

SBD Motorsport

May 2010

SBD FUEL INJECTION ASSEMBLY AND SET UP INSTRUCTIONS 2.0L DURATEC TAPER THROTTLE KIT

SBD would like to thank you for choosing the taper throttle injection kit.

The kits are extremely efficient and as a direct replacement of the standard induction system, give a significant increase in power (provided a suitable exhaust system is used) and an almost road car like driving characteristic, very smooth and progressive.

This system is a direct replacement for the 2.0L & 2.3L Standard Ford Duratec 16v induction system. It does not use the air mass sensor or air filter box that is fitted to the Standard engine. It fits exactly same as the Standard unit. The fuel rail that is fitted to this kit uses a high pressure coupling system called JIC-6. These couplings are specifically designed for use with a high-pressure steel braided fuel hose, which is by far safer to use than a standard rubber fuel hose and has a greater tolerance to damage. It is recommended that you use JIC -6 couplings and steel braided fuel hoses when fitting your system because of the increased safety element. There are cheaper alternative coupling and hose systems available, but SBD do not consider these safe enough to use in Motorsport applications.

The wiring looms have been specially designed to be as neat as possible and to cover as many applications as possible. These wiring looms are kept on the shelf and are available in both front & rear wheel drive applications.

When ordering your kit most of the components should be in stock, which means that we can usually despatch your kit immediately.

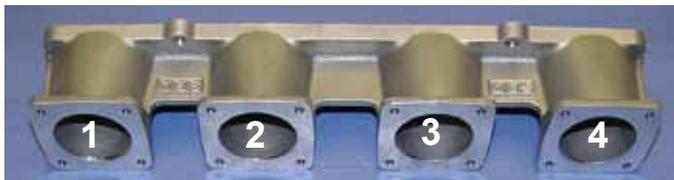


Bill Gouldthorpe had one of our first kits in his Van Diemen RF96M in 2005. He has since upgraded to our 270+bhp kit in 2008.

IMPORTANT INFORMATION YOU WILL NEED TO KNOW

There are many references to cylinder numbers in this document. The position of No. 1 cylinder is the cylinder nearest to the timing chain end of the engine and therefore No. 4 position is situated at the flywheel end of the engine.

Taper throttle inlet manifold



Taper throttle bodies



The air temperature sensor should be mounted so it will measure ambient air temperature & not engine bay temperature. If in a kit car then somewhere low in the engine bay. If in an Escort or Manta type car, then through the inner wing or in behind bulkhead.

TP203 BHP TAPER THROTTLE KIT COMPONENTS



OTHER PARTS YOU WILL NEED TO ASSEMBLE YOUR KIT

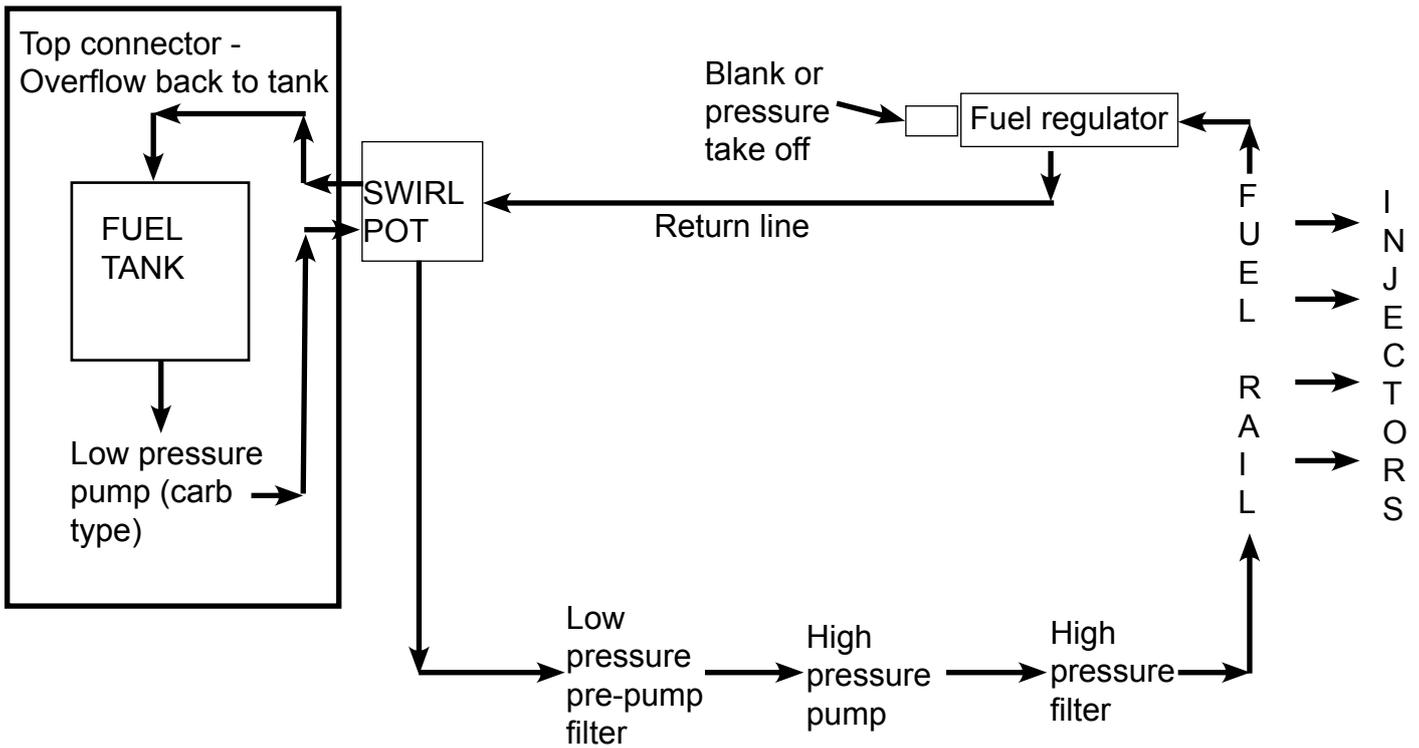
1. 7 x M8x20mm Cap head bolt for fixing inlet manifold to cylinder head.
 2. Air box / filter and backing plate.
 3. JIC (-6) fuel couplings.
 4. Steel braided high-pressure fuel hose.
 5. 1/8" BSP taper – 8mm push fit coupling for water bleed
- Thread locking compound (Loctite 243 recommended).

