

2L Engine Conversion

DISCLAIMER: The information in these documents are a collection from experience (friends or myself), magazine articles, mailing lists and Internet web sites etc. So don't take these as 100% correct gospel, hence I don't take any responsibility for any of these guides.



Difficulty Rating: Very hard, will need expert advice and tools.



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Caution: This modification WILL affect your insurance and make it invalid. So check BEFORE you even make an attempt on doing this modification.

Fitting a 'big block' 2L engine into a Vauxhall Nova / Corsa-A chassis.

Overall scope of the engine conversion:

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1.0: Introduction



This is a guide on how to fit the larger 'big block' 2L engines into the tiny Vauxhall Nova / Opel Corsa-A chassis. It isn't an easy job and it may take several weeks if not months to do the job yourself. Many years ago this engine modification was rare and difficult to do which meant only specialist garages were able to carry out the job. Typically this modification will cost you several thousands of pounds in parts and labour.

As the years rolled by, more adventurous people thought "I can do that", and behold people started to do their own DIY engine conversions. This guide shows you the most common of engine conversions of the Nova/Corsa-A. How to fit a 2L (8v or 16v) engine.

Please note that this is ONLY a GUIDE on how to do it. Depending on what engine you have fitted and engine mounts etc., there are different characteristics on getting the job done. Also the owners of Topbuzz Web Site have NOT done this modification themselves, this guide is a collection of peoples past experience and information from other web sites around the world with their permission. A 'collection' of information if you will in one location.

1.1: Types of engine to use



Common engines fitted are the following. One point to note, the BHP figures are quoted by the original car, i.e. a Calibra with a C20XE is 150BHP as standard. Now if you put that into a light chassis, i.e. the Nova, the BHP will be much higher. So even the lowest powered 2L 8v engine, is still going to have a hell of a poke to it ;-)

2L 8v SOHC engines:

- C20NE (115BHP)



20SEH SOHC 2L 8v engine.

- 20SEH (130BHP)

Found in Calibra's, Astra's and Cavaliers. The 20SEH are found in the Cavalier SRI's (higher insurance). All engines are injection fuelled and all have 5-speed gearboxes. Only very early models did not have a CAT fitted, otherwise expect all of them to have a CAT installed.



C20XE DOHC 2L 16v engine.

2L 16v DOHC engines:

- C20XE ("red-top" - 150BHP) - F18 or F20 5-speed
- C20LET (Turbo - 204BHP) - F28 4x4 5-speed

Found in Calibra's, Astra GTE's and Cavalier's. Standard gearbox was the F20 which was 5-speed. Only very early models did not have a CAT fitted, otherwise expect all of them to have a CAT installed.



C20LET DOHC 2L 16v Turbo engine.

All Turbo models had 4x4 transmission, hence the 6-speed gearbox will need to be modified to 2WD to fit in a Nova plus the gear linkage, bulkhead and rear engine mount needs to be modified. A conversion kit can be purchased for this, but a F20 will equally fit onto a C20LET engine.

Early C20XE engines were fitted with mechanical distributors (Motronic 2.5). While on later engines they were replaced with a DIS (Distributor-less Ignition System) unit, but still called C20XE (Motronic 2.8). All engines are injection fuelled. The Turbo engines are basically a normal C20XE with a Turbo bolted on (Motronic 2.7). However they do have a different compression ratio plus the piston and parts of the cam are made of stronger material and the the cast iron exhaust manifold is VERY heavy.



X20XEV DOHC 2L 16v engine.

2L 16v DOHC Ecotec engines:

- X20XEV (135 BHP) - F18 5-speed
- C20SEL (135 BHP) - F18 or F20 5-speed

Found in later Calibra's, Vectra's and Astra MK3 and MK4's. The Ecotec series engines are the cousin to the C20XE engines. All engines are injection fuelled and have 5-speed gearboxes. These engines were engineered to meet higher emission standards (hence the reduction in BHP) and all have a CAT fitted as standard.

Points to consider:



Insurance:

Any of these engines can fit into the Nova engine bay, but your new insurance premium will be based on the car that the engine came out of. For example an Astra GTE and Cavalier have the same 2L 16v C20XE fitted, however the Astra GTE is a higher Insurance Group (IG) than the Cavalier (because of the 'sporty' GTE name tag). Try and source the engine from a old Cavalier and your Nova IG will be based on that that car!

V5 or Log Book:

You need to make changes to this as well, change your new engine number and engine capacity, then send it off to the DVLA to get a new V5 form.

