World-class chemistry...

Shell Brake and Clutch Fluids are based on established glycol ether/polyglycol formulations and advanced additive packages. Our experience in this chemistry stretches back to the first hydraulic formulations in the 1950s.

Today, through an optimum balance of key parameters – boiling point, viscosity, lubrication, chemical compatibility and service life – our formulations offer proven advantages for hydraulic performance characteristics including:

- **Low compressibility**
  
  They retain the essential qualities of incompressibility under extremes of high and low temperature, ensuring pressure on a brake or clutch pedal is transmitted instantly and consistently through the hydraulic system.

- **Superior boiling point**
  
  To provide enhanced thermal protection against ‘vapour lock’, the boiling point of all Shell grades maintains a safety margin well in excess of internationally agreed specifications (see Figure 1). This is achieved without compromising on viscosity performance or other parameters.

  When requirements for boiling point are particularly stringent, the use of Shell Brake Fluid DOT 4 Ultra should be considered. Shell scientists developed this ultra high boiling point product to meet the demanding specifications set by Ferrari, for some of the world’s most powerful supercars, and it is suited to all high performance/premium vehicles.

  Eventually, over time, a braking system will absorb moisture through brake lines and seals, effectively lowering the boiling point of the fluid and increasing the risk of vapour lock and subsequent reduction in braking performance (see Figure 2). The ability of Shell Brake and Clutch Fluids to mix with water on a molecular scale avoids the local formation of water droplets or vapour bubbles within the fluid, which can seriously impair safe braking.

  Further protection against vapour lock can be provided by a water scavenging mechanism incorporated into DOT 4 and DOT 5.1 grades. This acts as a chemical ‘sponge’, soaking up water and keeping the fluid ‘drier’ for longer. As the water is chemically bonded to the fluid, it has minimal negative impact on the boiling point, resulting in more effective braking power over the service life of the fluid.

- **Viscosity control**
  
  Sophisticated anti-lock braking (ABS), dynamic and stability (ESP) systems incorporated into modern vehicles place additional emphasis on the ability of a hydraulic fluid to maintain low viscosity and flow through very narrow channels. These requirements are described by the ISO 4925-Class 6 specification.

  To meet these increasing demands Shell developed and introduced Shell Brake Fluid DOT 4 ESL (Extended System Life), a new formulation designed to maintain consistent low viscosity under all temperatures and conditions. This excellent low viscosity performance permits the use of advanced braking control systems without the need for expensive pre-charge pumps.
for advanced vehicle hydraulic systems

At the same time care has been taken not to ‘over-design’ the viscosity properties, to avoid the risk of leakage from brake components or a reduction in hydraulic characteristics and lubricity.

**Compatibility with other materials**

Shell Brake and Clutch Fluids are compatible with an increasingly complex range of vehicle hydraulic systems, and advanced new materials being adopted by system manufacturers in pursuit of weight savings or production/performance advantages.

This compatibility provides important protection for rubber, metal, polymers, elastomers and alloys, helping to maintain the integrity of braking systems in a number of ways:

- **Corrosion protection**
  
  Advanced chemical inhibition packages developed by Shell over years of testing, analysis and independent verification protect a wide range of metal brake components from corrosion, without compromising the performance of the fluid.

  Through careful tailoring of the chemical composition of the base glycol ether and inhibitor packages, Shell Brake and Clutch Fluids are able to meet specific corrosion inhibition requirements of a range of different automotive manufacturers.

- **Swelling/shrinkage control**
  
  Excessive swelling or shrinkage of rubber seals and hoses due to continuous contact with an incompatible hydraulic fluid poses the threat of leakage from the braking system. Shell products are blended using a glycol ether formulation that controls the swelling or shrinkage of rubbers.

  Again, the margin of swelling/shrinkage control built into Shell products is well in excess of the minimum requirements of international standards.

- **Polymer compatibility**
  
  After extended periods of exposure to brake fluids, polymers used in components such as fluid reservoirs may show signs of degradation and discolouration.

  A special package of additives developed for the Shell Brake Fluid DOT 4 ESL grade is designed to protect the integrity of brake system components for an extended period of use, including superior performance with rubbers and polymers. The system compatibility of DOT 4 ESL has been validated by third party certified laboratories and major component suppliers.
Excellence in manufacturing and supply

Shell is an integrated producer, with full control of the manufacturing process, technology and supply chain. Shell Brake and Clutch Fluids are manufactured in a world-class production facility in the Netherlands which, as one of Shell’s chemical manufacturing centres of excellence, is continually upgraded to raise quality and consistency. Shell Brake and Clutch Fluids are produced in accordance with the ISO/TS16949 automotive quality assurance standard, which encompasses the manufacturing and process technology. This is backed by Shell’s global supply and distribution network and expert chemical logistics, providing security and flexibility in supply.

- **Lubricity**

  The lubricity qualities of Shell Brake and Clutch Fluids help to prevent premature wear and abrasion of metal and rubber components in hydraulic and brake systems. They also eliminate the phenomena of ‘slip-stick’ on contact surfaces between moving hydraulic parts, including master cylinders, brake cylinders and ABS/ESP units, which can lead to noisy operation.

  The replacement of metal by plastic parts to save weight has raised the importance of this issue, particularly in clutch systems which are more prone to this problem due to the longer pedal stroke and greater potential for ‘squeaking’.

  In designing Shell Brake Fluid DOT 4 ESL, special attention was given to lubricity performance. Its excellent lubricity and low noise characteristics have been demonstrated in extensive application tests carried out by major hydraulic component suppliers. Under accelerated ageing conditions DOT 4 ESL passed industry rig tests with the highest possible score.

- **Long term performance**

  Shell Brake and Clutch Fluids are designed with enhanced chemical and thermal stability control to enable them to maintain their performance and protective properties over extended service intervals and under extreme operating temperatures.
All seven Shell Brake and Clutch Fluids grades meet or exceed every international standard, including those set by The Society of Automotive Engineers (SAE), International Organisation for Standardisation (ISO) and the Department of Transport/National Highway Traffic Safety Administration (DOT/NHTSA). Shell takes an active interest in standards development through its participation in SAE and ISO committees.
The Shell Brake and Clutch Fluids range has grades to meet the needs of all applications and markets. Please use the details below if you are interested in finding out more.

**Contact**
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**Further information**
For more information visit:
www.shell.com/chemicals/brakefluids

Brake fluid should be changed at least every three years, or otherwise subject to the vehicle manufacturer’s recommendation.