PI Conversion Thoughts …

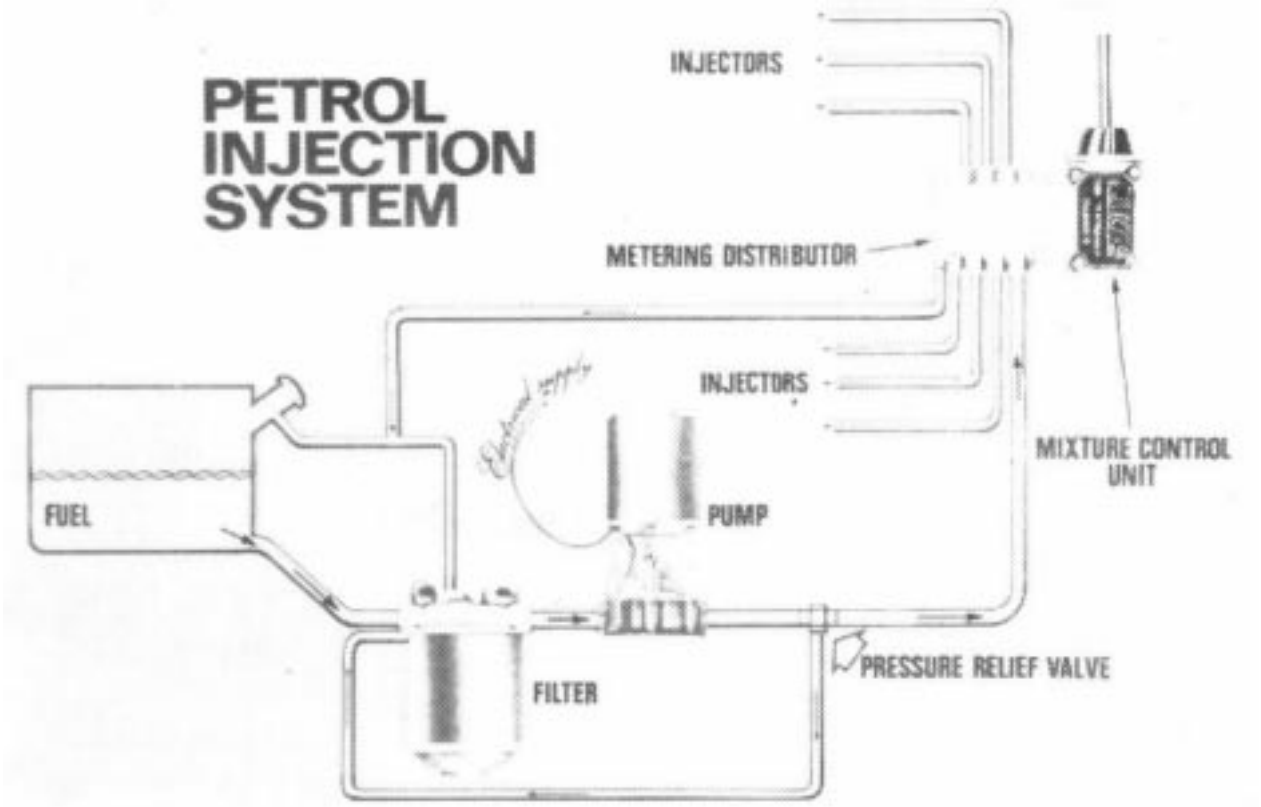
The following describes the conversion process, and rambles through all my experiences … and it cures insomnia! I have approached this task from a US-perspective, but have tried, where possible, to reference alternative suppliers, etc.

I've tried to organize the notes in a number of sections: 1) background, 2) detailed information on each element, 3) "how to" steps, 4) cost breakdown, and 5) source details..

Background:

PI stuff …

The Lucas PI system is a mechanical fuel injection system, fed by a high-pressure electrical feed pump. A really good description can be found at http://www.kvaleberg.com/t_pi.html: Egil Kvaleberg, the author, is an authority on PI systems. In the meantime, here is an overview of the system.



The TR5, TR6 and 2.5 Mk.I and Mk.II saloon were fitted with the PI system. The system came in 2 variants (plus an additional later green cap variant for the saloon): the early version can be recognized by the single balance tube on the manifold; the later manifold has 2 balance pipes for each manifold element. The internal characteristics of the metering unit varies between versions and cars, but the 72 and later setup is said to be the same for both the saloon and the TR6 (CR engine).

The mk.I unit, with the appropriate cam, will give 150bhp – the Mk.II will give 135bhp, but remember that the rating system changed between the publishing of those figures (it is said that the difference is not as great as it seems, but I can't find figures standardized for both).

Out of the 2 systems, the Mk.I manifolds are said to be better, giving better gas flow, but the Mk.II linkage is much easier to setup and use.

TR6 stuff …

The US Spec TR250 and earlier TR6 (up to CC75000 I think – don't take this number as gospel – like many things Triumph, it may be out by many thousands) – the cars were equipped with "narrow" port heads (the distance between the inlet ports is about 0.5" less on these earlier cars). This means that the PI manifolds cannot be fitted. A later head "will" fit the earlier block, so although complex, you can overcome this problem by fitting a "later" head. The clue to the change over to the later head is the use of twin-downpipe exhaust used by the PI-type head.

The fuel tank on the PI cars is fitted with a swirl-chamber or –pot: this little device ensures that fuel can be drawn from the tank when cornering hard – if the feed pipe is "uncovered" by hard cornering, the engine dies momentarily until the electric pump is once again "primed." The US tank was also missing the return feed connections: I have heard that the later tanks on US cars (74 on) are PI-spec tanks, but I have no evidence to support this conclusion.

The compression ratio is much lower on the US cars: ranging from 8.5:1 down to 7.5:1 on the later cars. This can be increased by shaving the head. The PI compression ratio is 9:5:1 – fuel injected cars, as a result of the nature of fuel flow when injected, can run at slightly higher compression ratios than carb cars, so it is likely that "pinking" or pre-ignition may not be a major problem if premium gas is used.

The valves are equipped with double valve springs on the PI cars – some carb cars are so equipped (mine wasn't). This is a useful modification since the PI engine revs very freely above 4000rpm, and you could get valve bounce.

The TR5 and early TR6 (CP engine) had a fairly radical cam, the later TR6 (CR engine) had a milder cam fitted (this is the same cam that is fitted to the carb cars after CC75000 and the PI saloon).

The distributor has some significant differences: the PI engine is not noted for developing very high vacuum levels, so, unsurprisingly, the vacuum retard is omitted. Also, the centrifugal advance has a different curve setup.

The carb inlet manifold is water heated – the PI manifold dispenses with this item (fuel injection atomizes somewhat differently, and so the problem of condensation of fuel found in the carb car is lessened).