Fuel tank/lines:

If your Nova is carburettor fuelled, then you need to replace ALL the fuel lines and fuel tank and pump to a injection system. This is because the injection system found on the 2L engines run at a higher pressure rating. Hence the old carburettor pipes may blow ! Easiest method is to fit a fuel

system from a injection Nova, i.e. GTE, SRi or GSi cars.

Engine bay strengthening:

The Nova was never designed to cope with the big demand of movement and weight of the heavier 2L engines. Hence if the engine bay isn't strengthened in any way, the panels will begin to split and an expensive repair bill is on its way. There are several ways you can strengthen the engine bay:

- Stitch or seam weld
- Buy ready made plates to weld on.

Note: Nova GTE and GSi models had thicker gauge metal in the engine bay and strengthening already applied to the suspension turrets. However, these cars still need strengthening.

Brakes:

These will need to be upgraded no matter what base model of Nova you have started with. The minimum requirement is to replace the front brakes with the bigger 16v ATE calipers as found on the Astra GTE and Cavalier SRi's (basically any 16v car). The rear brakes don't really need upgrading, but they can if you so wish. Both the GTE and GSi models had bigger brake servos as standard. If your Nova is not a GTE or GSi, then changing the brake servo to the bigger item will benefit the feel and braking power of the bigger brakes.

Suspension:

Again these need to be upgraded as the extra weight will affect the handling. Ready made springs can be bought from several suppliers that cater for this engine conversion in mind.

Engine mounts:

There are ways of using the Nova mounts to install the 2.0 lump, but it can be more hassle than it is worth. There are 3 engine mounts in a Nova, only 2 of them need modifying or changing. First off is the drivers side (off-side) engine mount bracket needs to be lowered by 1.5 inches, then the rear mount need cutting in half and re-welding. This method works but puts the engine too far forward and can complicate other things. The highly recommended option is to fit some specialised mounts (i.e. from CarQuip - £50), these are modified to give the engine a good position and look better too. Also fit new engine mount rubbers all round if the old ones are worn. The near-side needs no modification and can be alone left as is.

Chassis rails/alternator side:

When the big 2L engine block is fitted, the pulley wheel on the crank for the alternator and the PAS pump fouls the Nova chassis rail as does the alternator itself. Using a lump hammer hit the chassis rail where the alternator will sit to clear it. As for the crank pulley you have a few options,

1. Remove the PAS pulley (remove from crank and get it machined or ground off.
2. Cut and weld in a box hole so the wheel now clears the chassis rail [recommended]

Both methods have their ups and downs, Option 1 is neater, but getting the crank pulley off the crank is difficult, most of the time the heads of the bolt strip and you end up drilling the rest out. Also the extra wheel is there to help resist vibration as it spins up to speed. The other option requires a boxed in section, this can be a pain to do, cutting the chassis rail is difficult as the metal is ½ an inch thick. Use heavy gauge metal for the boxed in section.

Gearbox linkage:

To be revised.

SFi air box:

Early C20XE SFi boxes are small enough to fit without modification, later models had a different shape and need modifying to clear the bulkhead behind, to do this, cut the section out that is required and hot-glue gun a flat section of plastic and make sure its airtight (important). The Ecotec engines do not have a large box on the throttle body, hence no modification is required. C20LET Turbo engines have a different method, hence no modification is required (in fact this can be transferred over to the C20XE engines instead of modifying the SFi box). Also PVD sell a replacement part - a power cap (£95) that fits (looks exactly like the C20LET part).

Drive shafts:

Several solutions to this, but any version is expensive. The standard Nova drive shafts won't fit the larger 'big block' inner CV joints. Either modified Nova drive shafts are required or modified CV joints are used. More details on these later.

Hubs:

No information on these yet.

Exhaust/manifold:

The existing exhaust system can still be used but the manifold will either have to be modified or a ready made unit can be bought. The C20XE downpipe will not mate with the Nova system, so the pipes will have to be heated up with a blow torch and bent to shape so they mate. Or you can weld and fabricate the exhaust till it mates correctly.

Wire loom/ECU:

There isn't much wiring to be done, but it is easier if your start off with a injection model of Nova. The whole original Nova engine, gearbox, wiring and ECU (if fitted) can be removed as a whole from the car. Then when you fit the new engine in, you need its ECU and wiring loom to finish off the job. Basically there are only a few wires to connect

1. 1 to the coil (green) + rev gauge if fitted (DIS systems have this wire at the ECU end).
2. 1 to ECU light (brown/white).
3. 1 to fuel pump (Red/Blue).
4. 1 to battery +.
5. 1 to ignition (Black / red).
6. 1 to the starter motor positive (+12v).
7. Several GND wires to chassis.
8. Also wire from the ignition to the coil (+).

