

Quantum Fiat conversion – phase 1

I've had a Quantum 2+2 – number 359 – for a couple of years now, and while it's a great car for the sunshine it's fair to say it's had one or two faults. The handling is excellent, but the power from an ancient CVH lump is, to say the least, less than sparkling. I suspect most of the alleged horses have been put out to pasture long since. I've also had problems with the throttle cable sticking, the clutch operating point, and the general nastiness of the gear-change – taken together, they meant that smooth driving was never an option. The exhaust drone at 3000rpm on the motorway, while infinitely better than with the Scorpion pipe it came with, was exhausting. The complete rat's nest of wiring, with obligatory random and unfindable short and open circuits, was a mere courtesy detail...

So along comes spring, and a young man's fancy turns to thoughts of engine modifications. Obvious thoughts are of an injection engine, but all the obvious ones – Zetec, XR2i and so on, have been done. Besides, there's no guarantee that the end result will be any better than it is now. So, other thoughts... I'm very familiar with the Fiat Coupe and its four commonest engines; four and five cylinder two litre lumps in atmospheric and forced induction versions. Power ranges from around 165bhp for the 16vNA (with a suitable chip) to 220bhp for a stock 20vT; reliable 350bhp modifications are common and there are a few running past 400bhp – not what I'm looking for, but demonstrating the basic strength of the block.

The 16v blocks are the same width as the CVH block, with perhaps a couple of inches more for the 20v blocks. The heights are the same, but the engines are packaged and mounted differently. And while I've seen lots of engines in lots of kits over the years, I've never seen a five cylinder kit before.

So – a challenge. Can I get the Fiat 20vt engine into the Quantum, without butchering the bodywork, and make it work? And can I get it back to a rolling shell in a week?

As it happens, I'm friendly with a fellow who runs a Fiat Coupe repair and dismantling

business – Joe Knight, at FCSS in Bromyard. He's a chap who knows his way about a 20vt engine, and which bits fit together in interesting ways that Fiat never intended. He's also an artisan blacksmith and a nuclear welder; I have no doubts about any bits of metal he's stuck together. We've been discussing this for a couple of years now, off and on, but suddenly he's available for a week and so am I.



We're planning severe modifications. We know we need to change the fuel system to include a swirl pot and fuel pump, and that we're going to have to make heavy modifications to the engine frame to accommodate the Fiat lump. We intend to use the Fiat wiring loom – anything to get rid of the dog's breakfast I inherited when I bought the kit – and to cope with the weight of the engine we want to use the Fiat's power steering, too. The gearbox is a no-brainer, but that implies a hydraulic clutch and cable gear-change. Ford's remote brake servo will interfere with the inlet plenum. So the Fiat gearstick needs to fit in somewhere and the pedal box – which contains the servo on the driver's side of the firewall – will go in too. While we're at it we'll also need the Fiat steering column and switches to meet up with the loom (we won't be using the airbags, thank you, nor the antilock brakes) and the instrument pack to get the speed and revs from the ECU – which we will also use. As a bonus here, we get a 'key-present' immobiliser free of charge. We intend to use the existing Fiesta suspension, though the springs will require upgrading, and we'll probably need to sort out something larger in the

brake department – though the vented Ford discs currently on do a pretty good job of stopping the thing at the moment.

So – here's what we managed in a week... there are a hundred and sixty or so photos documenting this build, so have a look at http://s156.photobucket.com/albums/t31/nailed_barnacle/Quantum%20engine/ for the gory details. There were one or two false starts, but not as many as might be expected, nor as serious as they might have been.

Saturday: a day of taking things to pieces – by 20:00 we've removed:

- The bonnet
- Inner wings
- Radiator
- Front suspension and driveshafts
- Engine and gearbox
- All engine bay ancillaries
- All the wiring loom forward of the driver's seat
- Pedal box
- Steering column and wheel
- Entire dashboard
- Carpets curtains and light fittings

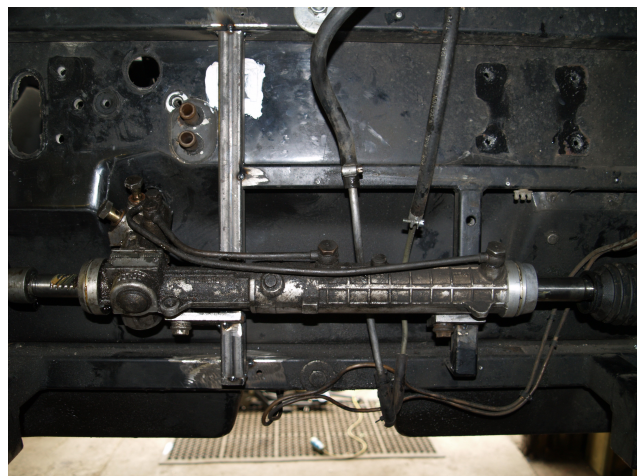


The only things remaining forward of the driver's seat are the wiper motor and the heater fan and matrix. The wires to the rear of the car are sliced – we'll find out what did what later – and now we can see what we're doing in there.

