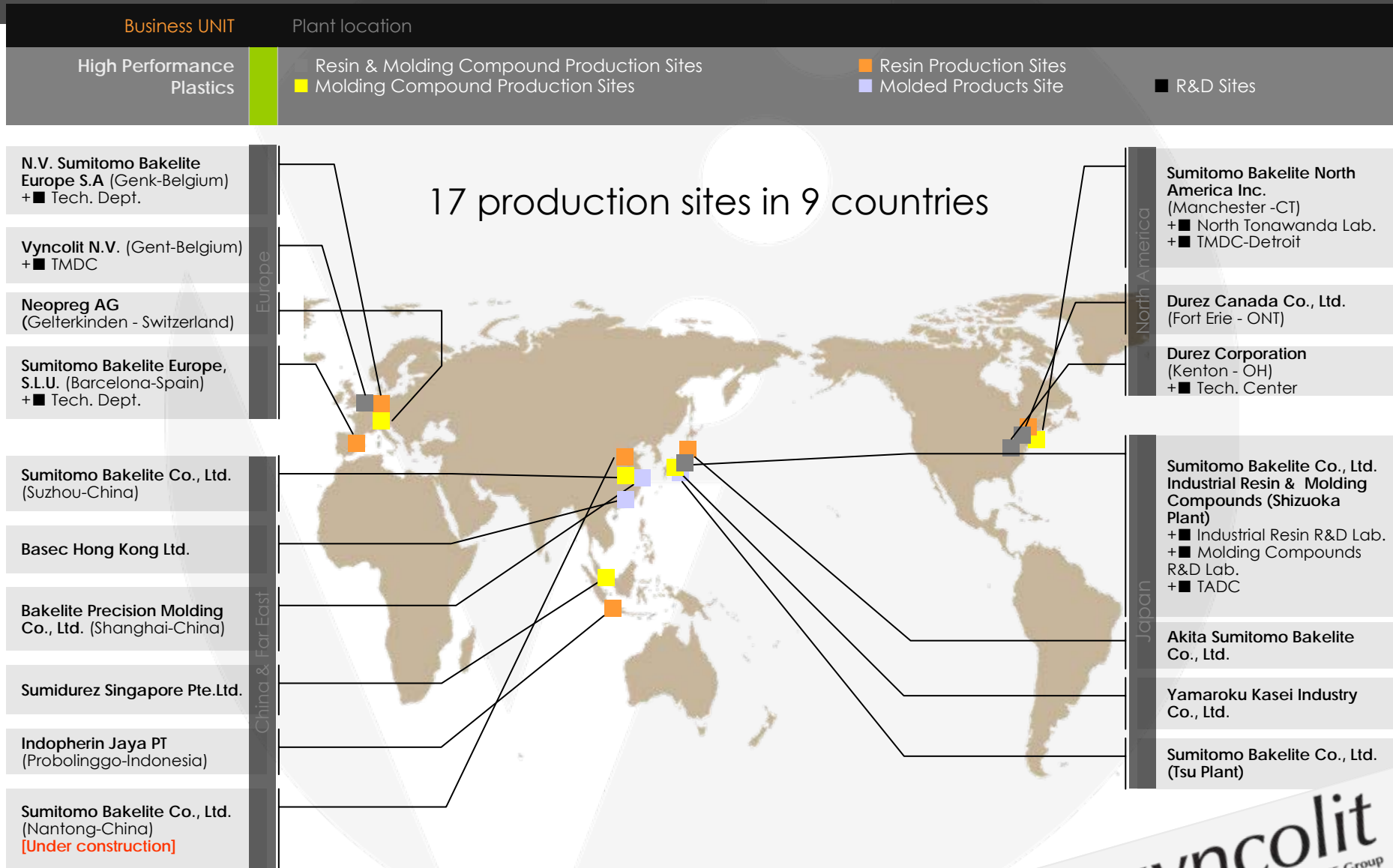
New Lightweight Powertrain & Transmission Components



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Sumitomo Bakelite Co., Ltd.

