

## REPLACING LUCAS PETROL INJECTION PUMPS WITH BOSCH FUEL PUMPS WITH TUNING NOTES

For many year owners of cars using the Lucas Petrol Injection system have been encountering fuel delivery problems, particularly during hot weather whilst using the original Lucas pump, and also when a replacement Bosch pump is fitted, without due consideration for the Bosch pumps' requirements.

Invariably the problem lies with the fuel pump itself. Most Lucas units have now been reconditioned at least once in their lives and are in less than perfect condition. The composition of "unleaded" fuel, increases the chance of cavitations occurring where fuel in the overheating pump turns to a vapor, in which the pump spins uselessly. The fuel flow is cut and the engine is abruptly stopped.

At Revington TR in the early days of these problems (early 80s) we tried a few solutions on the Lucas P.I. equipped TR5 and 6, including square-section cooling coils for the Lucas pump motor and Bosch fuel pumps from other suppliers. These pumps did not last well, were also prone to cavitations, and caused resonance in the fuel lines. There are over 300 different Bosch fuel pumps. It is important that the correct unit is used and that it is mounted below the tank and does not have to suck through the C.A.V. filter or any other micron filter. As fuel injected Mercedes or BMWs are not commonly seen stranded by the roadside with overheated Bosch pumps during the summer months we realized there must be an effective solution.

First, it is necessary to understand the design/installation criteria for the Bosch pump. The pump cannot draw fuel up from a lower level (unlike the Lucas unit). It requires a flood feed, draws more current than the Lucas unit and normally has the paper (micron) filter after the pump.

When arranged correctly the Bosch pump will work well under all conditions and last longer. We have now sold many, many hundreds of these kits and when all criteria are met, the system will neither over-heat nor cavitate even when exposed to extremely high ambient temperature.

Investigations of the various parts of the Lucas system, which will remain when a Bosch pump is fitted, reveal that there are limitations. The Bosch pump requires a minimum of 2.6 litres per minute (LPM) free feed of fuel and preferably 5 LPM. When we took the fuel delivery pipe out of a TR5/6 fuel tank and allowed petrol to flow freely, with half a tank of fuel, we got 2.5 LPM. Not quite enough, but the best we could hope for without altering the fuel tank. When the 5/16" fuel delivery pipe was refitted [with 1/4" internal diameter (1/D)] the flow was immediately reduced to 1.7 LPM. When the Lucas filter and housing assembly was re-introduced into the line, this figure further reduced to 1.0 LPM. Clearly an inadequate feed. Add to this the normal practice of mounting the Bosch pump on the boot floor adjacent to where the Lucas pump was fitted (where it would be

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# REVINGTON **TR**

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required to suck fuel up on a low tank of fuel which it is not designed to do) and it becomes obvious why early Bosch conversion had a less than glittering reputation.

At Revington TR, armed with the basic criteria, we designed a system in conjunction with the technical team at Bosch UK, which allows the Bosch pump to work in its intended environment. Firstly, the pump must be sited as low as possible. With the Lucas filter assembly removed, the forward LH corner of the spare wheel pan is ideal in temperatures encountered in England. In much hotter environments, the pump can be sited outside of the spare wheel compartment, although this has been proved not to be generally necessary. Nonetheless we sell many more 'outside' kits as this seems to reflect customer preference. We have many units in operation abroad where temperatures are exceptionally high without problems and have campaigned our TR5 in stage rallies and races around the world in hot climates without issue.

With over 30 years' experience with our pump kit we know that the feed from the standard tank outlet without alteration is adequate for correct pump operation. Between the tank and the pump we use stainless steel braided hose with large 3/8" bore and a simple in line gauze filter. A stainless steel braided hose with banjo unions connects the pump to a Bosch high-pressure filter, via a non-return valve. The outlet of the filter is fitted with an adaptor to which the original hose to the pressure relief valve is connected or our special hose RTR4048 can be used. See our website for up to date recommendations.