SPECIAL TOOLS YOU WILL NEED TO ASSEMBLE YOUR KIT

- Laptop
- Easimap 6 software
- Digital voltmeter
- Fuel pressure test gauge
- Syncrometer (Vacuum gauge), see right
- Soldering iron or gun
- Pair of electrical terminal crimps



SBD FUEL SYSTEM PLUMBING WITH FUEL SWIRL POT (RECOMMENDED)

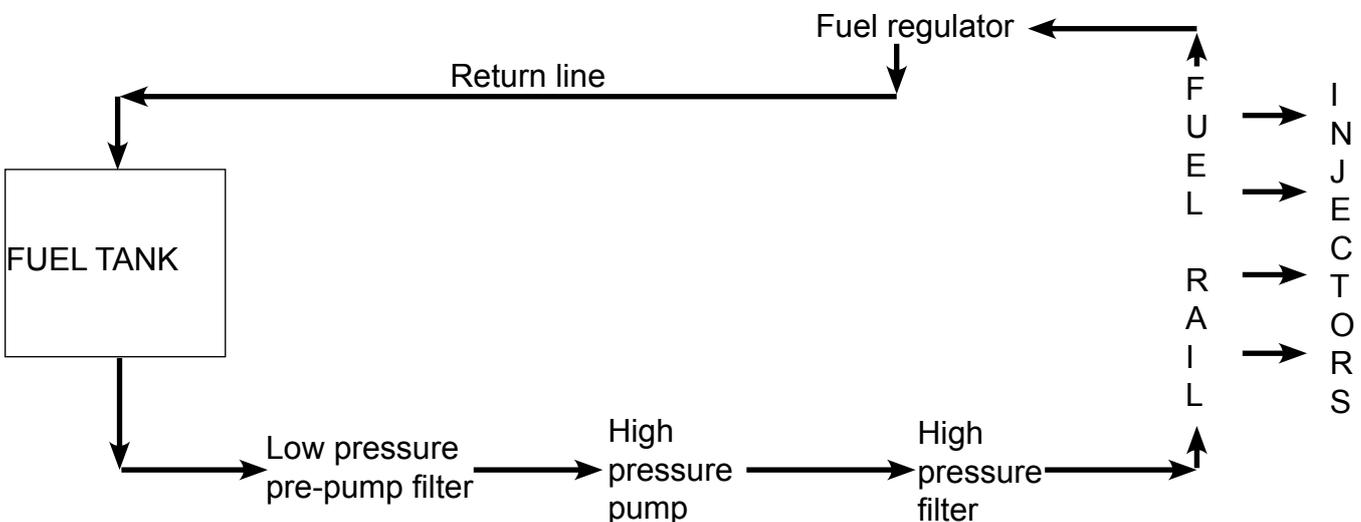


High pressure pump must be mounted below the level of swirl pot to allow for gravity feed

Notes

1. Use straight connectors where possible as they are approx. 1/3 of the price of angled ones.
2. High-pressure & Return to swirl pot use JIC -6 couplings.
3. Contact us for all your hose & connector requirements as each installation is different.

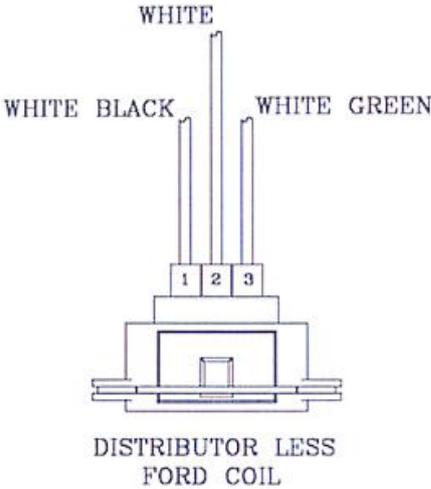
SBD FUEL SYSTEM PLUMBING WITHOUT FUEL SWIRL POT



