The Calibra/Cavalier 2ltr 16v Turbo Engine Conversion for the MKII Astra GTE 16v

The Calibra/Cavalier 2ltr 16v Turbo engine conversion is fairly straight forward as engine conversions go. However, there are a few things to watch out for. These will be described later in detail. The average competent mechanic armed with a few basic tools should have no difficulty in carrying out the conversion.

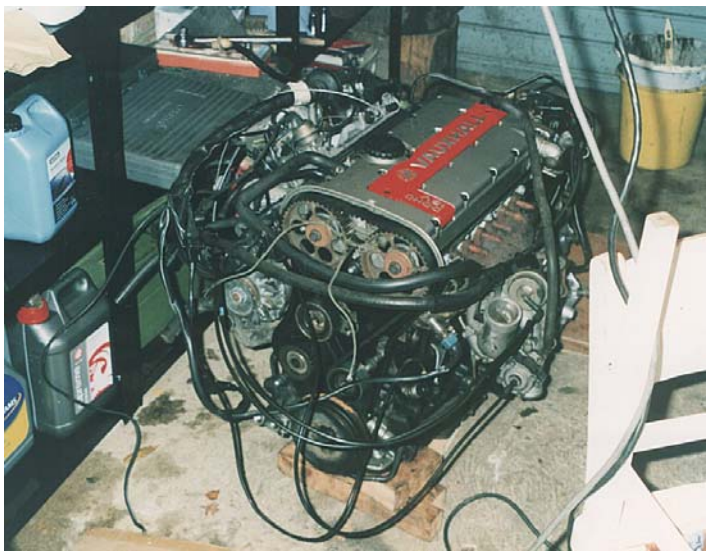
I will make several assumptions in describing how to carry out this conversion which are as follows;

- You know how to remove your existing engine and have done so.
- You have access to an Engine hoist (obviously you'll be buggered without one)
- You have access to welding equipment
- You have access to soldering equipment
- You have all the necessary sockets, ratchets, torque wrenches etc.
- You have access to the MKII Astra Haynes Manual – You Will need this.
- And finally, that you take this job on at your own risk, I take no liability for any accidents, injuries or fuck ups that you make as this is only a guide. It is not definitive or complete in any way.

Just one thing, If you're not very careful, this could cost you a small fortune…You have been warned!!

The Beginning

Now that you have acquired your new shiny turbo engine it would be wise to carry out simple routine maintenance before fitting the engine as this will make life far easier:

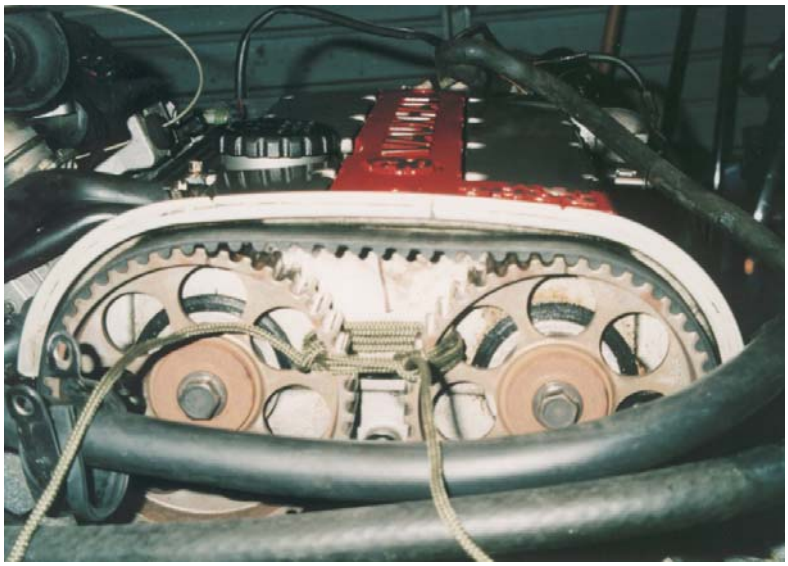


- **Change the cambelt**

The procedure below is described for a pre 1993 engine. I.e. the cambelt configuration uses only one idle roller, the belt has rounded teeth and there is no self tension pointer for the cambelt. Be

aware that the details for changing the Post 93 engine is different from the explanation below so the Haynes manual will need to be consulted. Post 1993 engines use two idle rollers which are plastic as opposed to steel, and the belt has square teeth and is longer in length. It is highly recommended that these plastic idle rollers are replaced. If they have GF50 written on the rim of the roller then this definitely needs replacing as these break up. They need to be replaced with new ones that have GF25 written instead.