Oxygen/Lambda sensor:

The lambda sensor reads engine emissions from the exhaust gases and the ECU adjusts the Air/fuel mixture accordingly. Make sure your engine has a functional one of these attached to the exhaust manifold, these are delicate and expensive to replace.

Anti-roll bars:

If the donor Nova doesn't have any, then its wise to fit them. The easiest solution is to fit the fatter ones from the Nova GTE or GSi. The anti roll bars are going to catch in two places when you fit the 2.0 engine, on a lug on the gearbox and the exhaust manifold. The lug on the gearbox can be ground off. Sometimes you get lucky and the exhaust manifold does not catch at all, but more often than not it is going to, you will need to get some Lowered Tie Bar brackets or at the least some Lowered Anti-roll bar mounts, these either lower the Tie bars and anti-roll bars or just lower the anti-roll bars. I recommend getting the Lowered Tie Bar mounts as not only do these give better clearance but they make you handling better.

The Procedure:**Engine removal preparation:**

Get a Haynes book for your car and read it about the engine, transmission, brakes, suspension....the whole lot. The idea is that you will become familiar to the terms used, parts and where they are located on your car. It may be useful to have a camera with you and take pictures along the way. That way, when you fit things back, you know how they go and their orientation.

Engine removal:

- 1) Disconnect the battery and remove.
- 2) Drain the engine oil and gearbox oil may be an advantage.
- 3) Drain the coolant system.
- 4) Follow the Haynes book on engine removal.
- 5) When removing any electrical wires, connectors or sensors, you MUST label them. This will make life easier when fitting the new engine in.
- 6) You can leave the following items in the car; brake servo, steering rack and the coolant tank. Everything else can be removed.
- 7) The engine should be able to be removed from above or below, what ever is easiest for you.

You should have the following items taken out

- engine
- gearbox
- drive shafts
- inner CV joints
- outer CV joints
- radiator
- ECU and cable form/connectors
- gearbox selector/linkage
- coolant pipes
- alternator (on engine)
- starter motor (on engine)
- air box and piping
- anti roll bar (if fitted)
- manifold (on engine)
- ignition coil and HT leads

New engine preparation:

If the new 'big block' engine hasn't been removed yet, it may be wise to label up all the connectors and wires, so you know what to connect it to when fitting it in the Nova. But again, do the same as above, take notes of what went where and label anything. Its better to be safe than sorry.

Engine Bay Preparation:



With the engine bay empty, inspect the area for rust and bad corrosion etc. Treat the area, sand down and weld up the engine bay. If you have bought the plates, then use these. As you have the engine out and the room to play about with, you might as well do as much as you can here.

NOTE

When welding, please take the following notes:

1. The fuel is still in the fuel lines, so block/cover these up as much as possible, otherwise its a fire risk.
2. When welding near or on the bulk head, be careful that the carpet in the cabin doesn't set on fire due to the heat of the welding!! (it has been done, trust me).

The engine mounts will also need to be moved or modified. Again the offside engine mounts needs moving down 1.5 inches or buy a ready made one.

The area where the alienator pulley will go will need to be modified. As explained before either smack the area in so that the pulley will clear or cut out the section and weld in a box area. This will have to be judged upon where exactly you need to do this work. Either trial fit the engine in place and gauge where the work will be required. Only the engine can be lowered down from above, if the gearbox is still attached, then you need to put the engine in from under the car (its the only way it will fit).

Welding:

The following areas need welding (stitch or seam)

- front cross member meets the front chassis rail (noted as a weak spot on the Nova chassis).
- around the front tie bar brackets on the front cross member
- inner track control arm joint (the lower suspension arm).
- front suspension turrets
- areas immediately around the engine mounts
- area where the chassis legs meet the bulkhead

Once all the welding is done, clean the area and seal on the joints with silicon sealant and repaint the engine bay.

New 2L Engine:



You should already have the new engine, make sure you have the following parts/items:

- ECU and all the wiring and sensors that go with it (very important).
- Fuel pump.
- Accelerator cable.
- Gearbox and the selector linkage that goes with it (up to the knelled clamp).
- Inner 2L CV joints (gearbox end).
- Ignition coil and bracket (originally situated behind the headlamp).
- The air box.
- Manifold and downpipe including the oxygen sensor (if fitted).
- CAT (if fitted)
- All the coolant hoses and clips.

It would be ideal if the donor engine has been seen and heard running before fitting it into the car.

Fitting New 2L Engine:



If the gearbox is attached to the engine, then the engine can only be mounted in the Nova from underneath. Hence you need to drop the Nova on top of the engine.