High pressure pump must be mounted below the level of fuel tank

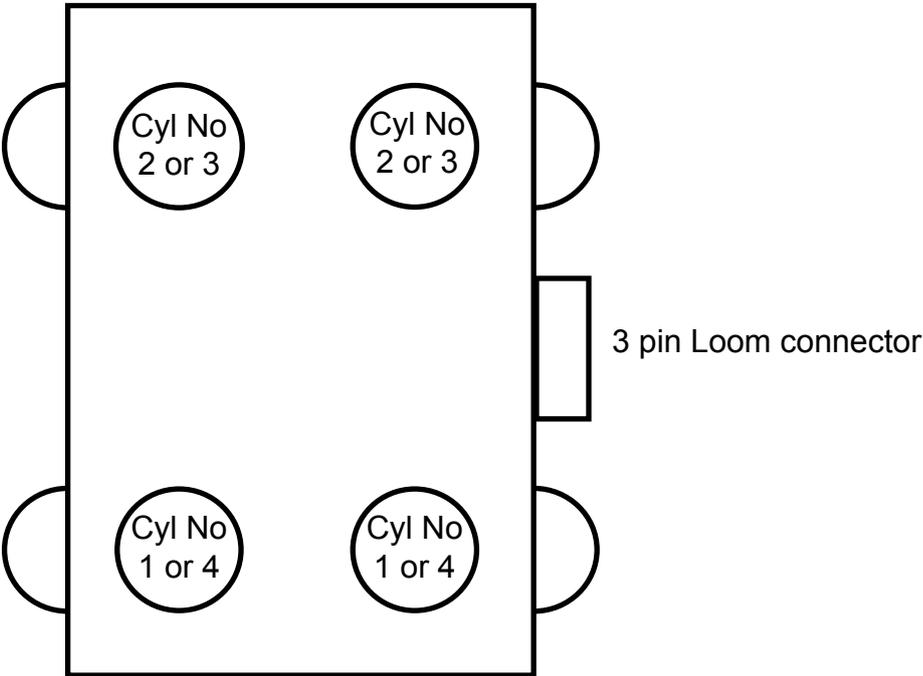
COIL CONNECTOR PIN OUTS

WHITE/BLACK = IGN/DRIVE 1
WHITE = +12V
WHITE/GREEN = IGN/DRIVE 2



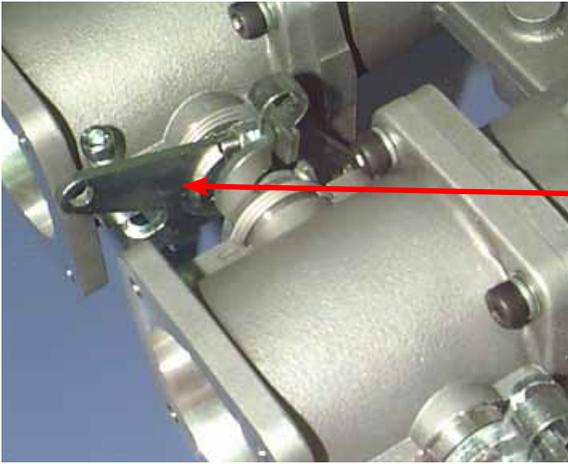
COIL CONNECTION FOR HT LEADS

For use with Ford coils



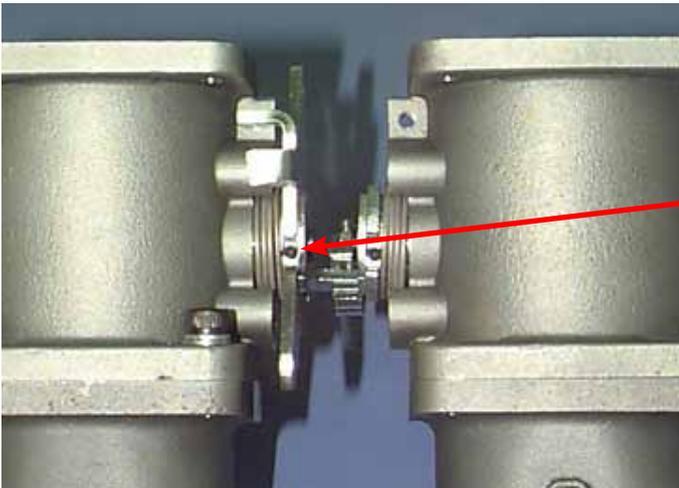
These coil packs, when used with the MBE ECU, use a wasted spark system.
Both cylinders spark at the same time.
That is why you can install 1 & 4 on either post & the same for 2 & 3.

ASSEMBLY PROCEDURE



STEP – 1

Note one of the levers on throttle No. 3 has 2 extensions; these are for the throttle cable to attach to (this is the primary operating lever). Check which extension is going away from the inlet manifold (shown in 4) as this will have to be cut off to prevent it fouling the airbox/filter backplate.



STEP – 2

It is very important that before removing the lever you carefully note the position of the return spring, in order to ensure correct refitment later on.

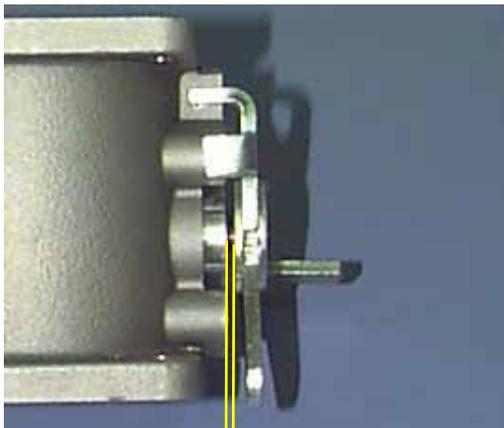
To remove the lever you need to undo the small grub screw (shown in Fig left) at the bottom of the lever and gently pull the lever outwards from the throttle body. Be careful not to loose the screw or the nut that the screw goes into once they are removed. Sometimes the levers are difficult to remove so be careful not to bend the lever, this may result in problems later on in use.



STEP – 3

Mark the lever with a scribe or a pen (shown left), then hold the lever in a vice and carefully cut along the mark with a hacksaw. Once the lever is cut, tidy the cut edge with a fine file and remove any burrs.

Be very careful when you cut down the lever to make sure that you cut off the correct bit as both extensions look very similar.



STEP – 4

First clean and then refit the lever ensuring the spring is fitted in exactly the same position as noted earlier. When the lever is pushed on you need to have about .020" or 0.50mm gap between the inside of the lever and the throttle housing (shown left). Refit and tighten the grub screw being careful not to over tighten.

Note – Picture left shows the throttle lever refitted without the spring in position. This is only done to show where you should measure the clearance from when refitting the lever onto the throttle.



