GATES HOT OIL WET BELT SYSTEM TECHNOLOGY

Recent events highlighting the effects of so-called greenhouse gases on global warming have led to the introduction of increased legislation regarding emissions from vehicles. This, in turn, has forced engine designers and manufacturers to maximise engine efficiency. It is well known from various studies that engine primary drive systems incorporating a synchronous belt have clear advantages over those having a chain in respect of reduction in frictional losses thereby increasing fuel efficiency and reducing CO_2 emissions. Gates has been manufacturing hot oil belt drives since the early 1990's for industrial application on generator, lawn mower and water pump. This technology has progressed to allow the systems to be used in automotive engines, driving both camshaft, crankshaft and oil pump drives, replacing the traditional chain drive systems.

PRODUCT ADVANTAGES COMPARED TO ALTERNATIVE DRIVE SYSTEMS

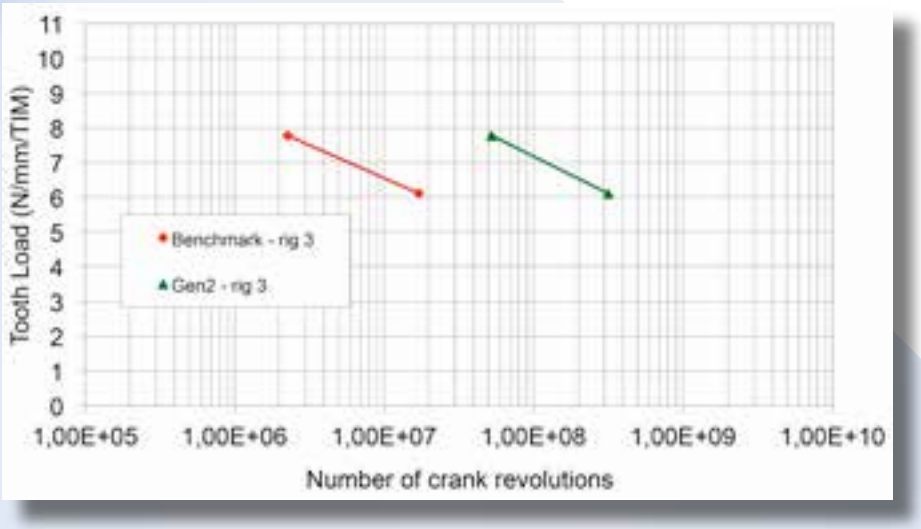
Synchronous belt drive system	System cost	Friction	Noise	Durability	Weight	Reliability
Dry belt	=	+	+	=	+	=
Belt in oil	-	+	+ +	=	+	=
Silent chain	- -	(=)	=	=	- -	=
Roller chain	=	-	-	=	-	=

PRODUCT BENEFITS

- Improved fuel economy/reduced CO2 emission
- Reduced cost of engine sealing (VVT)
- No camshaft sealing, reducing friction
- System noise reduction
- Decrease packaging requirements
- Timing accuracy over life of engine
- Wet synchronous belt technology can meet life of engine requirements, normally 240,000 km/10 years in Europe
- System development with specific tensioner based on engine dynamics

GATES GEN2

Gates Gen2, Gates' latest hot oil wet belt construction, exceeds the durability of current known hot oil market application serial production belt.

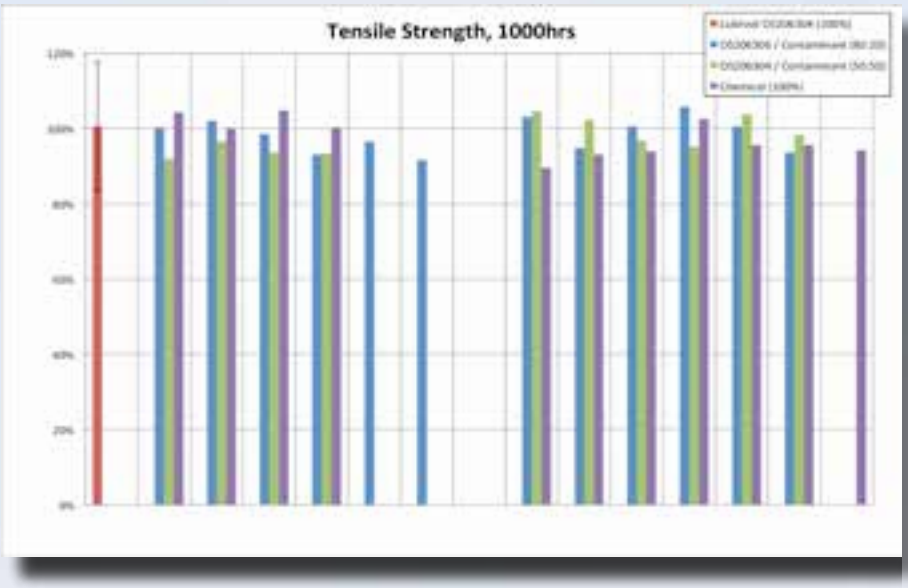


CHEMICAL "MAPPING" — BELT AGEING EFFECT ON PHYSICAL PROPERTIES

The mapping exercise is looking at all chemicals and chemistry changes that happen in engine oil throughout its life and how they effect on belt materials and physical properties. The tables below give a small summery of different chemicals on two important belt properties.

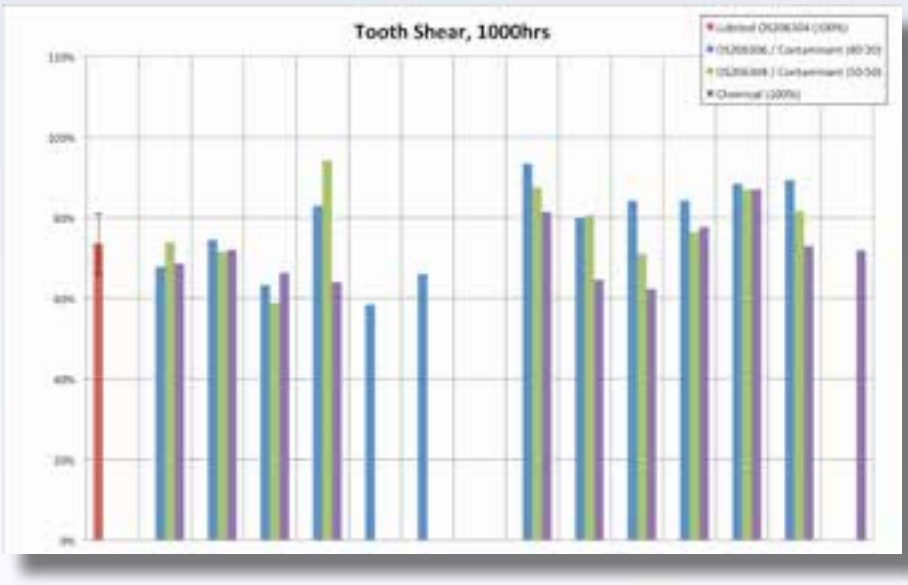
Tensile strength

Glass fibre strength is not significantly affected by ageing in synthetic oil, or by inclusion of oil additive and contaminants.



Tooth shear

Residual tooth shear strength may be affected positively or negatively, depending on oil additive, contaminant concentration level and exposure time.



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Printed in Belgium - 09/12.