'Double' crank pulley (PAS):

Depending on what model of engine you get, some will have an extra wide crank pulley wheel. This is because it does two jobs, one is for the cambelt as usual but the extra pulley on top is for the PAS belt (power steering). This 'double' crank pulley will almost certainly come in contact with the side chassis leg when fitting in the engine. If not it will be VERY close to it. You can either make room for the double pulley by cutting out a section, but as you won't be using the PAS, you doesn't need this extra double pulley. Instead you can remove it and fit a standard single pulley (off another engine) or "cut it off" as some people have or make extra room by cutting out a section in the engine bay (like for the alternator).

Fuel pump:

If your donor Nova didn't have an injection system, then you need a fuel pump. These are fitted in or just outside the fuel tank (depending on ova year). Its best to fit a Nova GTE or GSi fuel tank as these fit straight on. The fuel pump MUST be fitted by the fuel tank as they are a 'push' type and not a 'suck' type. If they were situated up in the engine bay, it wouldn't be powerful enough to suck all that fuel up to the engine and it will never start.

Ignition coil:

Very important to have this, the Nova one can not be used (well its best not too). The 2L coil can be situated in the same place as the Nova item, behind the headlamp.

Air box:

Depending on what 2L engine your fitting, the air box may *just* fit in the engine bay. But it may be best to simply fit an induction kit like K&N as this will be OK in the engine bay (apart from it sucking in too much hot air, but more about that later).

Radiator:

Again you need to uprate the radiator unless you have started with a Nova GTE or GSi, as these are perfect for the job. If you haven't got one, buy one as they bolt straight in. You can fit Astra or Cavalier ones, but they are too tall and won't fit in-between the slam panel and lower cross member. Just fit a GTE or GSi one for best results.

Engine mounts:

There are 3 in total on the nova. The passenger side (near-side [n/s]), the drivers side (off-side - [o/s]) and finally the rear engine mount. You need to modify the following

- [n/s] mount, needs no modification, leave as is.
- [o/s] mount, this needs moving down 1.5 inches.
- rear mount, this needs an extra hole drilled in.

The reason for the modifications is that the engine doesn't sit right in the engine bay, it will be too high and you'll need a bulge in the bonnet. The rear one needs modification to allow it to site correctly above the wheels and not be tilted over. However, of moving and welding the engine mounts scare you, you can buy ready made engine mounts from some rally shops. Costs between £60 - £110, depending on quality and amount of plates supplied.

You will need the bracket for the rear engine mount or you can modify the box. The gearbox mount for the nova box has two holes and the new box will have three holes. You can either use a bracket from car-quip or you can modify the box , but be careful not to strip the thread on the box. It is probably best to fit it after the engine is in.

The rear mounts need cutting and welding with the bottom section moved to the right by 10mm.

Note: Before installation of the engine the clutch pipes from the cabin needs to be bent down by 45 degrees and across to the passenger side by 30 degrees, this makes the clutch easier to push. Also the heater matrix pipes, the right one needs to be shortened by about 8mm to clear the inlet manifold.

Gearbox:

The F20 and F16 use the same shafts and are interchangeable on the engines.

Driveshafts:

Lots of options here. Now you'll be keeping the Nova hubs, so they can only fit Nova 1.6 outer CV joints. However, the new gearbox you have just fitted only accepts 2L inner CV joints. With this in mind, you can't actually use either the Nova or the 2L driveshafts, because they would only fit into one or the other drive shafts and not both. What you can do is get some special driveshafts which have a Nova CV and 2L CV splines on either end. That way they fit straight in. These cost about £200 for the pair. Remember to get them as a single bar, not cut and welded together. Best to be manufactured from blanks.

The other option is to retain the 2L drive shafts and modify the Nova hub so that it accepts 2L outer CV joints.

Procedure to fit the new 2L engine:



Now you have to put your new engine in the small engine bay. Start by fitting the drives side engine mount to the engine. Using the nova selector on the new box and rotate the white joint though 180 degrees. Mount the passenger side engine mount to the car making sure the nut a washer are facing toward the front of the car, don't tighten it as it will need adjusting.

Now lift the engine over the engine bay and get some mates to help you lower it slowly in. It will fit don't worry. When the gearbox gets level with the passenger side mount, put in the three 15mm bolts. Once that mount is attached, lower the engine, shouldn't be to far now.

When in get to the right point put in the drivers side engine mount bolts. Finally put the rear engine mount onto the gearbox and connect it to the car. Tighten all the bolts up. The engine should now stay in the car unaided.