STEP 5

You will need the o-rings for steps 5 & 6

Now you are ready to assemble your throttle system

First you must make sure that all of the components you are assembling are thoroughly cleaned.

Starting with No. 3 throttle body, fit the 'O' ring into the groove on the bottom face of the body, stretching the seal slightly helps it locate into the groove. Do not use any kind of sealing compound on this seal. Now place the throttle on the inlet manifold in the No. 3 position ensuring the levers are at the top as before, and the 'O' ring stays in place. Fix the throttle into place using the bolts & washers and tighten evenly.

You can check that the O-ring has remained in position by opening the butterfly using the butterfly using the operating lever & looking into the throttle, you should not be able to see any part of the seal.



STEP 6

Now fit throttle No. 2 onto the inlet manifold in position No. 2, following the same instructions as for fitting No. 1 throttle. When No. 2 throttle is fitted, ensure that the operating lever from No. 2 body fits in between the balancing screw and the throttle lever spring (shown in 2), and again ensure the 'O' ring is fitted correctly by looking down the throttle. Fit throttles No. 3 & 4 into position being careful to ensure correct positioning of the 'O' ring and lever arms as before.

STEPS 7 - 10

You will need the throttle potentiometer (including brackets & bolts) & fuel rail.

Depending on the type of vehicle this system is being fitted to, the throttle potentiometer can be fitted to either No. 1 or No. 4 throttle body. For most kit car and front wheel drive applications the throttle potentiometer will be fitted onto throttle No. 4. This position will be determined by where the connecting socket is fitted on the wiring loom. Refer to your wiring loom drawing for confirmation.

You have two throttle potentiometer options PT1 or PT8.



STEP - 7

PT8 comes with the sure seal connector already fitted. It will only fit on the left hand end of the throttle bodies.



STEP 8

The throttle potentiometer will need the 3 pin sure seal connector fitted to it. First make sure you have about 25mm of the red, yellow & green cables protruding out the end of the black cable shield. Strip 5mm of cable outer off of each of the three wires and "tin" each wire using a soldering iron or gun. Now using a crimping tool fit the electrical pins to each of the 3 wires, being careful to ensure the correct pin is fitted to each wire.

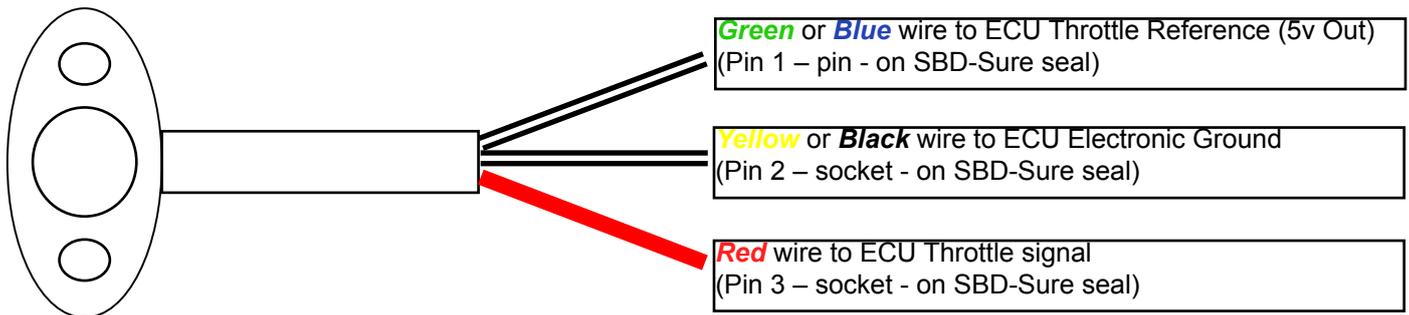
Solder each terminal onto its wire once it has been crimped.

Pin 1 – **Green** or **Blue** – Male pin

Pin 2 – **Yellow** or **Black** – Female pin

Pin 3 – **Red** – Female pin

Culven Throttle Pot



992/9A4/9A8 ECU Pin out for Throttle sensor

5v Reference = Pin 22 of ECU
Electronic Ground = Pin 23 of ECU
Throttle Signal = Pin 20 of ECU

IMPORTANT NOTE

In most Cases the voltage for the throttle pot when the engine is at idle is 0.37 Volts this is however only for engine that have been programmed by SBD. You will also need to know the units of air when the engine is at idle (this will be in KGs per hour) & the fuel pressure your engine was mapped.

STEP 9



The terminals will now need inserting into the rubber Sure seal socket, this is done by spraying some silicon spray (or equivalent) on the terminals and into the rubber socket, and then evenly pushing the terminals into position from the back. Be careful to ensure the correct pin is fitted into the correct position. The sockets, when fitted correctly, should be flush with the inside rubber part of the connector & the pin level with them.

The throttle potentiometer is now ready to be fitted onto the throttle system.

Note – The pin positions are marked on the rubber sure seal at both ends.

Follow either Step 9 or 10 depending on where the throttle potentiometer is be fitted to.

STEP 10

NOTE

If the throttle potentiometer is being fitted to No. 4 throttle body follow the instructions in this Step.

The throttle potentiometer will only operate correctly if fitted the correct way around. For fitting to No.4 throttle body the throttle potentiometer must be mounted with the lip on the side, facing outwards, and the clamping plate will then fit on over the lip.

Note – Do not fit clamping plates, bolts & washers yet.



STEP 11

NOTE

Follow the instructions in this step only if your throttle potentiometer is being fitted to No. 1 throttle body.

The throttle potentiometer will only operate correctly if fitted the correct way around. For fitting to No.1 throttle body the throttle potentiometer must be mounted with the lip on the side facing inwards (as shown in Fig 24), and the clamping plate will then fit against the outside of the potentiometer.

