



# Hydraulic Fluid Changes - Part 1.



From an Article by Pleides in *Citroënian*, January 1990

## THE IMPORTANCE OF REGULAR FLUID CHANGES

The subject of hydraulic fluid is very complex and most interesting. Not nearly enough thought goes into the importance of using the correct fluid and regular fluid changes by most motorists. We feel if more was known about it, greater respect would result, so here goes.

### Reasons for using a hydraulic system

- a. Hydraulic operations are almost 100% efficient with only negligible loss due to fluid friction.
- b. Great accuracy can be used with hydraulic systems.
- c. There are minimum maintenance requirements.

### What hydraulic fluid must do

1. First of all, it must transmit power. To do this efficiently the fluid must have a viscosity suitable to the particular needs (not too high to cause resistance to flow, and not too low to cause leaks and wear) and to maintain this viscosity through a wide temperature range. The tendency of all oils is to increase in viscosity with lowering of temperature, causing sluggish fluid flow, and decreasing in viscosity with higher temperatures increasing the possibility of fluid leaking past seals, and causing wear. A good hydraulic fluid keeps this variation down at varying temperatures and is said to have a high viscosity index (VI).
2. It must also provide lubrication for the moving parts. Hydraulic parts are made with great precision and must be lubricated to prevent wear. To provide this, hydraulic fluid must be 'oily' enough to get into the tiny spaces between moving parts, and to 'stick' to these parts, even when warm. However, the 'oiliness' of the fluid must not be too great to increase the viscosity.
3. Resist oxidation. Oxidation does occur naturally, as all oils, to some extent, combine with the oxygen in the air. This changes the chemical composition of the fluid; organic acids are formed which are harmful to metal parts. Oxidation increases rapidly with the entrance of dirt and other contaminants and increase in temperature. High quality fluids contain additives which keep oxidation down to a minimum, if used correctly.
4. Protect parts from rust and corrosion. Rust and corrosion are both related to oxidation. A good quality hydraulic fluid, provided it is kept clean, has anti-corrosive qualities which neutralise corrosion forming acids within its designed service life.
5. Resist foaming. Fluid is virtually incompressible. In other words, it acts like a 'liquid' steel rod. Air, which is compressible, can be absorbed by fluid. Good fluids have the capacity to 'dissolve' a small amount of air. However, if the amount of air which enters the fluid is greater than the fluid's capacity to dissolve it, bubbles form, resulting in mushy, unsatisfactory operation of the hydraulic system. Some air, in solution under pressure, comes out of solution when the pressure is released, causing a foam. This foam seriously affects proper operation and lubrication. A good hydraulic fluid contains a foam inhibitor which speeds up the rate at which bubbles break up. Low fluid levels in the reservoir and leaks hasten the ingress of air into the fluid.
6. Be capable of separating itself from water. Contrary to popular opinion, oil and water will mix to form an emulsion. It is virtually impossible to keep water out of the system as damp air is always in contact with the fluid in the reservoir. However, the levels are very low. Due to the violent agitation, churning and continual recirculation of the fluid, the water and fluid quickly mix to form an emulsion. Any appreciable amount of water in the system promotes rust, increases oxidation causing acids and sludges to form, reducing lubrication properties. The fluid's boiling point is lowered, worsening any tendency towards vapourisation in hot working conditions, i.e. braking.
7. Be capable of separating itself from contaminants. Localised hot spots occur when fluid is forced through a small orifice. Continuous passage of a liquid through these points may produce local temperatures high enough to carbonise and sludge the fluid. As soon as sludge or other deposits are formed in the fluid, the rate of formation increases more rapidly.

8. And be chemically stable over a long period of time.
9. During operation, the fluid picks up minute particles worn from moving seals. These particles become suspended in the fluid and move around within the system. Together with other contaminant build up in old or dirty fluid this will cause clogging in some of the hydraulic units, which then cease to operate correctly.

Filters in most hydraulic systems are designed to remove most foreign particles that are visible to the naked eye. However, hydraulic fluid which appears clean to the naked eye may be contaminated to the point that it is unfit for use. Having said that, visual checks of the fluid against new fluid should be done when in doubt. Darker fluid shows decomposition has taken place.

As you can see from the comments above, regular fluid changes are essential.

## Citroen hydraulic fluids

The early fluid -- LHS 2 -- is a synthetic fluid. The vast majority of brake fluids are and always have been synthetic. They are descendants of fluids employed in the days when the only rubbers available for seals, etc., were incompatible with petroleum oil. The biggest disadvantage with synthetic fluid is that it is hygroscopic i.e. it absorbs water easily. Citroën, leading the way yet again, came up with a mineral fluid -- LHM -- which is not hygroscopic, over 30 years ago. Obviously, there were other improvements with the advent of LHM.

Below is part of a chart, courtesy of BP, showing the differences between the specifications of LHS 2 versus LHM:

|                 | Units | LHS 2 | LHM    |
|-----------------|-------|-------|--------|
| Density 15°C    | kg/l  | 1.007 | 0.854  |
| Flash Point     | *C    | 99    | 135    |
| Viscosity Index |       | 256   | 285    |
| Boiling Point   | *C    | 200   | 255    |
| Colour          |       | Amber | Green* |

\* (LHM is more environmentally aware?!)

A high flash indicates good resistance to combustion and a low degree of evaporation.

## Problems incurred with old or dirty fluid in Citroens

The most obvious example of this is the height corrector. Height corrector malfunctioning shows itself with a variety of symptoms. a common symptom is 'auto lift', when the car rises up and sinks down all by itself! Another common symptom is a suspension that is harder than it should be, even though the suspension spheres have been changed recently. This is because the height corrector becomes very slow and sluggish to react to changes; it feels as if you have selected the 'high ride' position on the quadrant.

Some cars, notably the earlier BXs, have problems with accumulation of water within the hydraulic system. This is mainly due to condensation, but we do hear of people who confuse the reservoir for the windscreen washer tank! This level of water intake into the hydraulic fluid is a little more than the system can cope with. Oxidation, foaming and rusting of parts will occur. The system will be sluggish to respond. Seals will be destroyed, leaks and failures of hydraulic units will result.

Obviously it is important that the CORRECT fluid is used at all times. If brake fluid is used in an LHM system, the diaphragms and seals in the system swell up and split. Equally, if LHM is used in an LHS 2 system; Once the wrong fluid has been put into the system it is very difficult to eliminate all traces of the offending fluid, and very little is needed to permanently damage seals and diaphragms.

Due to the tight tolerances, small bore pipe and very small orifices in many of the specialised hydraulic units, cleanliness

is very much next to Godliness. In fact, it is essential if the system is to run efficiently. Many of the hydraulic units can become damaged if used with dirty or old fluid causing some of the stranger symptoms in hydraulic faults. Regular changes of hydraulic fluid are essential for trouble free motoring. so don't complain about the price of LHM - it's a small price to pay for owning a Citroen!

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*The author of this article advertises on page 7 of this Newsletter every month. As a local - Melbourne - sphere regasser I have no hesitation in giving Pleiades the highest accolade. We are fortunate that he has decided to settle in Australia.*  
-KIRK



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Citroën Car Club of Victoria

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