Finishing touches:



At this stage if not done all the brakes and suspension can be uprated now and the petrol tank needs be changed for an injection one if you haven't already got one.

Fit these following parts in the listed order to avoid difficulty later,

- Radiator WITHOUT fan

- Exhaust manifold
- Anti roll bars and tie bars
- Fan for the radiator (bit fiddly to get in)

When mounting the ECU, it needs to be located inside the cabin of the car, the loom will need to be fed around the driver side turret and into the cabin, then mounted either on top of or underneath the drivers side parcel shelf.

Depending on what engine mounts you have used will mean whether or not the gear linkage will need to be modified. If PVD engine mounts are used, for the rear all they did was get a standard mount and weld a slab of metal in to space the mount out a bit, this had the side-effect to moving the linkage pivot mount over by the same thickness of the slab of metal. If you have this problem then the linkage will need to be extended after the pivot by 5mm (weld an extra length of bar on the end), also extend the top arm by the exact same amount. This method also have a hidden side effect, it gives you slight quick-shift.

Because the Nova is so small fitting the standard air-box is hard and is very tight. Another option is to fit a Cone air filter, this looks a lot better and if set up correct to give you more power. There is a downside to this, the extra air intake can cause a problem known as 'Kangarooing', and this is where the car stutters when decelerating, doing a modification to the rocker cover can rectify this problem. This modification known as the breather mod helps relieve excess crank pressure and stop the problem. This modification be found on the MIG site. Also when the rocker cover is off spray it the same colour as the car!

There is not much space between the drivers side turret and the engine block to fit the air intake pipe, using some cutters take as much of the support rubber as you need and smooth off with a dermal multi with a grinding disc on it. This gives just enough room to fit the pipe in. Be careful not to squash the pipe.

FAQ:



Q) What's the best Nova's donor car to start off with?

Our advice would be the GTE or GSi model, because of the following

- already have the fuel injection fuel tank, pump, relay and pipes in place
- have the correct size of radiator
- have the bigger anti-roll bar to start with
- already have strengthening on the suspension turrets
- engine bay is made of slightly thicker gauge steel

Q) What does 'big block' mean?

Its the term used to express the bottom block of the engine. The size was very common in the Vauxhall range, in fact many of the time the head was simply the only deferent part. With this building block, different engines were created. So 'big block' is the crank half of the engine, which exists on the bigger larger Vauxhall engines (but the V6 are bigger of course).

Q) can I use my existing Nova gearbox on the new engine?

No, it won't fit. Even if you did the drive shafts would be difficult on getting to work too. Need some special one offs. More hassle than its worth.

Q) Do I need to upgrade the radiator?

The standard Nova GTE or GSi radiators are fine for the job, plus they fit straight in!

Q) I've fitted the engine but my anti-roll bar hits the manifold/sump!

You need spacers underneath the tie bar mounts. These can be bought ready mad. They simply lower the bar down towards the ground, hence creating a small clearance area round the sump or downpipe of the manifold.

Q) How do I find what engine I have or what type of 2L engine I can get?

The engine number is stamped on the block itself.

Q) What comes with the CarQuip mounts?

CarQuip mount is £50 + del + vat and includes offside mount and gearbox spacers but not bolts

Q) Where can I buy the strengthening kit?

For the chassis strengthening kit you go to Harry Hockley <http://www.hh-ms.com> . But note that this kit is for rallying purposes and may be over the top for a road car. ASW and Novatech may also be able to supply you a more worth while kit that does the job. Welding a strengthening kit is more convenient than seam or stitch welding.

http://www.hh-ms.com/shop/Nova_Body_Parts.htm
£74.85 for the kit.

Also, pro-tec do some stuff for the conversion too...
(Driveshafts and engine mount)
<http://www.pro-tecmotorsport.co.uk/>

<http://www.motorsportparts.co.uk/nova.htm>

Q) Where can I buy a ready made exhaust manifold to mate with my Nova one?

www.proven-products.co.uk/compition_exhusts.htm

Q) Where can I get the drive shafts from?

Novatech only supply the drive shafts which fit my existing outer Nova CV joints to Astra inner CV joints for £220 (a pair).

Also, pro-tec do some stuff for the conversion too...
(Driveshafts and engine mount)
<http://www.pro-tecmotorsport.co.uk/>

Links:

links to web sites here.



Example 2L Gallery:

Showing examples of the larger 'big block' 2L engine fitted in Novas and Corsa-A's



Credits:

Topbuzz Web site would like to thank the following people for giving me permission to use some of the pictures and content to help construct this guide.



- Steve at <http://www.Perpetualbliss.net> (originally written by Paul Jackson).
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