Make sure that the engine is secured in an upright position, Line all three timing marks up and then slacken the tensioner. Remove the bottom pulley from the crankshaft (power steering and alternator). Then remove the belt. Now at this stage you can change the water pump as you don't know how many miles the engine has done. To do this, first remove the camshaft pulleys by removing the camshaft cover and using a 24mm spanner on the shaft and a 15mm socket on the bolt. Don't forget to mark the pulleys as to which came from where (i.e exhaust or inlet). Undo the two 6mm Allen key bolts which hold the idle roller and the belt tensioner to the block. Now you can remove the black back plate via three star screws and the two supports for the cambelt cover screws. You should now be able to remove the water pump and rubber 'o' ring. Give the mating surface on the block a good clean and then fit the new water pump and torque the three bolts to the correct tightness. Refitting is then in the same order as removal. New bolts should be used for the tensioner and idle roller and the camshaft sprockets. To tension the belt fit a half inch three eighth socket reducer in the square hole in the bracket and tension. Correct tension is achieved when you cant quite turn the cambelt through 90º from the exhaust camshaft to the idle roller. Don't forget to turn the engine over by hand at least three of four times to check the there is no valve to piston contact and that the belt is still tensioned correctly and still lines up with all three markers.



- **Alternator and Power Steering Belts**
  You may find that you need to change the alternator, just use your old astra item due to the Cavalier/Calibra utilising a 'hoover' styled belt (fat wide one). This will also apply to the bottom pulley as well.

Obviously you should change any other items that in your opinion need to be changed at this stage as it's far easier to do so.

- **Gearbox**
  Once you are happy with everything, the gearbox should now be fitted, (Make sure the correct clutch is fitted depending on the gearbox to be used as the splines are different). At the time of fitting my engine I was unable to find a clutch alignment tool that had a long enough shaft, but its not essential and you should be able to get it lined up by sight.

  The choice of gearbox is up to you, most people tend to opt for the F20 5 speed item as it bolts straight on. However, the F28 six speed gearbox is a nice touch. You will need to get it modified to run two-wheel drive. This is something that most of you won't be able to do yourself, but it shouldn't be too expensive to get done. If you do opt for the F28 six speed box, make sure it's an older one with the speedometer sender connection on the box which is in the same place as the F20. You will need to use your old F20 one and the ring on the differential as otherwise you will get all sorts of wrong speedo readings on the dash.

- **Engine Mounts and gear linkage**
  As the Cavalier/Calibra Turbo 2ltr 16v uses essentially the same block as the normally aspirated 16v, you just transfer the old engine mounts to the turbo block and gearbox. The engine will fit straight in with no problems. However, this is only the case if you are going to use the F20 gearbox. You will also be able to use your existing gear linkage too.

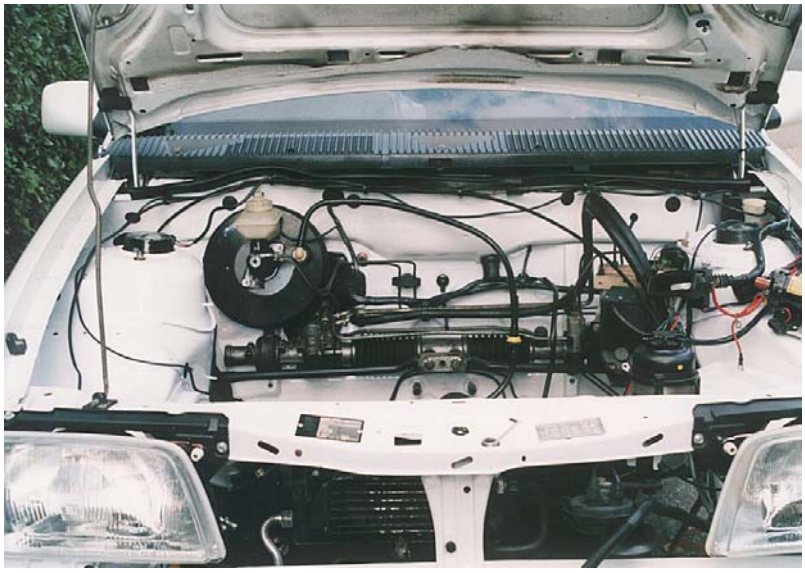
  If you want to use the F28 six-speed gearbox then some engine mount modifications are in order. This is simplicity in itself. The front off side mounting bracket bolted to the engine stays the same, as does the rubber part. The front near side bracket that is bolted to the front of the gearbox needs to be changed for the Cavalier/Calibra item as the bolt holes on the gearbox are wider apart. The rear engine mount that the gear linkage is fixed to has to be modified. To do this you will see two flanges that run along the top of the bracket. You need to remove part