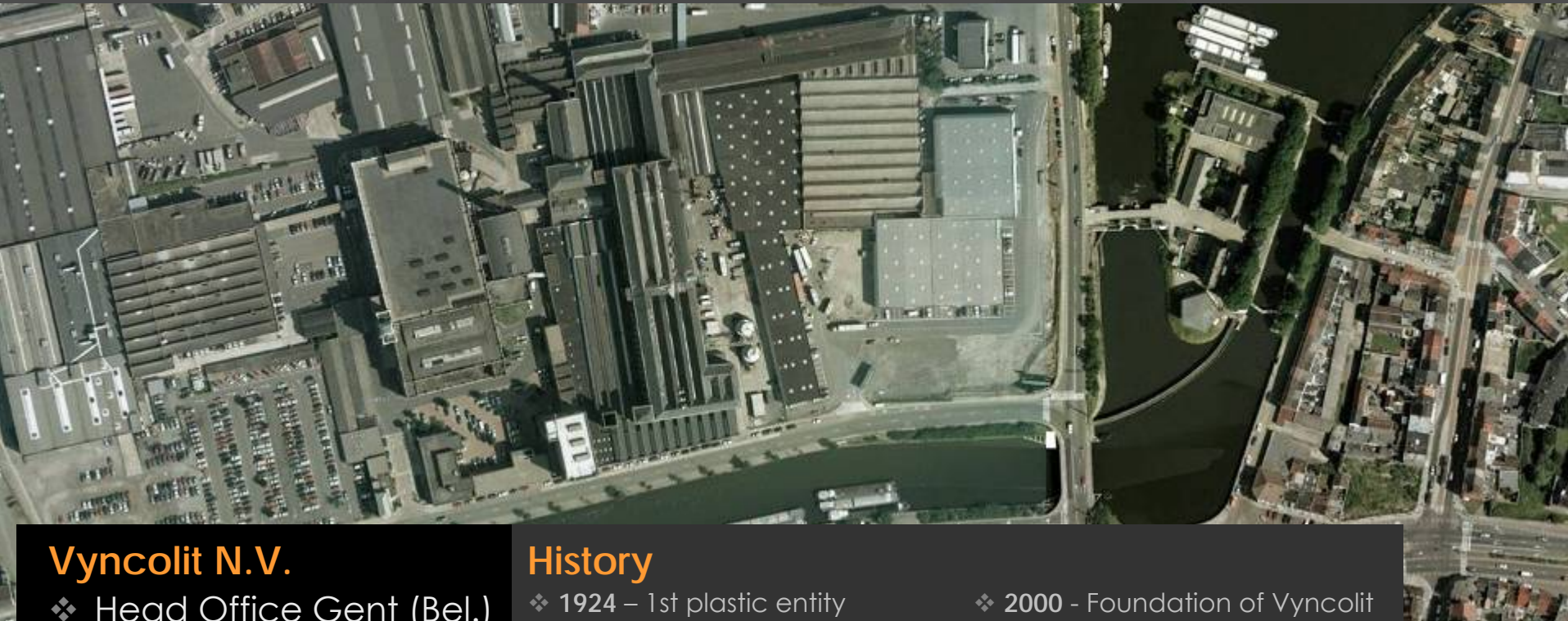


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Vyncolit N.V. for more than 85 years



Vyncolit N.V.

- ❖ Head Office Gent (Bel.)
- ❖ Annual Sales
EUR 35M / 13,000 tons
- ❖ Employees
135

Figures as of March 31, 2007

History

- ❖ 1924 – 1st plastic entity founded by Vynckier S.A.
- ❖ 1963 - 1st production of Engineering Glass Fiber Phenolic
- ❖ 1993 - Vyncolit N.V. created as a separate legal entity
- ❖ 1994 - Vyncolit N.V. acquired by Perstorp, a Swedish group.
- ❖ 2000 - Foundation of Vyncolit North America Inc.
- ❖ 2002 - Rogers MCD acquired as part of the strategy to become a global company
- ❖ 2005 - Vyncolit N.V. acquired by Sumitomo Bakelite Co. Ltd., an ind. Japanese group

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Drivers & Trends in Engine, Powertrain & Transmission Development

Drivers

- ❖ Engine downsizing
- ❖ Improving efficiency
- ❖ Reducing emissions
- ❖ Increasing reliability
- ❖ Driving comfort
- ❖ Increasing productivity with reduced costs

Trends

- ❖ Turbocharging, direct injection, EGR systems in Diesel and Gasoline engines
- ❖ Hybrid, H₂ Engines
- ❖ Multi Gear Transmissions, DCT & CVT
- ❖ Weight reductions through Metal-Thermoset/Thermoplastic conversion and design optimization
- ❖ Bio Fuels and Bio Diesel

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Drivers & Trends in Engine, Powertrain & Transmission Development

Drivers

- ❖ Engine Efficiency
- ❖ Improving Power
- ❖ Reducing Emissions
- ❖ Increasing Torque
- ❖ Driving Cycles
- ❖ Increasing Power Density with reduced engine size

Temperature Increase Under the Hood

Cost Reductions

Trends

Design Challenges

Weight Reductions

- Direct injection, Diesel and Gasoline
- CVT, PHEV, DCT &
- Weight Reductions through Metal-plastic design
- Diesel

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Vyncolit® Phenolic Engineering Polymers

PIERBURG AIR INTAKE
MANIFOLD

Vyncolit®

Phenolic Engineering polymers

With Glass Fiber as main reinforcement , these materials give very high mechanical and thermal properties. The high degree of pourability and plasticity makes them especially suitable for molding complicated parts.

This family is divided in five main series

BXE-Series

Dust-free Engineering
Phenolic Compounds

X-Series

Engineering
Glass Fiber Phenolic
Compounds

W & XB-Series

Mineral & Organic
Phenolic Compounds

CG-Series

Tribological
Phenolic Compounds

Vyntec®

Carbon Fiber
Phenolic
Compounds



Properties to Note:

- ❖ High mechanical strength, even in thin sections
- ❖ Excellent dimensional stability
- ❖ Very good electrical insulation
- ❖ Good resistance to automotive chemicals
- ❖ Excellent temperature resistance
- ❖ Excellent creep resistance
- ❖ Very low CTE

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New Lightweight Powertrain & Transmission Components



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Vyncolits History in Powertrain: Pulleys & Idlers

- ❖ 1992: Development of specific materials for Pulleys, with approval from BMW.
- ❖ 1993: First industrial production of Alternator Pulley
- ❖ As from 1993: Valeo, Hutchinson & Denso have been using Vyncolit Materials for alternator, air conditioning, steering pump, waterpump Pulleys



- Airconditioning Pulley
- Material Vyncolit 2940W
- Pulley V bearing
- Molder: Winkelmann
- OEM: Denso



- Waterpump Pulley
- Material Vyncolit X7255
- Pulley V
- Molder: Mark IV
- OEM: Fiat JTDi 1.3