Finally, the mechanical fuel pump, and the 2 Stromberg carburetors obviously differentiate the US-spec car from its PI relative.

The Quest Begins ….

After a number of dead-ends, I found a UK source for a full PI system for a reasonable cost. I very happily purchased from Chris Gibbard in Doncaster the following items for $225 (actually 150GBP):

- Manifold set with linkage (these turned out to be mk.II manifolds from a 2.5 saloon.).
- Set of 6 injectors (luckily, the type with the circlip which CAN BE serviced).
- Metering unit and distributor pedestal.
- Distributor drive shaft with the double drive gears (one to pick up the drive from the camshaft, the other for the metering unit).

- Pressure relief valve (a 3-way pressure sensitive diverter valve).
- 6 injector feed pipes.
- Lucas fuel pump and filter unit (check that the pump has the electrical innards! – mine didn't have that bit).
- Cutout or "tilt" switch (the electrical switch fitted to the bulkhead that cuts off electrical power to the fuel pump in the event of an accident).
- Plenum chamber and its 6 rubber trumpets.
- Air-cleaner (there are 2 versions; the later 2.5 saloons – which is the same as the TR5-6, or the early saloon one, which cannot be used. Make sure you get the right one).

I found out subsequently that I should have also got the following items!

- Distributor bob-weights and springs (the mk II saloon is near to the CR series car, and not too different from the CP set – the carb setup is different!).
- The fuel pump blanking plate (not a big deal since the GM pump cover plate sold in many tuning shops fits fine).
- Plenum chamber support bracket (fixes to the engine mounting and holds the plenum in place).
- Throttle return springs – they are elusive, so try and get them from the source of the rest of the system.

I was able to bring the whole package back to the US as checked baggage when visiting my Mum in London (and you could combine the purchase with a holiday!). Shipping costs from the UK are quite high – Lee Janssen in Denver, CO, has had a PI system shipped and I think it cost quite a bit.

Documentation …

You will need reading material, as well as the list, to carry out this task. The Factory/Bentley Manual is a really good source of general overhaul information, and you could carry out the conversion with this as a source of info. The Haynes manual does have some PI information, but not enough to be able to carry out a conversion.

If you intend to do any rebuilding or tuning of the metering unit (or overhaul of any of the PI system), you will need the Lucas MkII Petrol Injection training manual (you can obtain a copy of this gem from http://www.kvaleberg.com/r_bookshop.html#pi). The Lucas manual is very helpful in any case, so I would recommend getting a copy if you have a PI system.

Let the Quest Begin…

Metering Unit …

Unless you are very fortunate, the metering unit will need to be rebuilt with unleaded-fuel compatible seals. I bought a complete set of seals from Pumford's.

The rebuilding is actually quite straightforward, but the seals are expensive ($130). In my case, I left the unit on the shelf after the rebuild for a long time, and the unit "dried-out" in that the lube disappeared (I

have since learned that I should have followed Michael Porter's advice, "try something I found a few years ago - it's a ladies' makeup remover called Albolene (a blend of mineral oil base with petrolatum and paraffin) and it is slicker than fresh snot."). The result was a broken drive dog on the spur gear that transfers the drive from the distributor shaft to the Metering Unit. Once that was fixed, the very elderly and very brittle plastic coupling piece then broke.

These 2 items caused me to spend an inordinate amount of time trying to "improve" the fuel flow/pressure in the mistaken belief that the problem was located in the pump! I should have checked to see if the rotor in the metering unit *was* turning. This is a pretty straightforward task, requiring the removal of either the #1 or 6 injector feed pipe and the non-return valve. Once the fuel has run off (I used an airline to clear it), you can easily see if the rotor is actually turning – in my case, it wasn't (but I had the best Bosch pump setup by now! You'll see why later).

I also discovered that the unit was somewhat worn (and it is very difficult to reset the metering unit without very rare Lucas calibration bench), and since a rebuild takes care of that, I would now go that way in the future. In fact, I am buying a second unit so I can send it to be rebuilt. By the time I had bought the seals, new spherical bearing link (also broke when rebuilding), drive dog and coupling, I was into this for $280 … it would have been cheaper to have got a rebuilt unit, and it would have been calibrated!

If you do decide to rebuild the unit yourself, you can carry out a field calibration using a vacuum pump (the Mighty-Vac does a good job) and feeler gauges. I checked my unit out using this method, and the variance I discovered matches Mike Pumford's diagnosis, "It'll run rich at idle .. and maybe at low RPM" (this man knows what he is talking about). The Lucas manual, and the Triumph 2000/2.5 website, covers this task well. The much more accurate setting of the unit requires the Lucas calibration bench … rarer than hens teeth, and you need to be an expert to use one: Pumford's, Prestige Injection and Kinsler all have such devices.

Back to the rebuild: you will be installing a new injector seals that fits into the outer body (and the Lucas and Triumph manual will have you making a tool), but as Mike Pumford mentioned, if the unit is already apart, in that you have the rotor removed, you can fit the new seals fairly easily in the outer body without a tool, just make sure that the seals do not protrude into the rotor area.

The non-return valves (the bits sticking out of the MU) must have new O-rings installed: #2 and #5 are banjo's – the others are straight couplings. Ensure that you DO NOT over torque these fittings. Rubber O-rings are not noted for their ability to deal with very high pressure, so do not exceed the 150-200 in/lbs (NOTE: NOT FT/LBS).

One final tip: the inner workings of the metering unit comprises a fixed stop, a shuttle, and a control stop. The later version of the unit used a "paddle" shaped control stop (rather than the "pin" type used earlier). The paddle end can momentarily partially obscure the fuel feed from the metering unit – Mike Pumford described it as causing "scatter" when trying to calibrate the units. Lucas was trying to increase the longevity of the control stop with this "upgrade." Mike Pumford's advice is to grind down the paddle part of the stop a little so that fuel can easily flow past the "paddle" end.