of this flange that mates to the gearbox and seam weld the top strengthening plate up as it will foul the gearbox casting. You will also need to use the Calibra/Cavalier gear linkage as this has a shorter arm. Your old F20 5 speed item will not fit.

- **Preparing the Engine Bay**
  I found it easier to remove both drive shafts completely from the hubs for better access, but according to the Haynes manual this is not actually necessary. But in practice this doesn't actually work so I would definitely advise removing them.

  Before fitting the engine you will need to remove you old resonance chamber from below the air box as you will need to use the rubber mounting bush that it sits in for the new radiator/intercooler. You will find that the spigots don't quite fit the old radiator holes in the bottom cross member. So, as mentioned before, use the resonance chamber mounting then drill a small hole the other end just behind the power steering pipe and insert a rubber gromit. I found that there is no need to make up mounting points for the top of the radiator/intercooler as the pipework will hold it in place but its down to personal choice.

  Now you are ready to fit the engine.



- **Fitting the Engine Part 1**
  Before the engine is fitted, I found it easier to leave the inlet manifold still bolted to the head as this is a nightmare to fit when the engine is in the car. I did remove the turbo, oil feed pipe and oil return pipe spigot for ease of fitment but leaving these attached saves you work at a later date.

  The Haynes manual suggests that you remove the bonnet to do this but this is not necessary at all. If the car is already on axle stands at their highest point then you are able to move the engine in front of the car, tipping it forward and wiggling it under the front of the car etc in order to get it into the bay. Once the engine is in position, lower the car around it slowly. You will find it a bit of a tight fit gearbox end if you use the F28 six speed gearbox as the casting just misses the chassis leg by about 5 – 10mm. Then manoeuvre the engine hoist under the bonnet from the side of the car (hoist legs then fit nicely around the engine) and connect it up to the rope or chain via the lifting hooks on the cylinder head and hoist into position. Once the

engine is bolted in, refit the drive shafts making sure to lubricate the splines with gearbox oil.

If the radiator and the turbo are not already fitted then these can now be attached. This is really up to how you go about the procedure but you can be sure its gonna be a tight squeeze. As I had installed the engine without the turbo attached I personally I found it easier to fit the radiator/intercooler from the top and then the turbo from underneath. I also fitted the radiator fan and housing from underneath it too can be done from above.

Your old power steering pump will just bolt back onto the block in the same place as before and the lambda sensor also screws straight in aswell if this was also removed for installation.

- **Radiator Fan**
  Vauxhall made two types of fan for the 16v engine, one in plastic and one in metal. The plastic fans were used for most of the non turbo cars but you will need to make sure you use the correct metal one for the conversion. This is because the turbo will sit that much closer to the fan when installed in the Astra engine bay, (see picture below) and the heat from the turbo will melt the plastic fan blades if used. Be aware that the electrical connection to the Calibra/Cavalier fan motor is slightly different to the Astra 16v loom connection. In order to overcome this you can either make up a connection yourself or much easier, is to just swap the fan motors over.

- **Fitting the Exhaust Down Pipe**
  The down pipe from the turbo is quite a bit longer than the original exhaust manifold from your old engine. You will need to cut the pipe at the bends close to the sump and bend it to straighten up in line with your original centre section. You will then need to weld it and shorten the pipe so that it will mate up with your existing system and then re-weld the triangular bracket (As mine was fitted with a CAT) onto the end of the newly modified down pipe. I fitted a cat replacement pipe for the Astra which has to be modified. To do this, cut the cat half of the flexible joint off and weld on a triangular bracket to the pipe to mate up with the down pipe. This was all done with lots of patients and checking the position for fitment. I was fortunate and had access to a car ramp.

