



DOT 5 TECHNICAL BULLETIN

DOT 5 SILICONE BRAKE FLUIDS

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HISTORY

Silicone Brake Fluids were first introduced in the early 1970's. Produced by several of the major chemical companies in the USA, they received glowing reviews from several organisations, notably the US Army and were widely expected to become the Brake Fluid of the future. To date, this has not happened. Today, sales of Silicone Brake Fluid run at a tiny fraction of those of more conventional types.

ADVANTAGES OF SILICONE FLUIDS

- i. **High Boiling Point** - Brakes become hot in use and Brake Fluid needs a high boiling point if it is not to vaporise (boil) in service leading to brake failure. The boiling point of current Silicone Brake Fluids is typically >300°C, whereas most conventional types, based on glycol ethers and their esters, such as DOT 3, do not better 250°C.
- ii. **Hygroscopicity** — Conventional Brake Fluid is hygroscopic (it absorbs water from the atmosphere) and this lowers its boiling point over time, necessitating changing the fluid approximately every two years. Silicone Brake Fluid is not hygroscopic, and thus its boiling point in service does not decline in the same way. This means Silicone has a far longer service life.
- iii. **Viscosity Index** — Silicones have an excellent viscosity index. Put simply, this means they are thinner than conventional fluids at low temperatures and thicker at high temperatures.
- iv. **Not Harmful to Paintwork** — Conventional Brake Fluids will damage paintwork if spilled on it. Silicones do not do this, which has made them very popular with classic car restorers.

DISADVANTAGES OF SILICONE FLUIDS

- i. **Compressibility** — Silicones have a poor bulk modulus. In practice, this means they can compress up to three times more than conventional fluids when pressurised in a brake system. This results in a “spongy” feel to the brake pedal, together with long pedal travel. These effects can be countered by fitting oversized master cylinders but this is expensive and produces non-standard components.
- ii. **Poor Lubricity** — Silicones generally do not provide the same level of metal to metal lubrication as conventional Brake Fluids. The early Silicone Fluids were particularly bad in this respect, but even now with the use of lubricity enhancing additives, their performance leaves a fair bit to be desired. Braking system manufacturers have raised the question as to whether these fluids are really suitable for use in ABS systems which have a large number of moving parts to be lubricated.
- iii. **Water Intolerance** — while the fact that Silicones are non-hygroscopic is one of their greatest advantages as outlined above, it also has a downside. This is that they are water-intolerant, i.e., they are totally immiscible with water. Hence if any water finds its way into the braking system, it will not be absorbed by the Brake Fluid but will remain as free water. Not only can this cause severe corrosion, but under heavy braking, the free water may boil (at 100°C) giving rise to vapour lock or loss of pedal. It is only fair to point out that the likelihood of free water entering a braking system is low, but it certainly has been known to happen — by condensation, jet washes, crossing rivers, etc.
- iv. **Solubility of Air** — This is perhaps the least well researched problem connected with the use of Silicone Brake Fluid, and it is often difficult to separate fact from rumour. What is established fact is that Silicones will dissolve (not entrain) approximately twice as much air as conventional types. While this in itself does not affect the operation of the braking system, there have been several reports that suggest this dissolved air can be released suddenly at either high temperatures or high altitudes (i.e., low atmospheric pressures), leading to instant brake failure. To our knowledge, these reports have never been reliably substantiated, and in our opinion the sudden loss of brakes is just as likely to be attributed to small amounts of water in the system. However, it remains an open question and has cast a shadow over the use of Silicone Brake Fluids.
- v. **High Viscosity** at Normal Ambient Temperatures — While Silicones have an excellent viscosity range at normal ambient temperatures, which are between 5 & 30°C, their viscosity at these temperatures is approximately double that of conventional fluids. The vehicle manufacturers dislike this, as it makes bleeding or initial fill of the brake system slower and more prone to air retention. Not a very significant disadvantage.
- vi. **Cost** — Lastly, the fact that Silicones cost approximately five to six times as much as conventional fluids has certainly not helped to popularise their use. This cost disadvantage can of course be offset against greatly reduced change periods when compared with conventional fluids.



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CONCLUSIONS / RECOMMENDATIONS

It is our opinion that for ordinary passenger vehicles, Silicone Brake Fluids do not represent the best option. While they have certain advantages over conventional fluids, they have flaws which are too significant to ignore. Conventional fluids are certainly not faultless, but all things considered they have been well described as 'the most forgiving Brake Fluids, and their current domination of the market reflects this.

This might not be so if conventional Brake Fluid development had stopped when Silicones were introduced, but of course this is not the case, and conventional fluids continue to be constantly improved. For example, the Federal Department of Transport introduced a new specification for Silicones in 1972 — namely DOT 5. Within 15 years, conventional fluids had progressed to the point at which they too could meet this specification, thus creating a very confusing situation where there were two completely different types of DOT 5 fluid. The DOT recognised this in 1992, and created a special category for non—silicone DOT 5 fluids — being DOT 5.1.

It is worthy of note that all the major braking system manufacturers in Asia and Europe have considered the use of Silicone Brake Fluids, and have decided against it for ordinary vehicles. Most major motor manufacturers have come to the same conclusion although one or two specialist American manufacturers such as Harley Davidson did use Silicone Fluid for a period.

This is certainly not to say that Silicones do not have uses, or to imply that they are highly dangerous, as some rather misleading articles have suggested. Millions of development miles have been logged with such fluids and we recommend them for classic vehicles which are not used regularly. As well as not damaging paintwork, they are well suited to long periods of inactivity followed by normal use. Cost is usually of lower significance when dealing with classic vehicles. Another area of application is if specifically recommended by the vehicle manufacturer as noted above.

Although we do not recommend Silicone Brake Fluid for racing use (Penrite recommend **10 Tenths Racing Brake Fluid**), in fairness, we would point out that Silicone brake fluids have been used in racing vehicles for years and to our knowledge, without any serious problems.

APPLICATION AND USE

Silicones are theoretically suitable for use in the braking system of any car, motorcycle or commercial vehicle designed to use a conventional fluid. They cannot be used in systems designed to use a mineral oil (LHM), e.g., certain Citroen and Rolls Royce models.

We do not recommend that Silicones and conventional fluid are mixed, as, while this is theoretically possible, in our experience several problems may occur:

- a) The advantages of both types of fluid are lost in a mixture.
- b) Additive migration may occur from one phase to the other, leading to corrosion.

When changing to Silicone Brake Fluid, it is always beneficial to start with a new braking system as it saves purging the old fluid. An old system should be dismantled and purged with methanol or industrial methylated spirits. Every trace of solvent must then be removed by blowing through with dry air. Ordinary assembly fluids should not be used when assembling a system to be used with Silicone Brake Fluid; instead, apply a little of the Brake Fluid.

Penrite recommend “**The Right Oil for the Right Application**”

[Click Here](#) to visit the Penrite Recommendation Guide, which will ensure you receive the correct oil for your vehicle



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