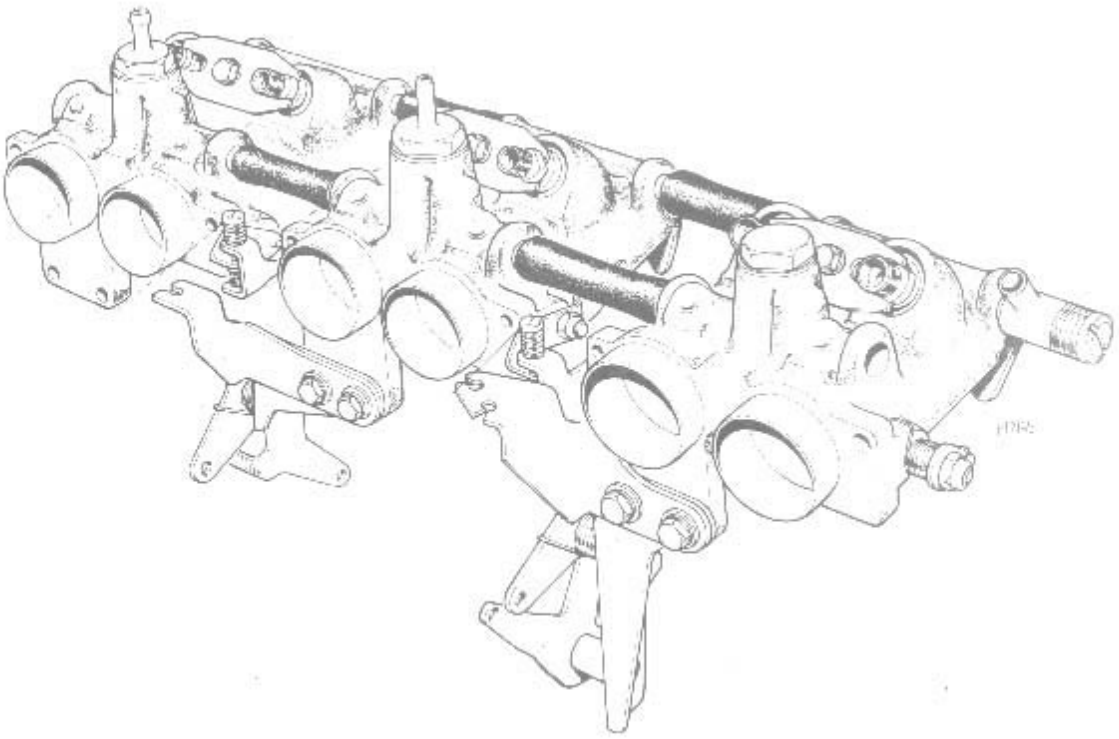
Injectors …

The injectors are rebuildable, you will need to send them to Pumford, Prestige or Kinsler to get them rebuilt. The rebuilding is pretty straightforward, requiring new seals and springs.

The early crimped injectors are not rebuildable, so try and find the later type with the circlip fitting.

Manifolds …

The manifolds comprise 3 linked units, each with 2 ports. The manifolds are linked by a vacuum balance tube (one per unit on the mk.I setup, and two on the later version – I've included a scanned image of a mk.II system below.



The throttle linkage is shown on the right of the above image – it is cable operated, so conversion to cable throttle is needed (covered elsewhere). Once you have the correct cable, hooking up is easy: getting the correct return springs is a bit of a bear.

The choke is shown to the left, and it is a simple matter of hooking up the rear carb choke cable (the front choke cable is fitted to the metering unit).

Fuel stuff …

The AC mechanical fuel pump, and the pipe-work to the carbs will have to be removed. The aperture is a standard size, and a capping piece can be found from any local parts store (it is a standard GM pump size). Rimmer's and TRF also sell an original pattern piece.

Lucas Pump …

My pump was missing the electrical innards, so I decided to look at an alternate approach. And everything I read seemed to indicate that the original Lucas pump wasn't the best answer since it was prone to overheat, leading to cavitation (and no liquid being delivered to the metering unit). The original

wiring is said to be decidedly very close to its limit, so an upgrade is worthwhile if you use either the Lucas pump or replace it with the Bosch unit.

If you do go the Lucas route, The brackets and holes to fit the original Lucas pump, filter and PRV are easily found to the left of the tank on the carb. car. If you decide to move to the Bosch pump, the following will help.

The Bosch Pump …

The suggested replacement is a Bosch semi-high pressure system. So I started by buying a used Golf GTI pump and accumulator (that's a sort of pressure reserve unit, that will "boing" away to let you know that you have system pressure).

Once I had the system installed, I got the car started for about 30 seconds, and then nothing … so I assumed that it must be a pump problem. At that time, I hadn't purchased a fuel injection test kit. The pump was fine as I later learned, in the meantime, I had bought a new pump.

The Audi 5000T/Quattro pump can be used to good effect (Airtex/Master 8307): this is a 130PSI pump that can be fitted inline. There is one other pump (Airtex Automotive/Master 8309 that is rated at a higher pressure but it is hybrid in-tank/inline pump that has really odd fittings, so I avoided it). The 8307 pump cost $160, or the original Bosch pump (0 580 254 957) can be used, although it would have cost a deal more.

Using the Bosch pump is easier if you are not retro fitting a pump to a PI system. There is a ton of space under the left hand side of the boot floor just above the chassis rail. The pump, accumulator, filter and pressure relief valve can all be smuggled into that space with enough room to link everything together. If I wasn't just a fair-weather driver, I would have installed all the bits in the boot (the space by the side of the tank, and the corner of the wheel well look good).

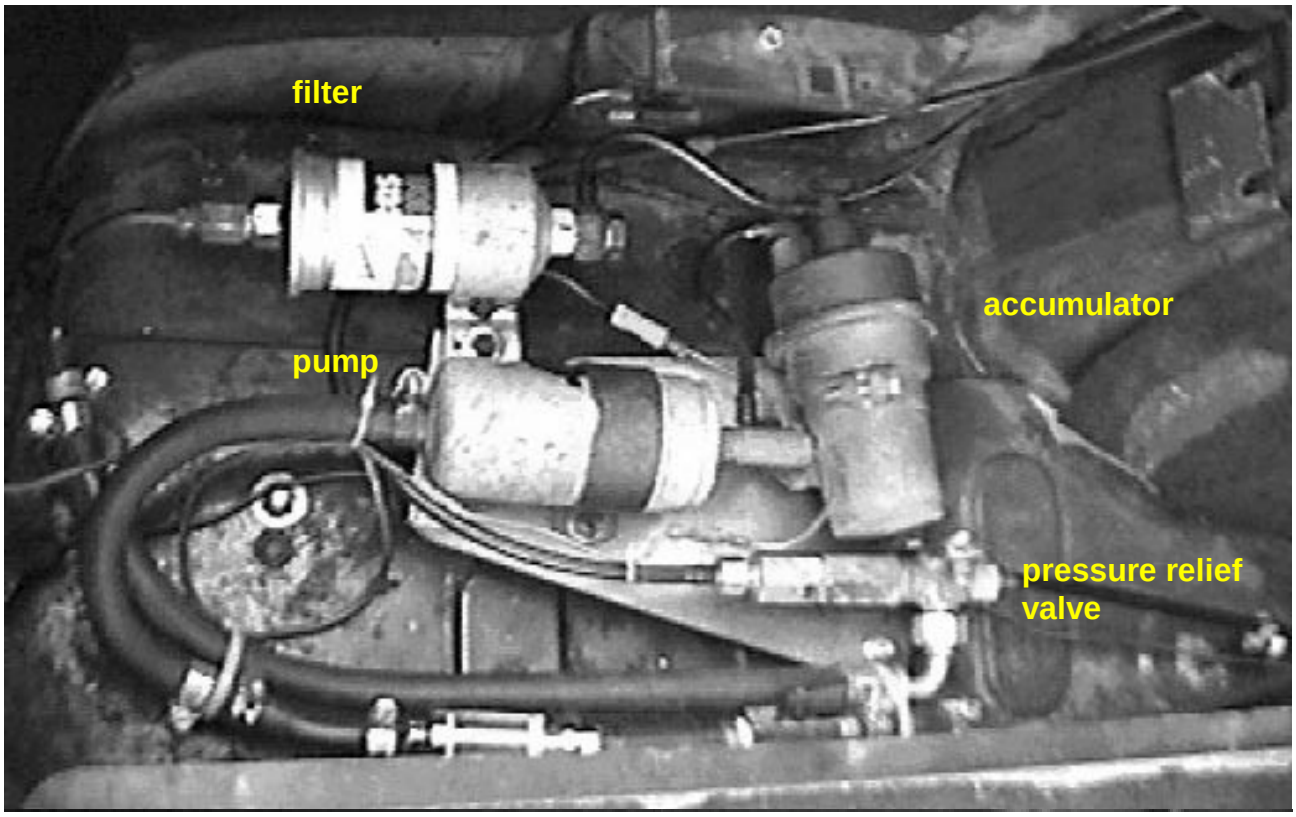
The Bosch pump has a 12mm inlet, and is not noted for its suck. Although not convinced (now) that I had a fuel problem, I did increase the diameter of the feed pipe from the tank to the pump to 3/8" (8.5mm). The existing compression joint fitting can be drilled out to 3/8" and used (although a 3/8" olive will need to thinned a bit to fit into the ½" compression fitting in the tank), but otherwise this is an easy swap: I'm not sure it was really needed, but Pumford and Prestige both recommend it, and they've been at this a lot longer than me, so I would probably go that way.