- Idler
- Material Vyncolit GL120
- Hutchinson

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Clutch Pistons



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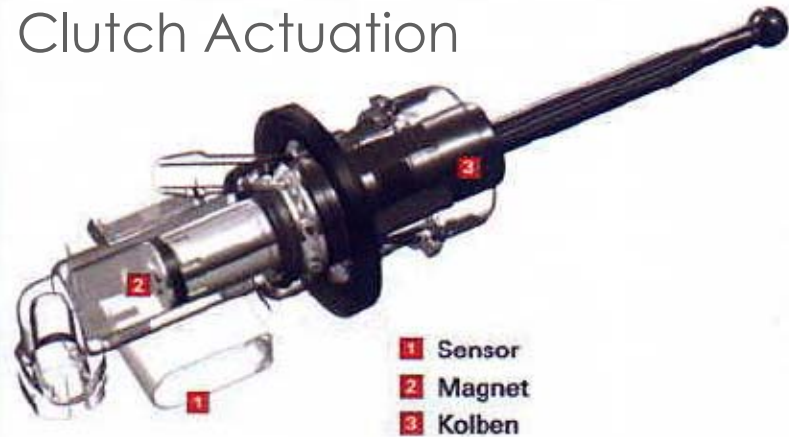
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Clutch Pistons: Parts description



Source: K&E website

Clutch Actuation



Source: K&E website

- ❖ Material: Vyncolit X655/X680
- ❖ Molder: K & E
- ❖ Tier I: ZF Sachs, LuK
- ❖ OEM: VW, Audi
- ❖ Models:
 - Audi A3
 - VW Golf V

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Clutch Pistons Properties

- ❖ Integrated Magnetic Sensor (positional detection) prevented the use of steel pistons
- ❖ Compared to steel-alu versions, the Thermoset Piston achieved higher efficiency, reduced NVH, weight reduction and high durability

- ❖ Due to the material properties the Pistons:
 - have a highly polished surface: the glass fibers are perfectly incorporated into the resin matrix
 - are dimensional stable due to the low Coefficient of Thermal Expansion
 - maintain their properties even at higher temperatures and in contact with hydraulic oils & chemicals.



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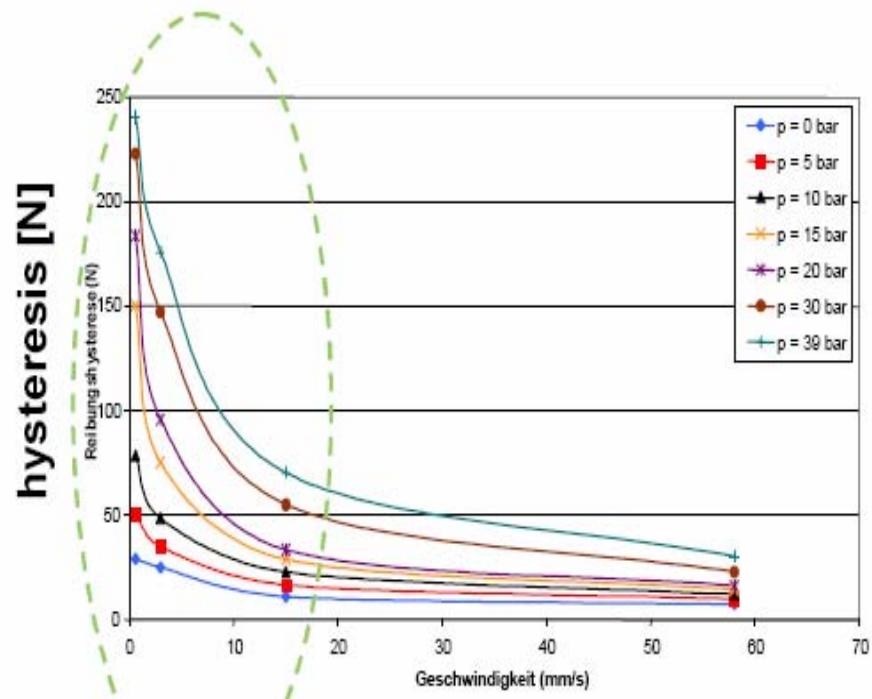
Source: K&E website



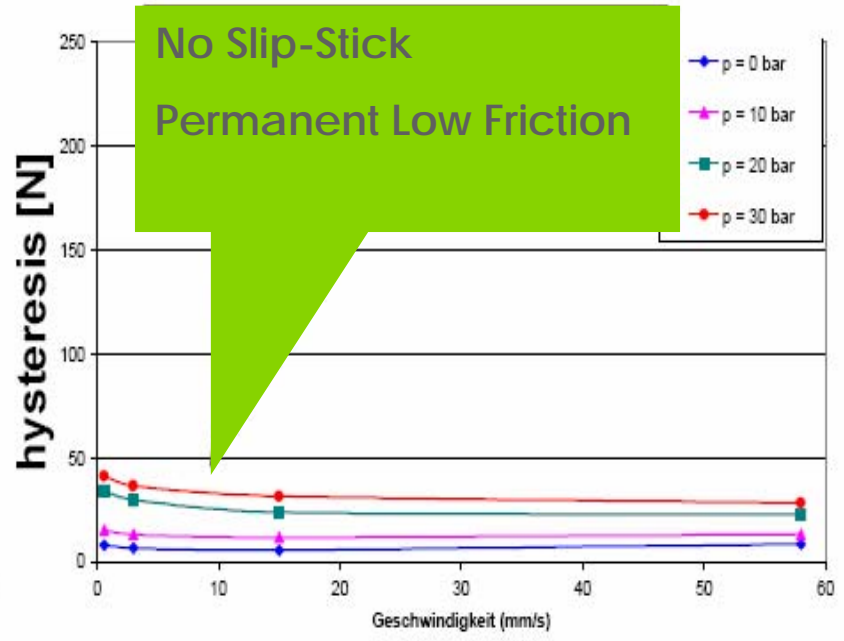
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Clutch Piston Material Properties Reduced Noise, Vibration & Harshness