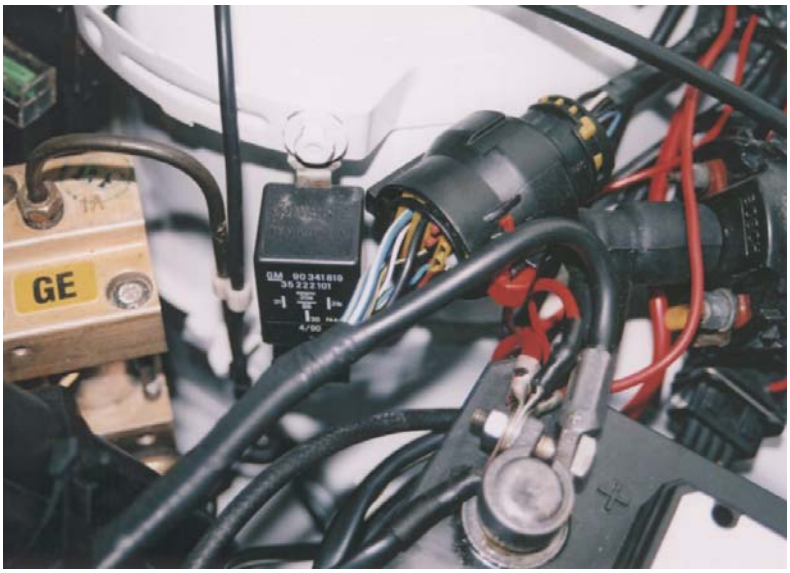
The car can now be lowered back onto it's wheels.

- **Wiring Looms**
  This is the part that most people seem to have large headaches with including me. However, with a little patients and methodical thought you shouldn't have any problems. There are three main problem areas:

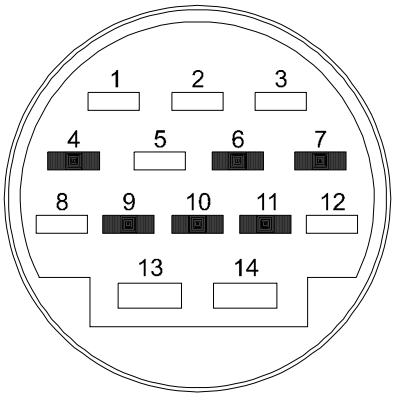
  1, The starter motor loom.
  2, The Injection/ECU loom.
  3, The radiator connection.

Note :- Wiring loom connections may be different to those shown below depending on the age of the car and engine looms being used.

The Starter motor loom.
The most common occurrence is to use your original 16v starter loom but you can utilise the turbo one either way you will need to jiggle some wires around. To help you out, I have included diagrams of both sides of the X5 plug and which wires you need to connect up.



Plug X5 – Turbo side

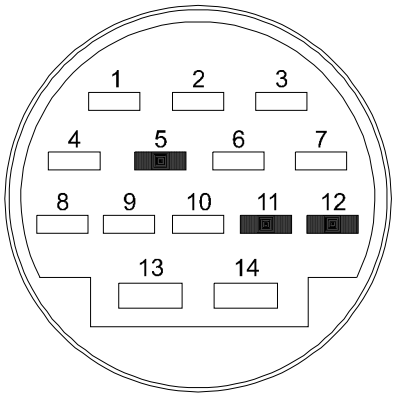


Pin	Colour	Action
Pin 1 =	Blue/White	Alternator
Pin 2 =	White/Black	To twin pin plug (Motronic) injection loom
Pin 3 =	Blue/Green	Oil Pressure Switch
Pin 4 =	N/A	Not in use
Pin 5 =	Brown/Green	Check Control Low Oil
Pin 6 =	N/A	Not in use
Pin 7 =	N/A	Not in use
Pin 8 =	Black/Yellow	To twin pin plug (Motronic) injection loom
Pin 9 =	N/A	Not in use
Pin 10 =	N/A	Not in use
Pin 11 =	N/A	Not in use
Pin 12 =	Black	To Single pin plug (Motronic) injection loom
Pin 13 =	Brown	Low Oil Check Control to Earth
Pin 14 =	Black/Red	Starter Motor

Note: The plug is viewed from the pin side

The wires to pins 5 and 13 can be discarded as these are not needed. You will find that you need to move some of the wires about within the plug for them to match up to the car part of the loom. This can be done by inserting a small flat bladed screwdriver into each pin and releasing the locktab. The wire just pulls out and can then be repositioned. Once this is done, just connect the two parts of the plug together.