You cannot use the Lucas/CAV filter in this mix (it usually fits between the tank and the pump). The Bosch pump will not "suck" through it. You can use a simple glass-barrel type low pressure Purolator filter in the line to the pump to catch the worst of the crap before the Bosch pump starts to do its job.

The Bosch pump needs to be mounted below the tank so it gets a good head of fuel feeding it. If not, you will need to look to a low-pressure feeder pump (I have a little used Facet pump I can sell …) that will lift the fuel to the HP pump. In short, the Bosch pump is best described as a good pusher, but a poor sucker.

More information can be found on the conversion at http://www.adelaide.net.au/~frankb/ , where Frank Biedermann has done a really nice job on describing the parts needed and the conversion process.

I've included a scanned image from Graham Stretch that show the general layout of the Bosch pump, accumulator and PRV used in his 2.5 saloon (as Graham mentioned to me, the entire assembly is hidden beneath panels in his boot. This set up doesn't need a feeder pump since the tank is above the level of the pump).



The PRV …

I haven't touched my PRV, though now I have a fuel injection pressure test kit, I might test it just to check the system pressure. Incidentally, this pressure tester would have saved me some time earlier in the process when I could have more easily ruled out the pump as a problem by determining that it was capable of producing more than 85 PSI.

The PRV is pretty much a straight through unit (the feed in/feed out are a straight-through connection – the bleed off depends upon hydraulic theory – the pressure in sealed liquid system is uniform). It can be cleaned, and has a filter that is worth checking, but otherwise, it can be left alone.

The Fuel Tank …

The PI cars are equipped with a different tank to the carb cars. The swirl chamber reduces the likelihood of the engine cutting out on corners (and this does happen from half tank down). The other difference is the fitting of return feed pipes (2 on early tanks, 1 on later versions). I removed my tank and had a local tank repair company to fit 2 return feed pipes (cost $40). These are used by the return pipe from the metering unit, and the excess pressure pipe from the PRV. I did try initially to use the breather pipe fitting on the filler neck (don't bother, it won't work!).

With regard to fuel surge, the most comprehensive solution (which is better than the PI tank) seems to be the idea suggested by Terry O'Beirne (an Australian TR5 racer) who recommends having a twin pickup system installed (one on each side of the tank). There are other ways of overcoming surge including using the Bosch accumulator (will only give you 2-5 seconds of relief though), or a catch/feeder tank (complicated).

The Plumbing …

The PI system uses a high pressure feed pipe that runs rear-to-front, and a low pressure return pipe, that runs front-to-rear. The carb car uses a single low pressure feed to the mechanical pump.

You will need to fabricate a high pressure feed pipe. I used 3/8" OD nylon fuel pipe (rated at 450lb/sq.in). This is run alongside the existing low pressure pipe, and I was able to use some of the existing pipe clips, with heavy-duty cable ties finishing off the task.

The existing low pressure pipe can be used for the return pipe in a PI system. To do so, you will need to change the fittings at the pump end (simply cut the pipe and fix a ¼" ID flexible rubber fuel hose). At the tank end, you will need to cut the pipe near the tank outlet (empty the tank first!), and fix ¼" ID flexible hose, that is then routed to the newly fabricated return feed on the top of the tank.

I was fortunate that I did have most of the original hoses (and their valuable fittings), so I was able to use the old fittings, and then get them fitted to the new black nylon high pressure hose. This process of inserting the fittings could be undertaken if you have the ability to make the securing block that anchors the tubing while the fitting is inserted cold with some force. I would recommend using a pipe specialist. The ½" BSP fittings that are used on the outlet of the PRV and inlet of the metering unit seemed to the only ones I couldn't find in the US, so try to make sure you pick those up.

My scrap-yard Bosch pump came with the hose linking the pump to the accumulator, but to connect the accumulator to the Bosch filter, and then from the filter to the PRV, I had to have some hoses made. A local hydraulics company seemed to find this task very straightforward (cost about $55).

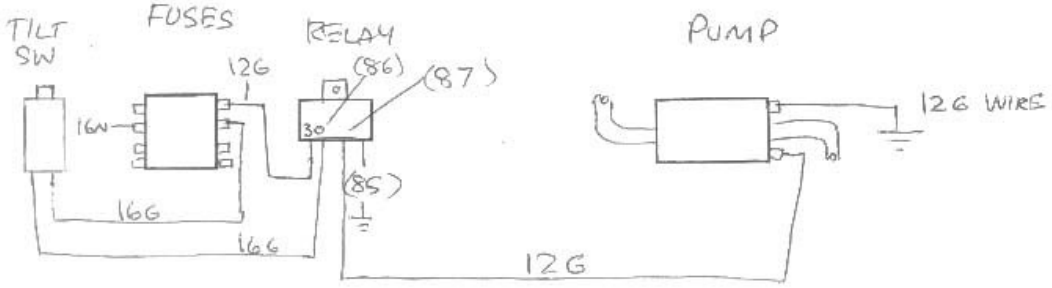
The only other odd piece of plumbing was the 1/8"bsp fitting that feeds the excess fuel from the metering unit back to the tank – since BSP (British Standard Pipe) is almost identical to NSP (National Standard Pipe), I was able to pickup a 1/8" male-to-1/4" push-on fitting.