Note – Do not fit clamping plates, bolts & washers yet.



IMPORTANT

Please read the following carefully, as failure to do so may result in damage to your system.

To confirm that the throttle potentiometer is fitted correctly, you will need to gently hold the throttle potentiometer with your hand, and then slowly open the butterflies using the primary operating lever. If the throttle potentiometer is fitted correctly you should be able to achieve full throttle without the throttle potentiometer body moving. If the body does move then fit the throttle potentiometer on the other way around and repeat this step. Fit the clamping plate and then screw bolts & spring washer onto the throttle body until they just begin to tighten.

Do not tighten the bolts & spring washers yet, as the throttle potentiometer will need adjusting later on.

STEP 12

You will need a set of injectors and the fuel rail & injector clips for steps 12 - 14. The next step is to fit the fuel rail, injectors and injector clips. You will need first to confirm the type of injector you should use for your kit. Refer to table on page 15.



INJ-690
High flow injector,
blue 690cc, 12.5
Ohms

STEP 13

Fit the injectors to the fuel rail by applying a small amount of lubrication (silicone grease or vaseline) to the rubber 'O' rings, ensuring that the 'O' ring fits squarely into the cup.



STEP 14

Fit the throttle system to the cylinder head. A suitable sealing compound (such as RTV Silicone) is required to seal the manifold to the head. Use M8 x 20mm bolts to fix the inlet manifold to the head (bolts not supplied). Once tight wipe off any excess silicone from inside the ports.

NOTE: One of holes on the cylinder head is not tapped therefore you do not need to use a bolt.

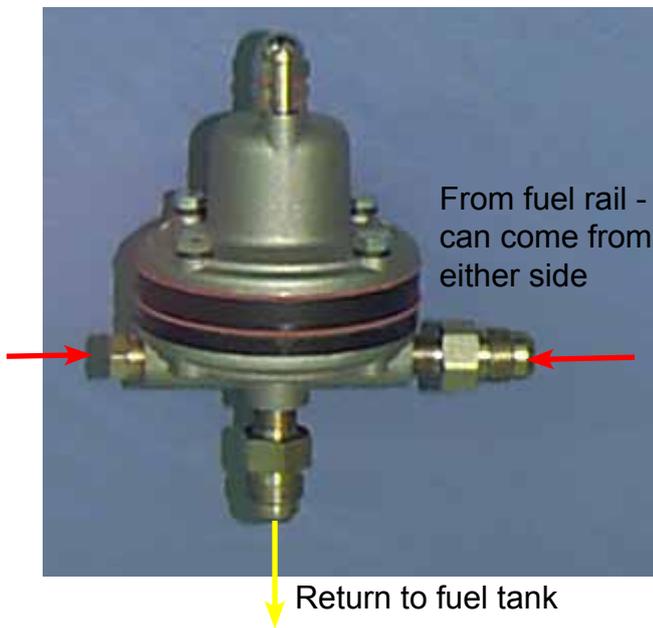
STEP 15

The fuel rail with injectors can now be fitted into position using lubrication (silicone grease or vaseline) by locating the bottom of the injectors into the pockets in the cylinder head and gently pushing on the fuel rail at both ends. The injectors will only press in so far until the mounting arms on the fuel rail rest against the cylinder head. Fit the fixing screws and tighten evenly.



STEP 16

Do not fit the fuel regulator directly on to the fuel rail, because the Duratec produces a resonant frequency, which can make the regulator vibrate & break the fuel rail. Ensure fuel lines fitted to it are not straining.



You will need the fuel regulator, coupling & blank, some fuel couplings and fuel hose (not supplied).

You need to decide where the regulator will be mounted & from which side the fuel line will be coming from. Carefully screw the coupling & blank into the fuel regulator, ensuring the blank is on the opposite side from the fuel line, applying a small amount of thread locking compound (Loctite 243 recommended) onto the threads to ensure the couplings seal.

Be very careful when tightening the couplings, the tapped hole in the regulator and the couplings are both tapered, and even if slightly over tightened this could cause the fuel regulator housing to crack, which will cause it to leak.

Note –Do not fit the blanking plug into the bottom (outlet) of the regulator. Doing this will cause the regulator to operate incorrectly and may damage the unit.



NOTE

The vacuum pipe fitted to the top of the fuel regulator is not used with this kit and can be left vented to atmosphere.

The domed nut at the top of the fuel regulator is a locking nut. When the nut is removed it will reveal a brass centre, which has a slot in the top. This is the adjusting screw for the fuel pressure. When adjusting the fuel pressure as described in Setting up instructions, you will need to turn the adjusting screw clockwise to increase the pressure and anticlockwise to reduce the pressure.



Alternatively, you could use a fixed rate regulator, which is fitted in the same way as the one shown above.

STEP 17

Connect loom to various components as labelled.