Steel-Alu Pistons



Vyncolit Pistons



Source: LuK

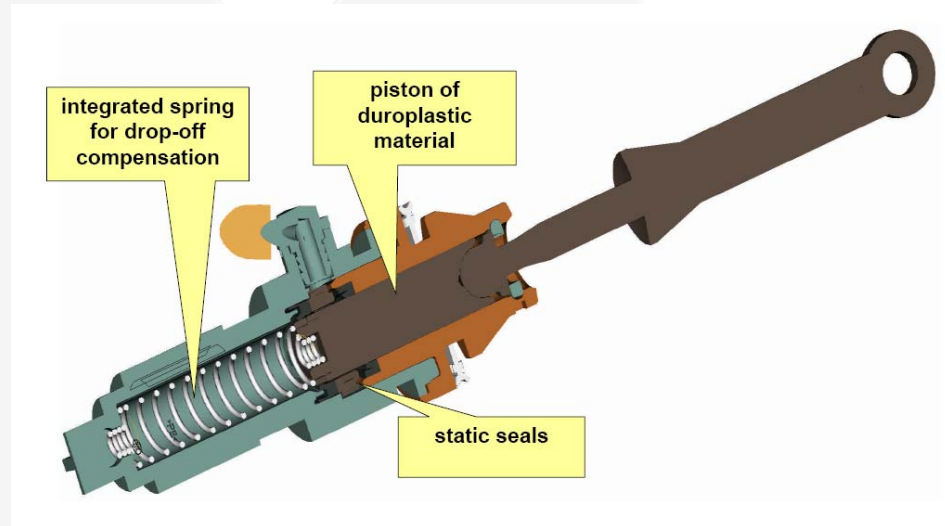


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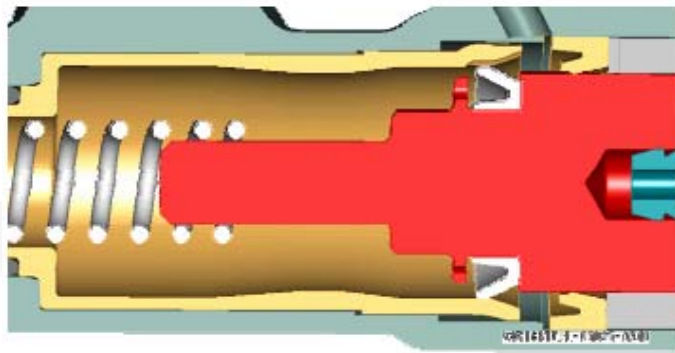
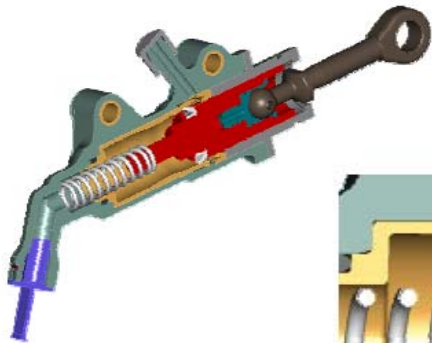
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Other Clutch Pistons

Clutch Master Cylinder: LuK



Source: LuK



Source: LuK

Variable Master Cylinder: LuK

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Valve Block DCT



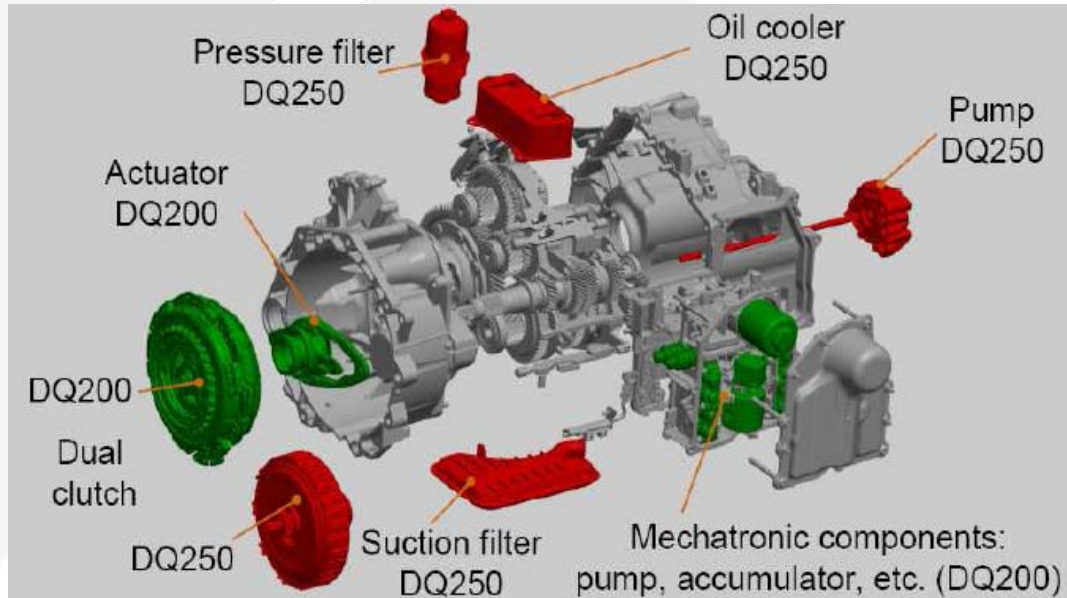
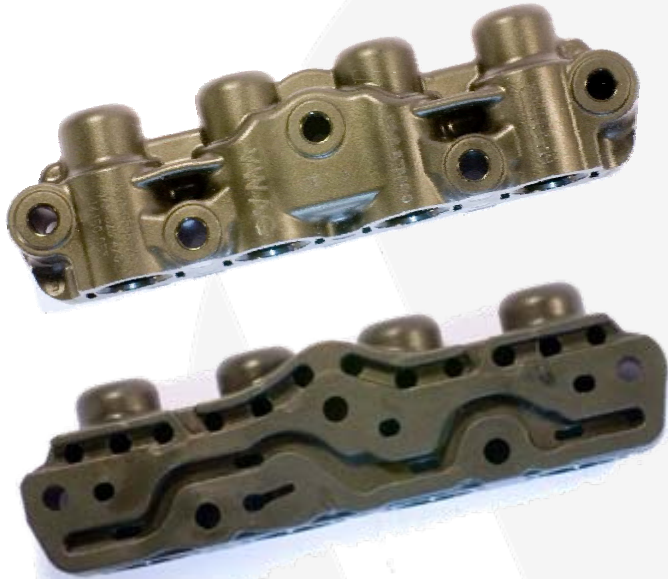
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Valve Block DCT