The Astra GTE 16v Starter motor loom



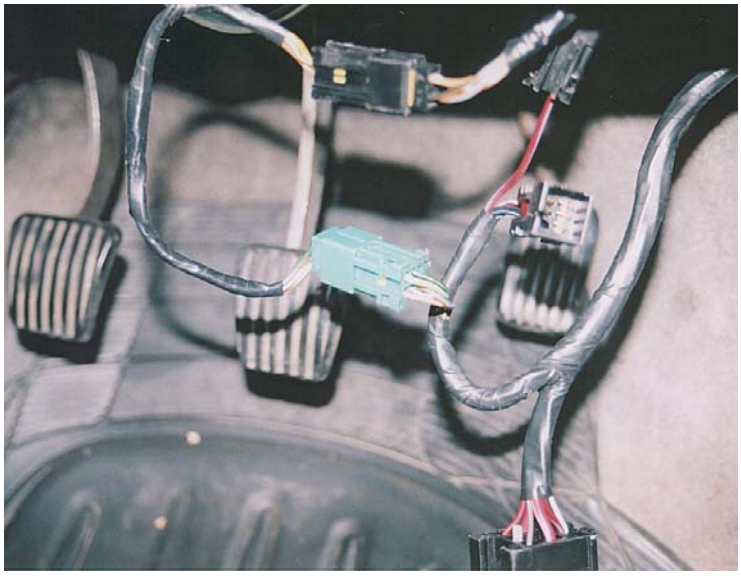
Pin	Colour	Action
Pin 1 =	Blue/Yellow	Oil Pressure Gauge
Pin 2 =	White/Black	To twin pin plug (Motronic) injection loom
Pin 3 =	Blue/White	Alternator
Pin 4 =	Green	To X19 multi Plug Injection loom
Pin 5 =	N/A	Not in use
Pin 6 =	Blue/Red	To X19 multi Plug Injection loom
Pin 7 =	Black	To X19 multi Plug Injection loom
Pin 8 =	Blue/Green	Oil Pressure Light
Pin 9 =	Red/Blue	To X19 multi Plug Injection loom
Pin 10 =	Black	To twin pin plug (Motronic) injection loom
Pin 11 =	N/A	Not in use
Pin 12 =	N/A	Not in use
Pin 13 =	Black/Red	Starter Motor
Pin 14 =	Brown	To X19 multi Plug Injection loom

Note: The plug is viewed from the pin side

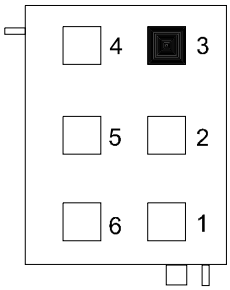
Injection/ECU Loom

The turbo ECU just bolts into the same position as the 16v ECU and the Large multi plug and loom will fit through the old 16v loom hole in the bulkhead and connect up to the ECU. Don't forget to connect the turbo vacuum pipe to the ECU as well. Now for more wiring loom trickery.

At the ECU end of the injection loom you will find four plugs, 1 is for the fuel relay, you can't miss it, it's the biggest plug. Two 6 pin plugs, one green and one black and also a 2 pin black plug.



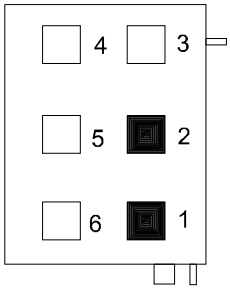
- **6 Pin Black Plug**
  You do not need to connect this plug to the car wiring loom unless you want to connect up the coolant gauge via this plug. This should be un-necessary as the coolant gauge wire is already on the car part of the loom which you just connect up to the sender on the engine. However I have included the plug and which colour wire does what.