Electrical …

The TR6 loom already has the electrical feed wired in (though in my case, they were capped), so it is tempting to use the existing wires. However, the Lucas and Bosch pumps both draw sufficient current that it is likely that the wire will not carry the current without problems. Many existing PI owners have upgraded the diameter of the wiring to the pump, using a relay to take the load off the ignition circuit.

I decided that was the approach I was going to take: I ran a 12 SWG wire from the engine compartment to the pump location. I connected the wire to a 30A relay, and fed the relay from the 1st. (unused) terminal on my fuse block, via a 15A fuse. I connected a feed from the fused side of the Ignition controlled fuse (2nd down in my car), and fed this through the tilt switch and back to the relay (my relay also needed a local ground so that was fed to the fixing screw).

The following diagram should ensure that you are completely baffled.



Clearly, I'm no Dan Masters, but I did use his excellent book to help me plumb the relay – and it was easy.

Distributor …

The PI manifold doesn't generate a lot of vacuum, so it is said that the engineers dispensed with a vacuum retard fitting. This was achieved by the simple expedient of not fitting a vacuum feed line – so you still have the bellows fitted to the distributor, but nothing fitted to it!

The mechanical advance curve is different for the PI car. You might be fortunate enough to find the original bob weights and springs, if not, the mk.II saloon weights and springs are the same as the mk.II TR6 PI setup (CR engine). These are very easy to fit: you just remove the contact breaker plate, and the weights/springs are easily accessed.

You can get the distributor re-curved by a distributor specialist – I didn't go this route but a number of other listers have done so to good effect.

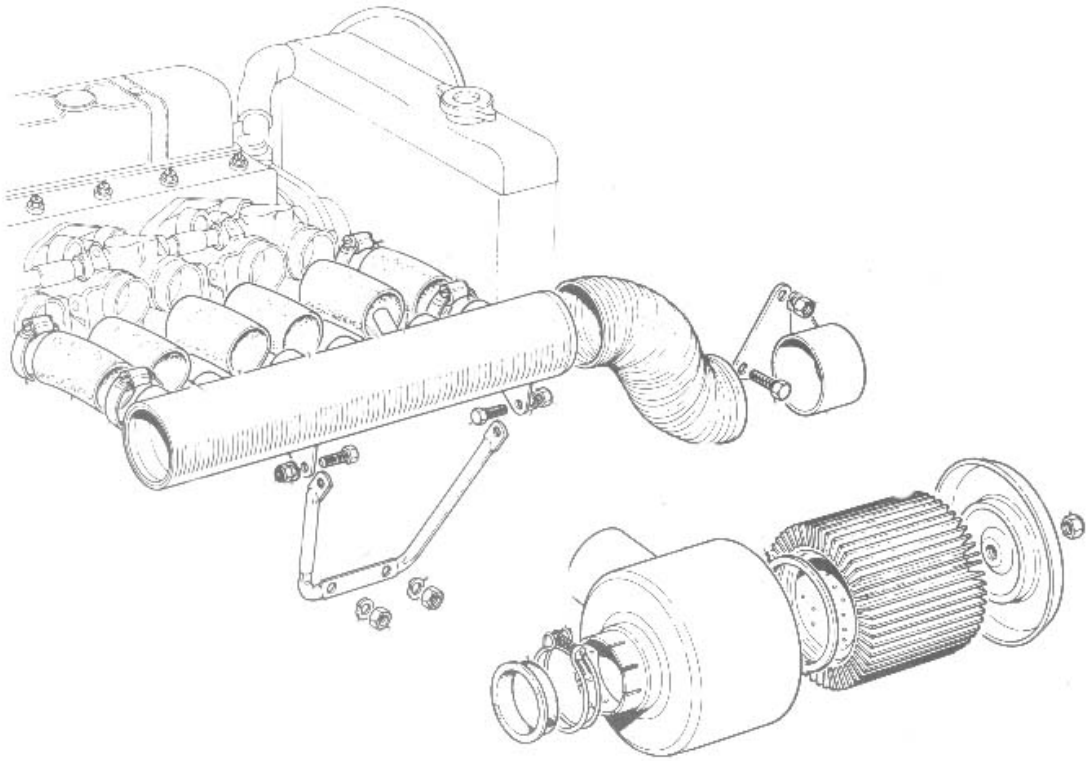
The Injector Feed Pipes …

The feed pipes link the metering unit to the injectors, and if they hadn't proved a little troublesome, I wouldn't have bothered to mention them. The PI system I purchased came from a Mk.I 2.5 saloon, so I estimate that it was fitted in the mid 70's. The tubing (black high pressure nylon) ages over that time. During the assembly process, I found that 3 hoses were splitting as a result of age-hardening.

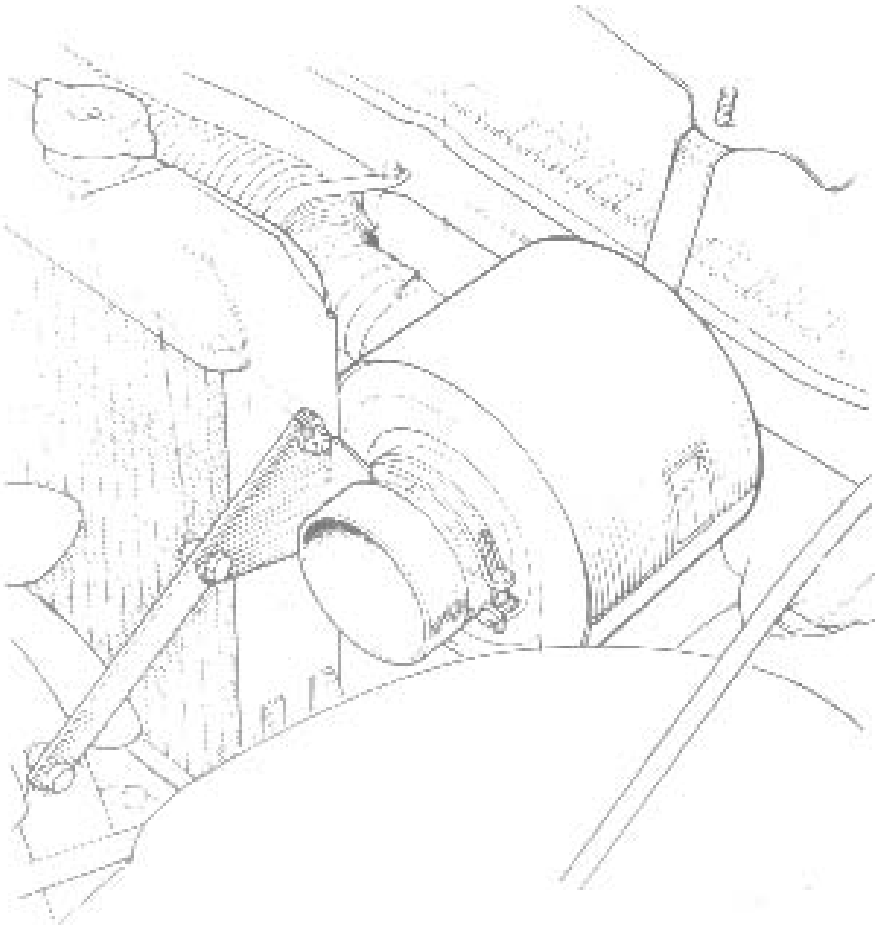
I would recommend buying the necessary materials from the suppliers listed at the end of this note and refitting the ends (not too bad to do, if you make the holding block detailed in the factory manual). You can cheat and buy completely new feed lines from one of the suppliers, but this is quite expensive.