Source: CTI Transmission Symposium

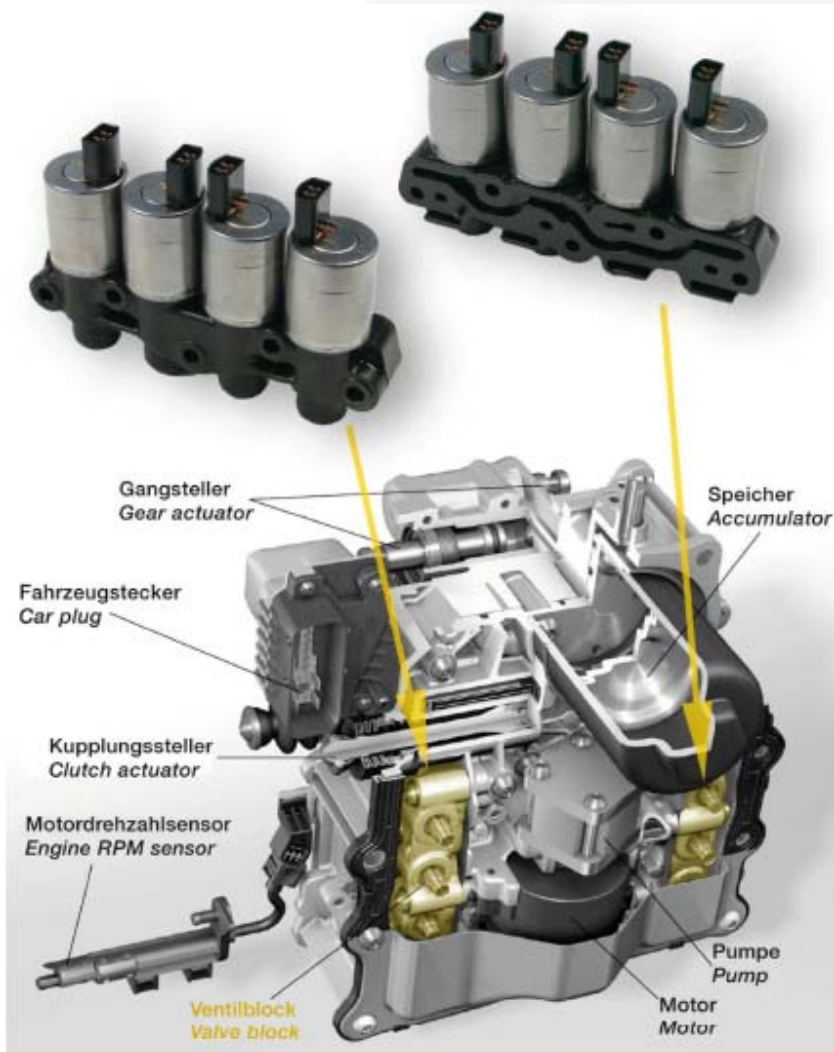
The control unit of VW's new DCT

- ❖ The Valve block:
 - Material Vyncolit X6952
 - Molder: Baumgarten
 - Tier: Hilite International
 - OEM: VW's next generation DCT's: DQ200

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Valve Block Function

- ❖ Identical Valve Blocks for each sub-transmission: one part number for both valve blocks
- ❖ High system pressure and small actuators possible
- ❖ Valve Block Design:
 - 1 Proportional pressure reducing Valve
 - 3 Proportional Flow Valves
 - Each block has 1 supply pressure in-port & 3 out-ports for shift and clutch actuators



Source: CTI Transmission Symposium
The control unit of VW's new DCT

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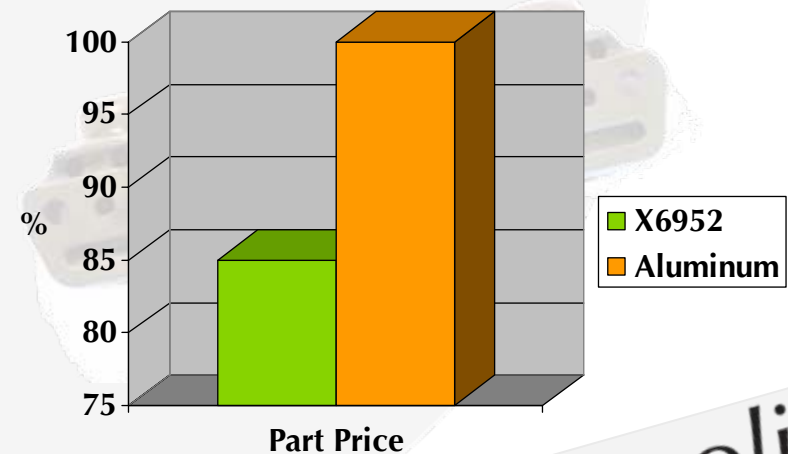
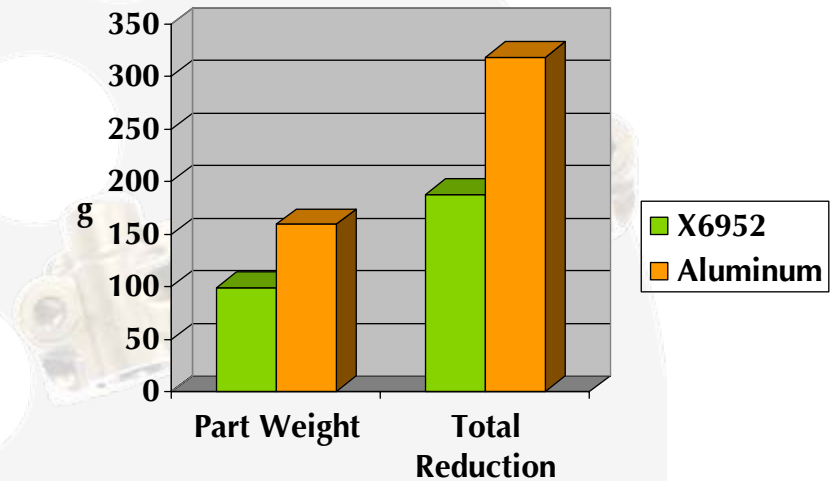
Valve Block Thermoset: **Material Advantages**