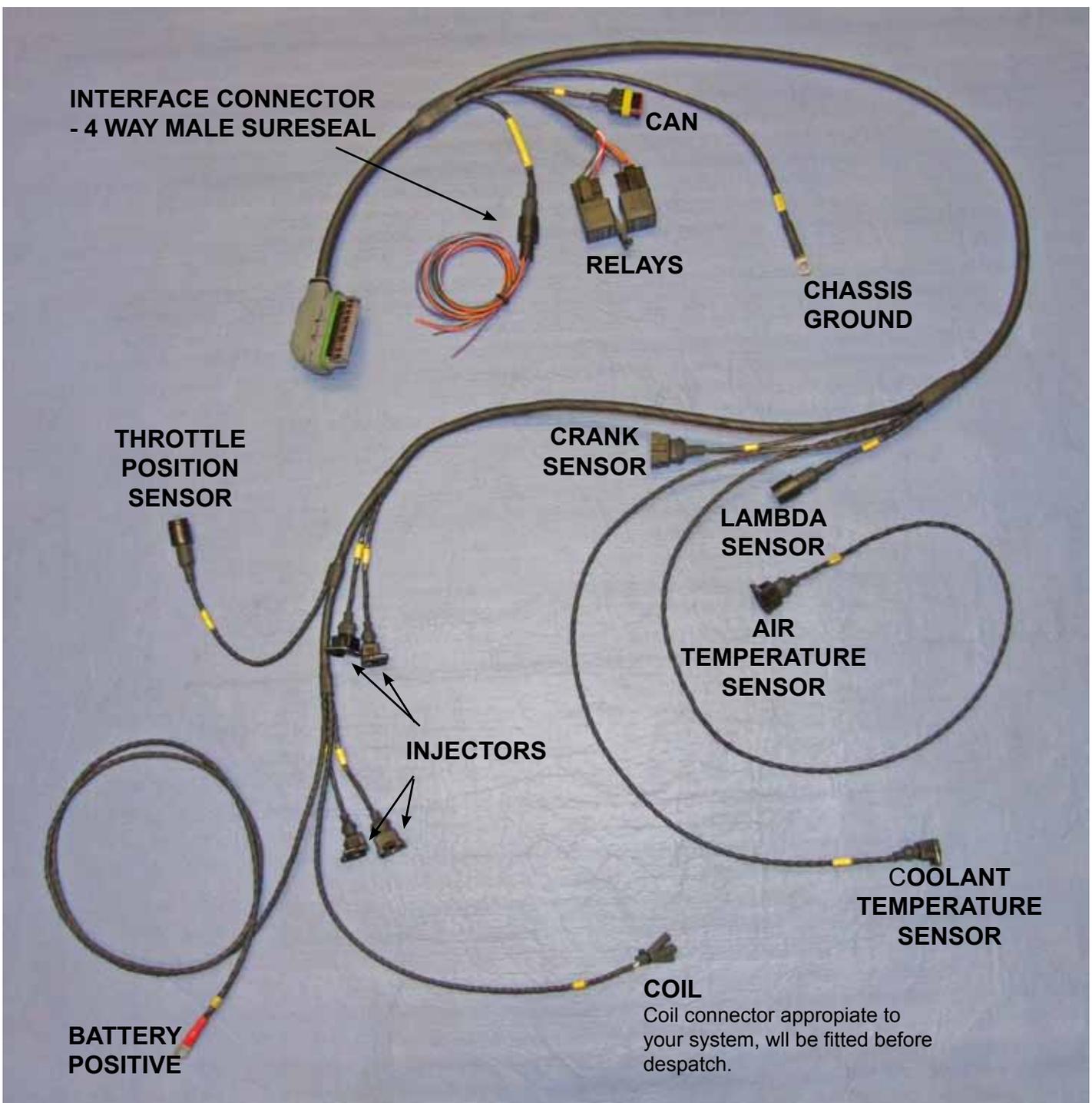
MBE9A4 - The injector plugs labelled with cylinder numbers.

The air temp sensor should measure ambient air temperature so should be mounted away from engine heat.

Connection of interface wires: -

Pin 1	Purple or Red	Switched +12v (Ignition)
Pin 2	Orange	+12v out to fuel pump
Pin 3	Green	Taco signal
Pin 4	Blue/White or White	Gear change light

Connect either way as described in step – 20.