The Air-cleaner …

First, make sure you get the right one …. The early saloon one is a different design, and although it can be persuaded to fit, it will not have the advantage of looking the correct!). The image below shows the correct TR6 pattern.



The air-cleaner requires a bracket to hold it in place. This bracket is available from TRF (they have a large stock of the odd PI bits …, worth remembering when looking for the unusual item in the US, where owning a PI is a bit unusual). The price was higher than I wanted to pay, so I fabricated a bracket that does the job fine.



You will not find the air cleaner element in the corner US parts store: even though I now have every-cross reference under the sun, the major manufacturers do not carry this item in the US. The elusive GFE1048 can be found at the Roadster Factory, or you can just about get by with a Hastings FF963 – you will need a packing washer to ensure that it seals.

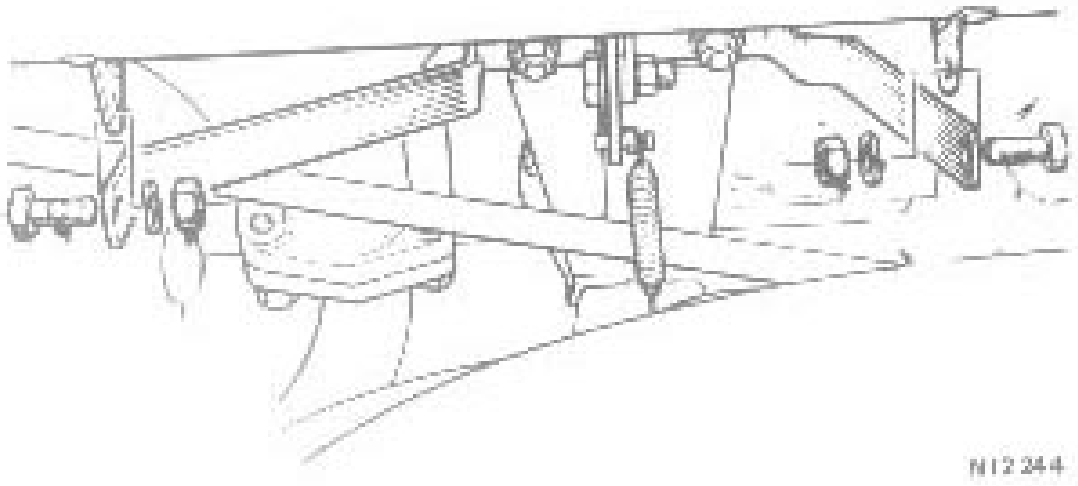
Linking the air cleaner to the manifold plenum is pretty straightforward – some 3.5" air cleaner trunking hose will do the job nicely, finished off with a couple wire clips and you're in business.

The Plenum …

The plenum links the air cleaner to the manifold. It is does this using 6 rubber link pieces.

The plenum chamber is secured in place using a bracket fixed to the RH engine mounting. It seems that the PI cars had studs fitted to the block, and then the bracket fixed to the block using nuts. The bracket can be fitted using the 3/8" UNF bolts used in the carb cars.

The bracket seems elusive, so I fabricated one using ¾" by 1/8" strip steel. The following image shows the general setup:



Accelerator Pedal …

The LHD carb car is equipped with a mechanical linkage. The PI cars (both L- and RHD) use a cable-operated throttle system. It might be possible to use the LHD mechanical system with the PI unit, but the clearance between the metering unit and the cross-rod is so small that there could be some contact.

Jean Roulleaux (a really helpful PI owner in Belgium) owns a very rare LHD PI car. Jean very kindly removed his LHD pedal, and sent me an engineering drawing of the unit, plus pictures of the installation. If anyone is interested, I can send the files detailing this work of art. Although I appreciated Jean's work, I found that a Mk.IV Spitfire pedal (which is a very simple cable operated unit) could be adapted to fit the TR6.

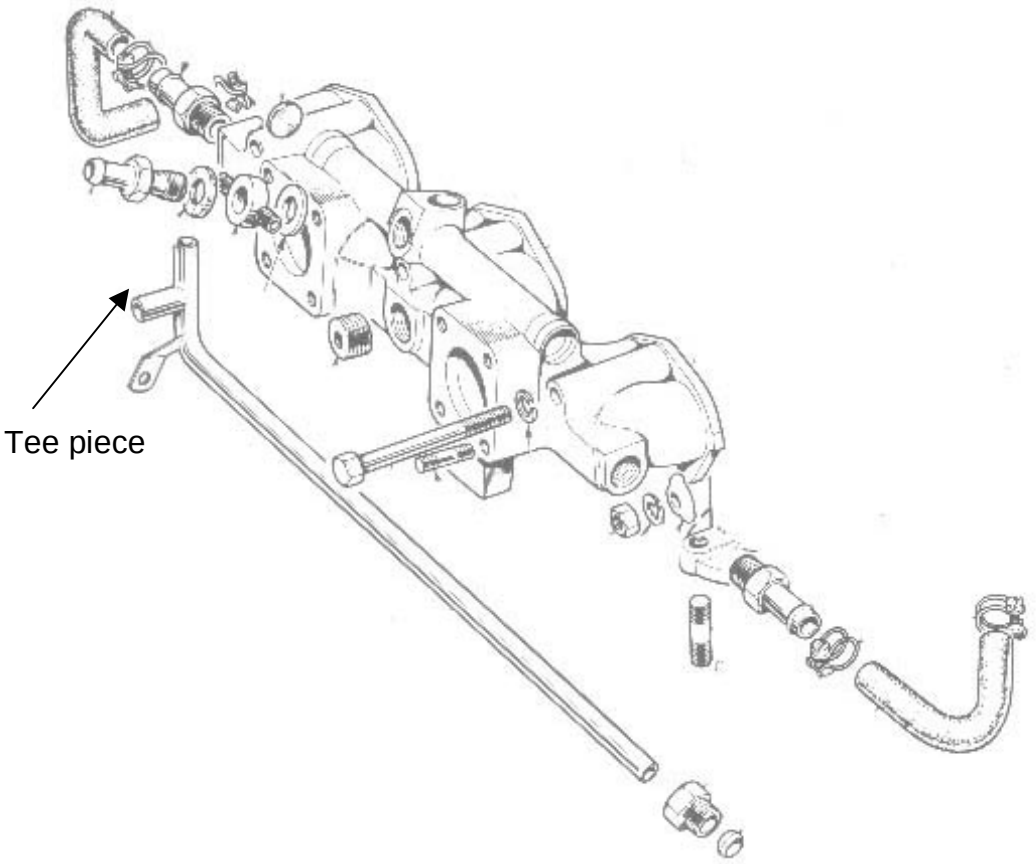
Once I removed the carb pedal assembly, I was able site the Spit pedal (a simple U-bracket and 2-captive nut system – a lot simpler than the LHD PI pedal by far!) in the space between the brake/clutch pedal box, and the battery box. Once in situ, I was able to mark the fixing holes, and drill the ¼" holes. The ¼" UNF bolts were then fitted from within the engine compartment (they are sited alongside the brake booster) into the captive nuts in the pedal.