The assembly is held in a special bracket and secured (in the original version, RTR4001K) to the sidewall of the spare wheel tray with shock absorbing mountings. This kit was then improved to incorporate a tap (RTR4050K) and then further improved to place the kit externally to reduce the possibility of fuel vapour contamination in the boot. This kit is part no. RTR4050XK. For those wishing to keep their Bosch pump components safe from the elements there is no technical reason for not using RTR4050K just that as modern fuel permeates through the walls of rubber hoses even modern braided steel covered versions, it is highly likely that the boot (trunk) will smell of petrol. We now however have under development a new pipe system with Teflon (PTFE) lined hoses that should not smell at all. Please enquire for more details

Installed in this way, with a correctly specified pump (we have seen some installations using a pumps designed for 40PSI operation and pumps which are designed to be force fed with a fuel tank internally mounted primary pump) designed for 110-PSI (7.5 bar) operation, the pump should not cavitate and should assume a normal working life. When our kit was originally devised, we used the Bosch pump with the highest pressure output available which was just adequate for our needs. Because of this we assumed the life of the pump would be slightly lower than on modern applications, this has proved not to be the case with many hundreds of kits sold and working well into old age.

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With development and improvement very much the Revington TR ethos, the pumps used in our current kits are of motorsport origin capable of operating at 11 bar giving a significant margin above the operating pressure required.

When considering the conversion, the following should be noted:

1. TR5's and early TR6's pre 1973 do not have an anti-surge reservoir in the bottom of the tank. If the kit is fitted, these cars will cough on sharp corners (particularly left hand) with a low tank of fuel. The solution is a new tank. These are available in aluminum. See below
2. The tank you use must not be internally rusty or dirty. Remember that the pump cannot suck through a paper filter and large particles of rust will quickly block the gauze filter. The small gauze filter between the tank and the pump lives inside a glass tube and is intended only as an indicator. Any debris found in this filter should be taken as an indication that the tank or fuel supply is suspect.
3. The pressure relief valve must vent into the tank reservoir if you have a separate return from the metering unit this can be connected to the PRV return via a 'T' piece or connected to another tank inlet.
4. The Lucas pump takes 3.5 amps and the standard car is wired accordingly. The Bosch pump draws 9 amps and will therefore require a separate feed and relay. The Bosch pump will not deliver full flow below 10 volts therefore operating battery voltage must not be less than 11.5 volts. A relay kit must be used to provide a proper electrical supply and the alternator must be adequate. We recommend a 65amp alternator.
5. A tap should be fitted between the tank and the gauze filter to facilitate ease of filter cleaning/changing. This tap when open must not introduce a smaller bore than the tank outlet. A suitable tap is included in our kits.

## *Tuning*

1. When all the above has been taken care of the car has every possibility of running correctly. However very few TR5-6 are completely standard and operating in the same environmental conditions as when the cars were new. If nothing else, the fuel used today is vastly different to that of the late 60's early 70's but most cars have had an engine rebuild, perhaps a different exhaust for example which to some extent makes each car individual. It is therefore important that the metering unit is set up correctly for its individual engine installation.
2. At Revington TR we are in a unique position to ensure this work is carried out correctly and precisely. Three elements are needed

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- i. A rolling road to enable the car to be run under load in the workshop and a gas analyzer to measure and display the completeness of combustion from the exhaust emissions. We have an 800hp rolling road and a range of gas analyzers
- ii. Some means of knowing what the metering unit is doing and how to adjust it for correct metering. We have a computer modeling program that enables us to feed in all variables measured from the metering unit, spring rates, stop positions, and cam angles. The model can then determine what fuel will be delivered for a given vacuum. From this we can adjust the Metering Unit for correct operation.
- iii. The final element is experience. The Rolling road equipment and information gained is of little use if the results are not understood. Fortunately our workshop technicians have over 40 years experience between them ensuring the information gained can be used to adjust the metering unit to give best results for power and economy on an individual basis.

We appreciate this is not of much use if you live in Australia or New Zealand, but our customers bring cars to us for this service from all over continental Europe. Once done it should not need doing again, the improvement in driving experience should prove to be well worth the effort.

### *Parts you might need*

All parts are available from Revington TR: -

Bosch fuel pump kit with tap, internally mounted	part number RTR4050K
Bosch fuel pump kit with tap, externally mounted	part number RTR4050XK
Relay kit	part number RTR4017K
Aluminum petrol tank	part number 312359XALK
Hose filter to PRV	part number RTR4048
Aluminium shield	part number RTR7259
New style diaphragm PRV	part number RTR4456K

Please use our website [www.revingtontr.com](http://www.revingtontr.com) for current prices

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