STEP - 18

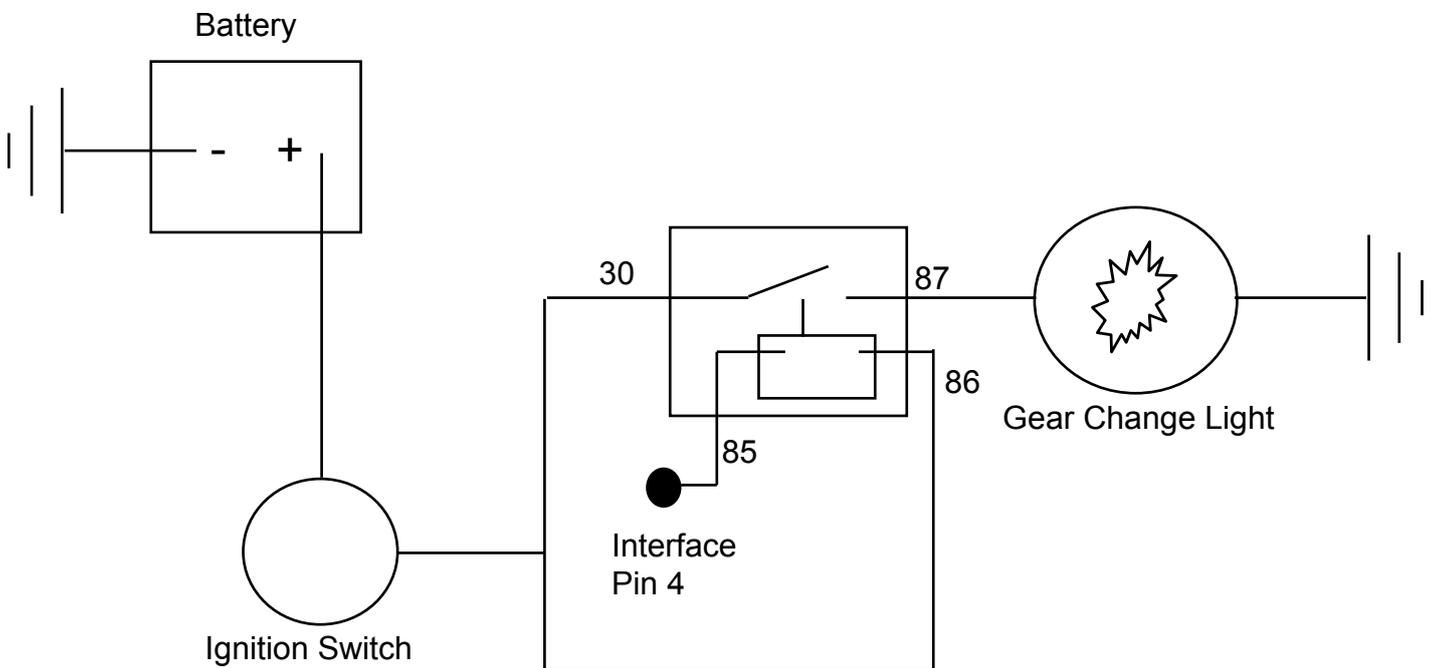
Installation of a gear change lamp

This are available from RS Components or Maplins

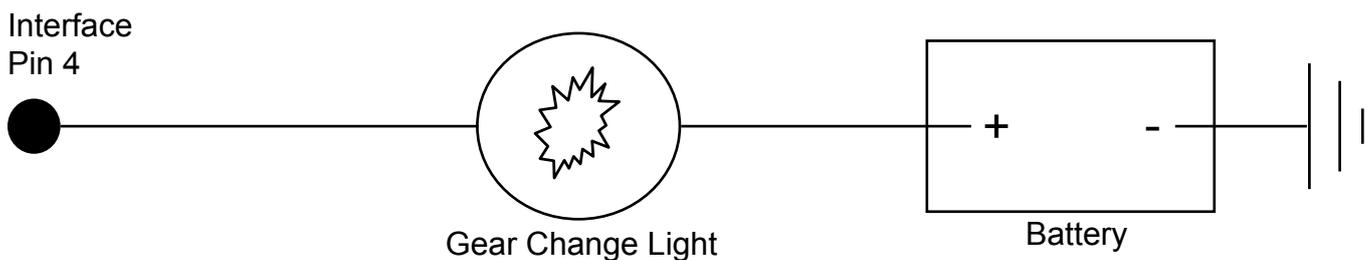
Installation of a large gear change lamp

Relay connections

- Pin no. 85 - Connect to interface sure seal pin no. 4
- Pin no. 86 - Connect to ignition switched +12V
- Pin no. 87 - Connect to gear change lamp
- Pin no. 30 - Connect to ignition switched +12V



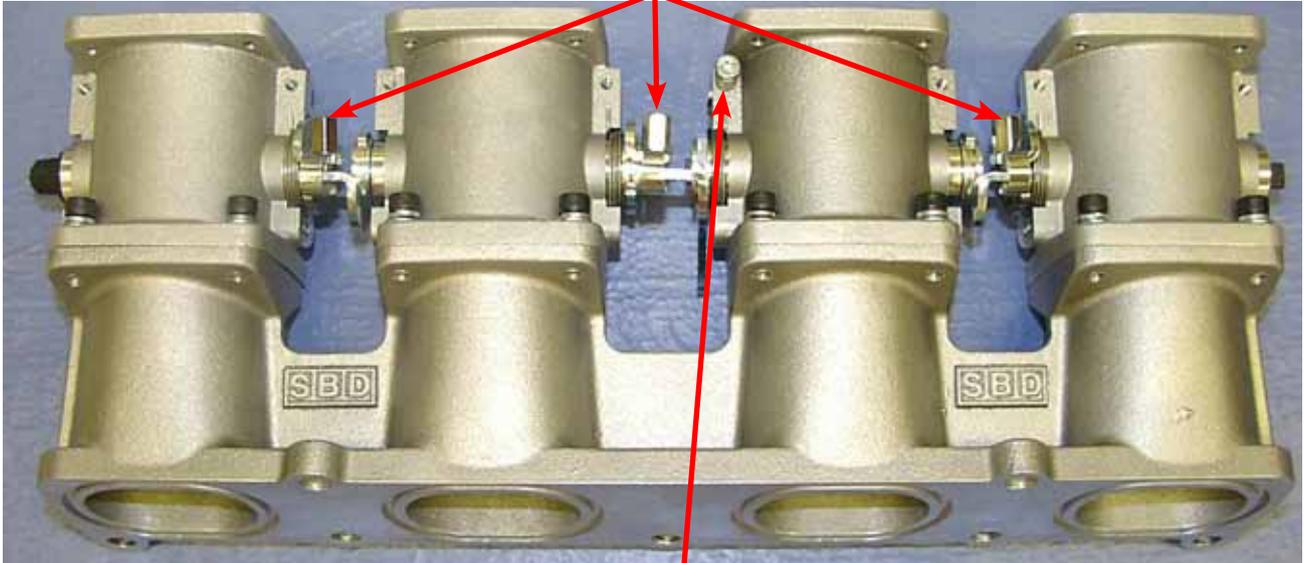
Installation of a small gear change lamp



SETTING UP PROCEDURE

It is very important to read first and understand the complete set up procedure in order to enable you to set up your throttle system accurately. You should have some assistance for the setting up. All of the steps in the setting up procedure are very critical to ensure correct and efficient running of your kit. Failure to accurately follow any part of these instructions will result in your kit not performing to its optimum.