- ❖ Heat, pressure and chemical resistance of the material, Vyncolit X6952
- ❖ This complex part can be made through injection molding without after machining
- ❖ Design freedom for compact & complex parts
- ❖ Weight reduction: 60 gr for each part = 120 gr reduction in total compared to Alu part
- ❖ Cost Reduction (15 %) Thermoset part versus Aluminum part: Simplified design, no after machining



Valve Block Thermoset: **Material Advantages**

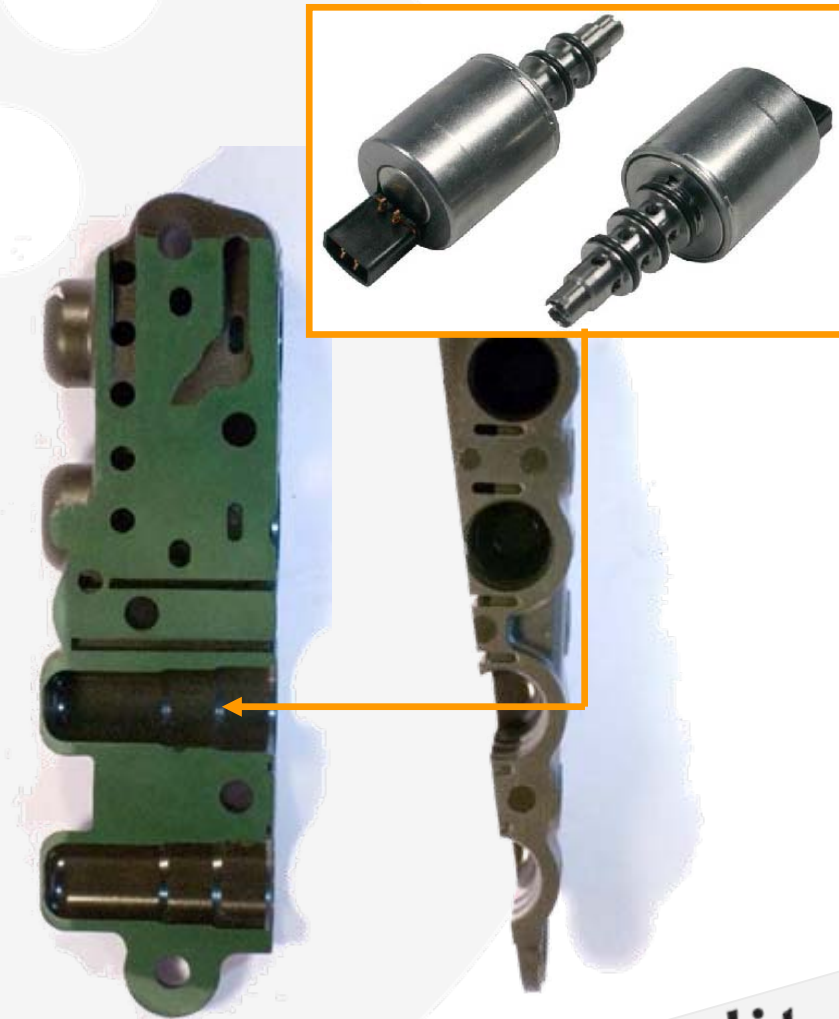
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Dimensional Stability

- ❖ Excellent Dimensional Stability at elevated temperatures (150°C) combined with high pressures (up to 60 bars) in hydraulic fluids
- ❖ Tight dimensional tolerances
- ❖ The Coefficient of Thermal Expansion and the tight manufacturing tolerances of the material allowed the use of O-ring sealings.
- ❖ The smooth surface finish protects against wear to the sealings: no glass fibers at the surface