Once the pedal was in place, I was able to mark the location of the cable, and to drill a clearance hole for the cable.

I purchased a LHP PI accelerator pedal cable during the Rimmer's summer sale. This was inserted from the engine compartment, and clipped in place using the existing Spit clip. The other end of the cable hooked up just as it should with the throttle linkage on the manifold.

Water Works …

The PI car doesn't have a water heated manifold. This means that the upper outlet from the water pump housing has to be plugged – requiring a ½"BSP/NSP plug. In addition, the ½" dia water pipe that runs behind the manifolds on the carb cars has a "tee" that connects to the other end of the carb manifold. This can be easily plugged – I found a ½" dia piece of steel stock and inserted that in the now-abbreviated rubber hose, and once tightened with a hose clip, sealed off the manifold heating system.



If you are really keen, you can remove the ½" dia steel water pipe that runs behind the manifold, and replace it with the PI version (that omits the "tee"). I would not recommend trying this unless you are willing to wrestle the old pipe out of the housing, and go through the pain of that process. I did replace this pipe on my car for a different reason (and decided to keep the carb "tee" just in case). I have, therefore, a complete description of that process – let me know if you would like a copy.

Making it all Work …

Step 1

The installation of the all the bits is very straightforward. We started with the removal of the inlet manifold complete with the carbs (you do not need to remove the carbs to do this). This also preserves the linkage setup, and keeps everything together: a worthwhile activity.

Step 2

Remove the mechanical fuel pump, and associated carb pipework. Fit the GM-type blanking plate.

Step 3

Remove carb throttle linkage.

Step 4

Fit the water pump housing blanking plug. Plug the "tee" at the back of the water pipe.

Step 5

If you have the plenum chamber bracket, now is a good time to fit it. You will have lots of room to do so. If you intend to make your own, you will need to hang on a while …

Step 6

Fit the PI manifolds. Since vacuum is so critical to the operation of the PI metering unit, take great care to ensure that you check the inlet manifold gasket (it is common with the exhaust as well, but it at this time, easier to change than normal).

On ours, the gasket was fine, and after the installation was complete, everything worked fine for a while, but slowly developed gasket leaks, so had to remove the three manifold units, and seal them with high temperature silicon sealant. This seems to have cured that problem for now.

Incidentally, low vacuum will mean rich mixture – the metering unit operation is such that you will get max fuel when you have minimum vacuum. So any vacuum leak is to be avoided at all costs – the metering unit doesn't have a mixture screw that you can tweak, so you are looking at a complex process of adjustment, or a simpler process of fixing leaks: no prizes for which way to go.

Step 7

Mark distributor cap-to-plug leads with WhiteOut/Tippex. Remove cap and leads.

Step 8

Set engine at TDC on #1 cylinder. If you are using the 73 and later MU, you will need to mark the mark the crank pulley at 20deg and 45deg.

Step 9

Remove distributor, but before you do so, mark reference points for the rotor alignment on the rocker cover, and once the distributor is removed, the drive-dog slot, using WhiteOut/Tippex.

Step 9

Remove the carb-type distributor pedestal. Fit a 2" stud in place of the ¾" stud at the rear of the pedestal location.

Step 10

Fit all the pipework … yea, it's more than one step, but it is so individual that I'm suggesting that you go for it now.

This should give you:

- New high pressure feed line with correct fitting to the MU feed
- "old" fuel feed modified to fit to the MU overflow outlet

Step 11

Fit your selected fuel pump system. Yea, this is a bundle of work, but it is well described in the previous section.

Step 12

Fit the wiring needed, including the tilt switch and relay.

Step 13

Fit the "new" Distributor/PI drive shaft into the engine, ensuring that the drive slot lines up with the WhiteOut marks made earlier. If it stands proud of the position of the shaft you have just removed, then it may not have engaged with the oil pump slot – check that it is engaged: if it is, it will be located at the correct height/location.

Step 14

Fit the rear choke cable to the metering unit.

Step 15

The metering unit needs to be prepared for installation. The injector pipes for 2, 4 and 5 should be fitted in advance. You can fit 1 and 3, but I can tell you from (my experience) that you can leave 1 and 3 until later (and 6 shouldn't be fitted in any case, until you've got the timing issue buttoned up).

You will need a in/lbs torque wrench for the installation process

The metering unit/pedestal assembly by now is ready to be fitted. Using the Factory manual, set the unit, and fit it according to the instructions.

Step 16

Check the timing of the unit by looking at #6 port as you rotate the crank.

Step 17

Fit the fuel feed to the metering unit (I overstressed the #3 feed doing this, so I would recommend fitting #3 after the main fuel feed). Fit the over-fuel return pipe.

Step 18

Fit #1, #3 and #6 injector feed pipes to the metering unit. Fit the vacuum control feed to the metering unit. Fit the vacuum line to the brake servo.

Step 19

Fill the tank 3-4 gallons fuel. Set tilt switch in run position. Get a 4lb/2Kg extinguisher and keep it nearby.

Step 20

Turn on the ignition – the pump will run, so check all fittings for leaks. If you see a leak, shut down until fixed.

Step 21

Set the ignition to the PI setting of 11 BTDC. Refit the rotor, distributor cap, and refit any plug leads than have been disconnected. Don't forget, you will not have a vacuum retard feed any longer.