Sunday: was mostly dedicated to steering matters. The complete Coupe rack is obviously much larger than the Fiesta's, and the track rod is thicker. So the obvious thing was to get the track

rods off, get them turned down, and thread them for the Ford track rod ends. But just on the off-chance, we tried the Ford rods in the Coupe rack – and discovered the same thread. And as the Coupe's rack is only about 7mm wider than the Ford... so we can take that up in the adjustment. Having a slightly shorter track rod will affect the bump steer and we won't know how much until we drive it – but moving the rack will also change it and we can't avoid doing that.

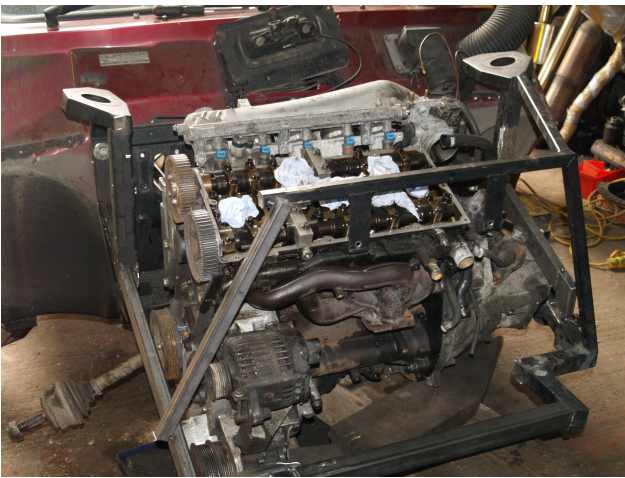
When the car turns, the outside wheel is compressed on the suspension as it takes the load. Ideally, you want everything to pivot in the same place but that is clearly impossible – but it helps if, as it loads up, the angle of turn is not forced to increase. If the track rod pivots above the steering knuckle, then the effective length increases as the load increases and this can increase the steering input – bump oversteer. Non-linear, positive feedback, and not fun. Fortunately, it looks as if we have the rack pretty much level.



We make a temporary frame to hold the rack so we can check for wheel movement, and discover that we made a bad guess: the Fiesta rack is four turns end to end; the 16vNA rack 2.75 turns, and the 20vt rack only two turns – and the 20vt is notorious for a poor turning circle. So we put the 16 rack in, only to discover it has too much travel. Fortunately, the 20 rack turns out to have the same travel as the Fiesta rack, so that's the one we select.

We drop the frame over the Fiat engine to see where it fits. Mostly it doesn't; the main issue is with the power steering pump and relay pulley to the alternator.

Monday: We raise and lower the body and engine frame a dozen times as we work out what needs to be done to the frame. This job would be impossible without an engine hoist, a trolley, lots of blocks, and a two-post lift... we arrange the engine in the desired position – basically flat with the sump, so the engine actually tilts forwards – and lower the frame, observing where it's going to catch. The bar across the front is going to have to go, so we tack in some supports and move it so it's aligned with the front of the bonnet support arms. It's raised a few millimetres to allow the bolts to fit through the existing tubes.



It needs ideally to extend all the way to the outer edge of the frame on the driver's side, but then the bonnet won't close, so we get creative and eventually end up with a clearance around the engine. We've replaced the 40mm diagonals on both sides with 50*25mm to maintain the strength, and on the driver's side that now goes forward to the new front. There's no chance that the existing tie bar pickup can be used.

Tuesday: we start to think about engine mounts. This is something of a head-scratcher since we have to create something which will accurately locate the engine under its weight and prevent it rotating under brake and acceleration loads. The Fiat engine has one mount at the front of each side and one under the centre tunnel from the gearbox; both front ones get in the way of the chassis. A torsion stay runs through a massive casting from the engine to the driver's side wing.

We decide to use the Ford system at the right

rear of the engine, and modify the torsion stay to hold a plate which then holds the Ford mount. The area behind the mount is reinforced with generous amounts of 5mm plate.



For the opposite front corner, I first design a complicated double box before throwing it out as too complex. I then come up with something which takes the load and has slots in the mounting plates – it picks up from the original Fiat gearbox mount location – to allow removal. It holds the engine up, but has too much shear in the rubber, so I need a re-think.

Meanwhile, we hoik the bonnet on and off again to check for clearance, and discover that the top right frame won't allow the cam cover on/off – time for a rethink there, too.