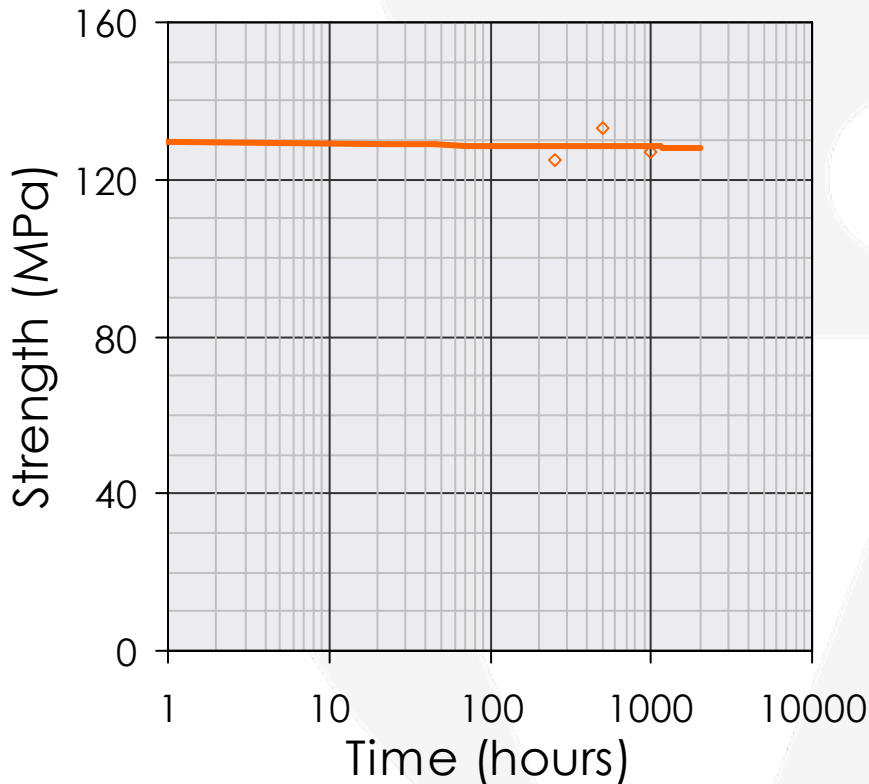


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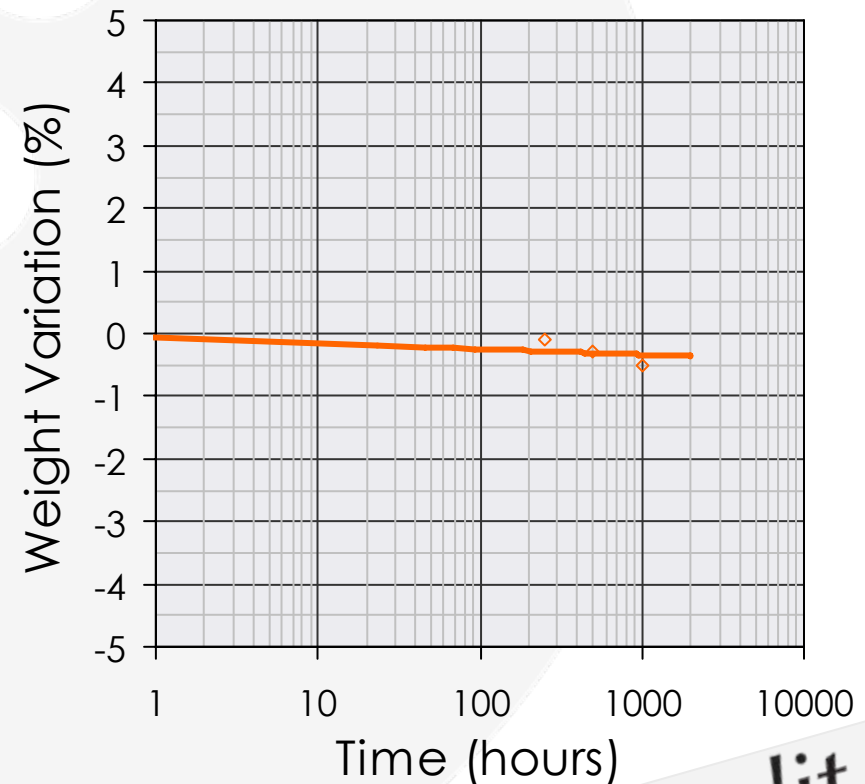
Chemical Resistance in Transmission Oil

— Vyncolit X6952 ageing in Pentosin CHF 2021 @120°C

Tensile Strength



Weight Change



Test specimens: MPTS bars according to ISO 3167, post-cured up to 180°C

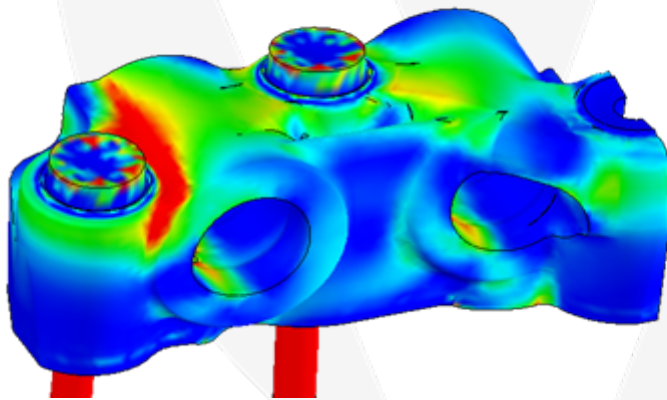
¹ Pentosin CHF 202 is a Deutsche Pentosin Werke GmbH product

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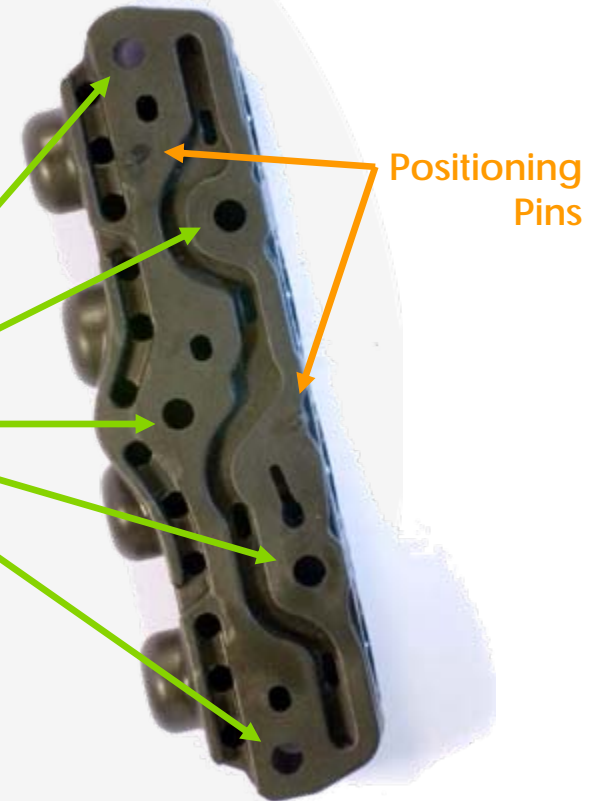
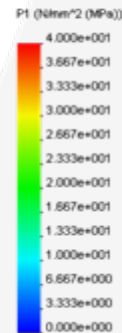
Low Creep under Static load