Grub screws & locknuts

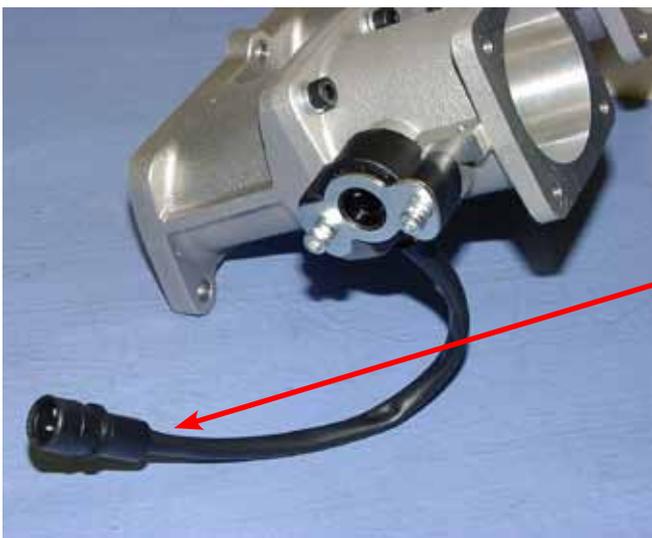


Throttle Stop Screw

STEP 1

Visual alignment of butterflies

Unscrew throttle stop screw on no. 3 so that it is off of the operating arm and the butterfly is fully closed. Visually adjust remaining butterflies to fully closed by loosening locknut in-between bodies & adjusting grub screw. Do not lock the screws yet, as you will have to adjust them again after starting the engine.



STEP 2

Initial setting for throttle potentiometer

Switch on your ignition only.

Do not attempt to start your engine yet!

Tighten throttle potentiometer clamping screws sufficiently so you are still just about able to move the potentiometer with your fingers.

Using a voltmeter probe the back of the throttle pot. sure seal on the Red wire (Pin 3) and a good earth. Set voltage to 0.25v, by twisting potentiometer (******This is an initial setting & you must not go back to this reading again.******). Leave the voltmeter connected, as you will need this later.

Screw the throttle stop screw clockwise on throttle no. 3 until you reach 0.30v on your voltmeter.

STEP – 3

Setting fuel pressure

Set the fuel pressure by switching the ignition switch (or power switch) ON. This will purge the fuel system by running the fuel pump for approximately 2 seconds. It may be necessary to switch ignition on & off several times in order to obtain the correct pressure reading, as the ECU turns the pump off when the engine is not turning. See chart below for correct pressure
The fuel pressure should be adjusted by turning the adjusting screw on the regulator, clockwise to increase the pressure and anticlockwise to reduce the pressure.

If you are using a removable gauge, you have two options for setting up the gauge, see below.

Leave it in the system until after you have the engine idling because the pressure may change once the engine has been running.

Fuel pressure adjusting screw
Clockwise – increase pressure.
Anticlockwise – decrease pressure.



Using an adjustable fuel regulator with our fuel pressure gauge **FPG1**.



Note: Be careful when tightening the gauge into the regulator, due to the conical shape it is possible to overtighten & crack the regulator housing.

Using a FPG1-ADP-6M-6F fitted between the adjustable fuel regulator & fuel line.



Do not start your engine yet!

You will first need to set the fuel pressure. Turn ignition on & off to build up pressure as ECU cuts fuel pump when engine is not turning.

TP Kit	Fuel Pressure	Injector Type	ECU Type	Idle RPM/kg/Ph	Cam Profile
TP203 2.0L Duratec	3 Bar (44.1 psi)	INJ-690	MBE9A4	980 / 5	Standard
TP214 2.0L Duratec	3 Bar (44.1 psi)	INJ-690	MBE9A4	1150 / 6.5	SBD-CM-DUR01 IN @ 1.67mm, EX @1.35mm
TP234 2.0L Duratec	3 Bar (44.1 psi)	INJ-690	MBE9A4	1150 / 6.5	SBD-CM-DUR02 IN @ 3.55mm, EX @3.35mm
TP250 2.0L Duratec	3 Bar (44.1 psi)	INJ-690	MBE9A4	1150 / 6.5	SBD-CM-DUR02 IN @ 3.55mm, EX @3.35mm

Note – As the fuel pressure may vary slightly between a static pressure check and a check when the engine is running, you will need to recheck and adjust your fuel pressure later when the engine is running.

Injector Types

INJ-690



STEP 4

Starting engine for the first time

When idle voltage & fuel pressure have been set, you can attempt to start the engine. You may have to hold the throttle to keep engine running.

To get the engine to run on its own you can screw the throttle stop clockwise slightly (Ensuring you do not go above the 0.37v & don't go more than approx 2 units higher or 1 unit lower than the idle Kg/Ph setting for your kit) until engine runs on its own, even if it's not smoothly.

STEP 5

Balancing the throttle bodies to read the same

Engine revs may increase during this stage, unscrew the throttle stop to decrease revs (you can re set pot voltage in next step) to keep it within 2 units above required Kg/Ph setting for your kit.

You now need to balance the butterflies using the syncrometer. Start by reading airflow through no.3 body, Adjust No.4 to read the same, then No.2 & then No.1.

When all 4 throttles read the same amount of airflow they are balanced. You can now do up the locknuts on the grub screws. Re check airflow & re adjust as necessary.





STEP 6

Fine tuning airflow & throttle potentiometer

You will have to do this step a few times to get everything right. – It's worthwhile spending extra time & taking care on this stage because if everything is not correct then engine will not idle properly.

With the engine still running, butterflies balanced insert the syncrometer on No.3 body & set the correct amount of Kg/Ph airflow for your kit (by adjusting throttle stop screw). Once you have the correct amount of Kg/Ph, re set the throttle potentiometer to read 0.35/0.36v.

Keep checking & adjusting until Kg/Ph airflow & throttle potentiometer are correct for your kit. (RPM will be correct when Kg/Ph is set)

Tighten the throttle potentiometer clamp so that it can't move. – **DO NOT OVERTIGHTEN AS THIS WILL DAMAGE POTENTIOMETER**

Re check all readings again & re adjust as necessary.