Wednesday: we sort out the clearance problem with the engine frame by repositioning bits top right front; a bracing piece maintains the strength but we don't put the vertical in for now – that will be set by the radiator position later. There's a slight clash with the headlight housing so a bit gets nibbled off there. We order all the Ford and Fiat service parts; they'll be here tomorrow. The short list includes cam and auxiliary belts and tensioners (the clutch parts

Joe had in stock), and the bottom ball joints, outer CV joints, and track rod ends for the Ford. Joe gets busy with the Mig and completes the welds. I insist on a diagonal to take the braking and acceleration loads back to the suspension tower and tub, as we don't know where the vertical will be otherwise. By now the bonnet has been fitted and removed at least five times.



Unfortunately the Coupe radiator is too tall for the space; the Fiesta rad is too small adequately to cool the much more powerful engine. A trip to Hereford Radiators, a quick mutter with the guys there, and a custom radiator is ordered with all the right pipes and angles and the turbo coolant return. We're promised eighteen hour delivery!

While Joe welds, I make the template to position the Coupe pedal box. It's a bit of an odd shape, but it looks good to fit.

Thursday: The front left engine mount is redesigned and works much better; the engine balances exactly between the two main mounts and the reduced angle.

The final mount is a doddle. A slotted piece of 25*50mm holds the remaining Ford gearbox mount and the Fiat rear mount slots on with no more modification than a quarter inch slice removing. With the pressed 'hat' that's normally there on the Ford engine, the clearance at the front of the chassis is spot on.

To our amazement, the nearside tie bar fits back in the original holes; clearances are fine all around. That's nice because it gives us a good reference for the castor on the other side;

interestingly, the two swing arm pickups differ by half an inch between the sides.



The new radiator arrives – shiny shiny. Two hundred quid; I'm not arguing with that for a hand-made special!

The wheel hubs are removed and sent to a local place for the bearings to be replaced (it needs a press) and the guy who does them has a couple of new discs which he offers to me for twenty quid. I have them, of course...

We reposition the steering rack slightly; nearer the firewall and up a little; nothing significant but it gives a little more clearance and means we don't have to modify the firewall quite as much to get the Fiat steering column in. By this time, the engine has been in and out so often we've lost count. We can get it out in three minutes and back in about ten...

Joe fires up the forge and makes the first modifications to the offside tie bar; straightening one of the bends. He'll ensure that when it's finished, it gets the proper heat treatment to ensure its strength is unaffected. He's happy because he had thought earlier he might have to fabricate one from scratch...

Friday: Bad news; half the parts sent were either wrong, or the original builder didn't use the bits we thought he'd used. The TREs are right, but the ball joints are for an XR2i – straight rather than angled. The new CV joints are smaller than the ones removed and don't engage the splines. Even the clutch slave cylinder was for the wrong Fiat... somebody is having a bad day and I fear it's me. A frank and

fearless exchange of views by telephone and some of the right parts appear, but the CV joint has confused them. We count splines by their request and they go off to see what they can discover. Worse: we get the hubs back and with the original CVs they lock up solid. This is not good, but we just loosen the nuts for now; we don't have time to waste if we're going to get the thing rolling by close of play. Joe will chase those up later.



Joe fires up the forge again for the final changes to the front right tie bar. One last bend and it goes where it needs to; I design a new mount to weld to the chassis. Since we've moved the chassis it's a bit difficult to see where it should be; lots of careful measurements locate it but we may have to change it later when we can get the car on a measurement set.



The fuel tank is swapped from the original – it's rusty enough to have been on the donor

twenty years ago – and we look at the exhaust. The Coupe downpipe and flex joint hook up, and we have only to straighten a couple of curves to clear the engine mount and proposed gear lever mount. The flange from the Ford downpipe is pressed into service and the Ford exhaust shortened to fit; it's going to constrict the engine but we need some back pressure to keep the turbo bearings intact. We'll get something nicer organised later.

We've worked about a hundred hours each over the last week, and it's not quite rolling. Plan A was to bring it back to Hemel and I'd get the engine and electrics sorted, but on sober reflection we decide better that I get the one and only train, and leave the car at Joe's. I catch the 18.40 from Hereford; as I pass Milton Keynes I get a text from Joe... he finished the last mount and rolled the car off the ramp at 20.45

What's left now? Well, the steering and pedal box will be next, then the engine comes out again to get the brake plumbing in. Joe will be fabricating the new drive shafts. There are a number of detail things on the engine – for example, sorting the details of the oil cooler and slight changes to the power steering pipes, and getting the radiator mount complete. That's going to have a knock-on to the bonnet which will require internal modifications, and possibly a larger hole in the front to let air in. Plus we need to sort out stuff like the cooling, induction, and any random sensors and switches. I need to rebuild the dash to include the Fiat instrument panel, and of course all the wiring.

If you're planning something as complex as this, it's going to be really difficult unless you have some serious hardware. The two-post lift is the most useful item by far, but the angle grinder and welder have also seen a lot of use. Not too many garages have a forge to hand, either. But Joe seems to have enjoyed himself, and is muttering about offering kit build/conversion services...

Next issue – hopefully, it's complete and I get to drive it home!