Step 22

Pull out the choke. Start cranking .. remember that you will have to crank until you bleed the air from the system before she will start. The clue is the pulse you will feel in the injector pipes to the individual injectors: once that is occurring, you are on the verge of running.

Step 23

If you've got his far, you can deal with the frustrations that will follow …

Step 24

Overcome all the problems encountered above (allow 4 weeks), turn the key and have fun, and worry about the clutch handling the extra oomph!

Costs (not sure I want to do this ….!):

Item	Description/Source	Costs
Metering Unit + pedestal + dist. Drive shaft	Lucas Mk II Unit – ex Mk.II 2.5 saloon (purchased from Chris Gibbard)	225.00
Manifold + linkage	Ex Mk II saloon (Chris Gibbard)	(included in above)
Plenum chamber + 6 rubber connectors	Ex Mk II saloon (Chris Gibbard)	(included in above)
Air cleaner	Ex Mk II saloon (Chris Gibbard)	(included in above)
Lucas fuel pump	Ex Mk II saloon (Chris Gibbard)	(included in above)
Lucas fuel filter bowl	Ex Mk II saloon (Chris Gibbard)	(included in above)
Pressure relief valve	Ex Mk II saloon (Chris Gibbard)	(included in above)
6 injectors + 6 injector feed pipes	Ex Mk II saloon (Chris Gibbard)	(included in above)
Tilt cutout switch	Ex Mk II saloon (Chris Gibbard)	(included in above)
Assorted high pressure hoses	Ex Mk II saloon (Chris Gibbard)	(included in above)
Unleaded spec seals for MU	Pumford Ltd	130.00
Spherical bearing for MU	Pumford (to replace the one that broke when servicing the unit)	35.00
Drive dog	Manvers Triumph (to replace the one broken by lack of lube)	25.00
Plastic drive coupling	Kinsler Injection (to replace the one broken by lack of lube)	27.50
Lucas manual	Triumph 2000 Website Booklist	12.00
Injectors rebuilding	Pumford Ltd.	135.00
Water pump blanking plug	Lowe's	4.00
Fuel pump blanking plate	Pep Boys	4.00
Material to make air cleaner bracket	Lowe's	3.00
Air filters	Rimmer's	12.50
Fuel tank mods	Return feeds fitted	40.00

Bosch fuel pump + accumulator + filter unit	Local junk yard	40.00
Airtex 8307 pump	Pep Boys (to replace what I thought was a not functioning Bosch pump).	160.00
Purolator (Facet) low pressure feed pump	Pep Boys (to feed what I thought was a poor high pressure pump ….!)	32.00
Relay	Pep Boys	12.50
3/8" high pressure hose	Local chandlery (12ft – a bargain)	16.00
¼" high pressure hose	Kinsler Injection (to replace the aged hose on the injector feed pipes) – 9ft - not a bargain!	32.00
Bosch filter element	Pep Boys	12.50
Coupling hose between accumulator and filter	Hammond Hydraulics	55.00
Assorted plumbing fixtures to couple everything together	Lowe's/Ace Hardware	40.00
Electrical cable	Pep Boys	20.00
Accelerator pedal	From son's Mk IV parts car	Free
PI LHD accelerator cable	Rimmer's	14.50
	Total	**1107.50**

Sources

Items	**Contact**
Used PI systems and all used Triumph spares	Chris Gibbard TriumphLand 011-44-1302-868450
PI parts and PI rebuilding	ME & JW Pumford 2 Alderley Road Hoylake CH47 2BG 011-44-151-632-0002 fax 100-44-151-632-0003 email: mpumford@aol.com
PI parts and PI rebuilding	Kinsler Fuel Injection 1834 Thunderbird, Troy, MI 48084 248-362-1145 web: www.kinsler.com

PI parts and PI rebuilding	Prestige Injection 011-44-1978-263449
New Triumph Spares including PI parts	The Roadster Factory 328 Killen Road, Armagh, PA 15920, USA (800) 678-8764 email: trfmail@aol.com web: http://www.the-roadster-factory.com
New Triumph Spares including PI parts	Rimmer Bros Triumph House, Sleaford Rd., Bracebridge Heath, Lincoln LN4 2NA 011-44-1522-526200 email: sales@rimmerbros.co.uk web: www.rimmerbros.co.uk
New and used Triumph spares	Manvers Triumph Triumph Sports & Saloon Car Specialists Station Road Elmswell, Suffolk IP30 9HR 011-44-1359 244417 email : clive@manvers-triumph.com web: www.manvers-triumph.com
Triumph Listservs	http://www.team.net/www/tn-mail.html
Triumph List Archives Triumph list (the Big List) 6Pack list (6 Cyl. List)	 http://www.listquest.com/lq/search.html?ln=triumphs http://www.listquest.com/lq/search.html?ln=sixpacklist

Conclusions …

This is a task that has taken over 2 years to complete, although I'm sure it could have been done in a much shorter period. During that time, I've learned more about the Lucas PI system than I would believe, although I am pretty confident that I could troubleshoot and perhaps repair most problems that I might ever encounter. I've had the pleasure of working on the project with my 2 teenage sons, who have taken a great interest in the project from day one. And I've fulfilled my initial task of seeing what a TR6 feels like with the injected engine … and it is so different, that alone seems worthwhile.

For the costs expended, I could have fitted triple Weber 40-DCOEs, and achieved the same power output (although tuning Webers is a bit of black art – not to say expensive - as well). But if I'd gone down that path, I would have missed all the fun of PI idiosyncrasies, and I would not have those beautiful manifolds that could very easily be adapted for Bosch electronic fuel injectors, and at some point convert the entire setup to ECC-V based EFI.

Although you by now think this is too long, I should mention that I have skipped over many issues that you will need to think about including changing of cams, and modifications to the cylinder head. So I'll leave all those for another day …

Finally, Thank you …

A project of this kind cannot be undertaken without considerable help. My help was not the "round the corner" type, but a group of willing and enthusiastic list members who happen to be PI owners, drawn from all round the globe. The following deserve special mention for all the efforts they have expended on my behalf over the last 2 years: many thanks guys:

Gary Blake, South Africa
Kenneth Brown, US
Steve Bruford, US
Dave Hill, UK
Lee Janssen, US
Egil Kvaleberg, Norway
John Macartney, UK
Michael Porter, US
Bernard Robbins, New Zealand
Jean Roulleaux, Belgium.
Dave Stauffacher, US
Graham Stretch, UK
Dave Wingett, US
John Worthy, Australia
Erik Quackenbush, US

Good Luck to all Prospective PI folks…

If you go down this path, you'll enjoy it, but have patience, and ask a lot of questions!

Tony Gordon

September, 2000