Pin	Colour	Function
Pin 1 =	Blue	Instrument Coolant Gauge
Pin 2 =	Blue/Red	Not Used
Pin 3 =	N/A	Not Used
Pin 4 =	N/A	Blanked off
Pin 5 =	Black/Brown	Trip Computer
Pin 6 =	Red/White	Trip Computer

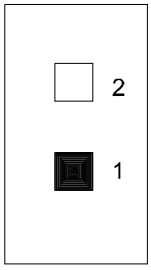
- **6 Pin Green Plug**
  You need to connect up some of the wires from this plug to the car loom. The green wire is for the rev counter. You have two choices on how to connect this up to the car loom. Option 1 is to connect it to the green wire near the plug at the back of the digital dash. This is probably the best way. However, this doesn't always work. If not, then you will have to take it from the coil pack or ignition amplifier which sits underneath the coil. When you connect up the injection loom to the ignition amplifier you will notice that there are only 3 pins in the plug but 4 on the pack. Pin 4 which is not connected in the loom is for the rev counter. Make a connection here for the rev counter and then join it to the car loom at the back of the dash as before.

  You should find a small 4 pin plug on the car loom which used to connect to the old injection loom near to the ECU. These are diagnostic wires for the engine and these need to be connected via this plug.



Pin	Colour	Function
Pin 1 =	N/A	Not used
Pin 2 =	Black/Green	Not Used
Pin 3 =	Green	Rev Counter
Pin 4 =	Brown/Yellow	Diagnostics
Pin 5 =	Brown/White	Diagnostics
Pin 6 =	Brown/Blue or White	Diagnostics

- **2 Pin Black Plug**
  This is for the fuel pump. There are two ways this can be connected. Option 1 is to connect it to the top wire of fuse 16 (fuel pump) in the fuse box. Or you can run a wire into the engine bay and connect it up to the X5 plug. Either way it makes no difference.



Pin	Colour	Function
Pin 1 =	N/A	Not used
Pin 2 =	Red/Blue	Fuel Pump

Obviously you can choose to make these electrical connections whichever way you like. However you will make a better job if all connections are soldered and then covered in heat shrink.

- **Fitting the Engine Part 2**
  Now you can fit all of the hoses and pipes to the engine, radiator, intercooler, heater matrix and expansion tank if you have not already done so. This should be straight forward as most pipes will lay in the right place to make the correct connections. If you get stuck with this then check the Haynes manual or contact either myself, Not Normal or anyone else who has knowledge on the 16v and turbo engines via the Bulletin Board.

  The Calibra/Cavalier turbo standard air box does fit under the bonnet with modifications so you can forget about using your old one as this is completely different. You should be able to make the Calibra/Cavalier item fit by modifying the bottom half (cut most of it out). Or you can fit an after market induction kit (Cone Filter).

  All that is left to do now is fill the gearbox up with oil, the engine with oil and coolant and water for the radiator etc. (Make sure all connections are OK to avoid leaks and that new filters are used where appropriate).

- Gearbox F28 Six-speed
  There is a level plug on the near side of the diff housing. The correct amount of oil in the gearbox is indicated when the oil starts to flow out through this plug when the car is on **LEVEL** ground.

- Gearbox F20 five-speed.
  There is also a level indicator plug on the side of the gear box. To check the oil level is correct the oil should be 5mm below the hole. You can use a piece of wire with a 90º bend at one end.

- Turbo
  Now you think the engine is ready to run, don't even think about turning that key as you **MUST** 'prime' the turbo first. To do this you will find the oil feed pipe connection in the middle on top of the turbo. Remove the stop end nut and fill with oil.

- Power
  Again, before starting the engine you should have a long spare wire coming out of the ECU loom near where the loom goes through the bulk head. You're probably scratching your head wondering where this goes. It is the power cable for the ECU. To check it is the right wire, just push back some of the sheathing and you should see a red cable. Just connect this up with the rest of the power cables to the positive terminal on the battery. Connect up all the earth cables to the earth terminal. And finally….

  Turn the engine over to get oil pressure **before** firing up the engine.

In theory this is the end but in reality you are going to find teething problems with certain parts of the conversion and these should be dealt with as and when they occur.

The finished Product.