- ❖ The Valve Block is bolted directly to the hydraulic control unit: with the aid of positioning pins
- ❖ These 5 bolts induce each a static load of max 50 MPa onto the part

Model name: FEAssyVentBlock050907
Study name: F14drft_655_40KantAki
Plot type: Static nodal stress Plot1
Deformation scale: 50
Element Volume = 100.00 %



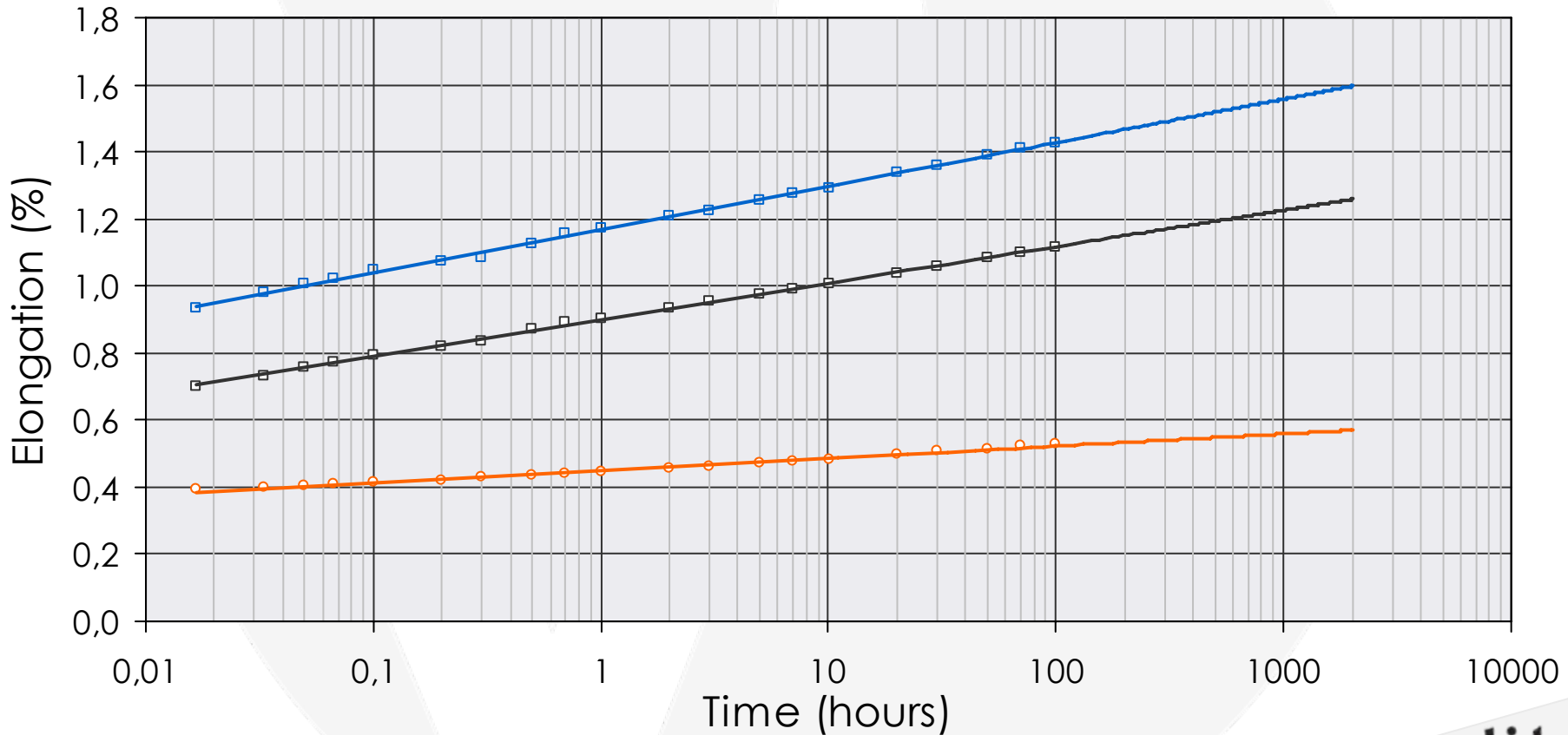
Bolt holes



Stability under load at High Temperature

— Vyncolit X6952, — PPS GF40, — PPA GF35

Tensile Creep @120°C (load 50 MPa)



Test specimens: MPTS bars according to ISO 3167, post-cured up to 180°C
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Future Developments



Air Systems:

Turbochargers & EGR:

- ❖ Developed: Plastic Turbohousing (Cold Side):
 - Cooperation with Woco for IHI – Daimler
- ❖ Under development:
 - other turbocharger parts such as compressor wheels
 - EGR Module (extra high heat resistance up to 450°C)

Pumps:

- ❖ Oil Pumps:
 - Developed:
 - ‚Schieber‘ Variable Oil Pump
 - Under development:
 - other oil pump parts such as gears, spurs, housings
- ❖ High Pressure pumps
 - Under development



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Thank you for your attention

For further information...
Please visit our website at
<http://www.vyncolit.com>

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