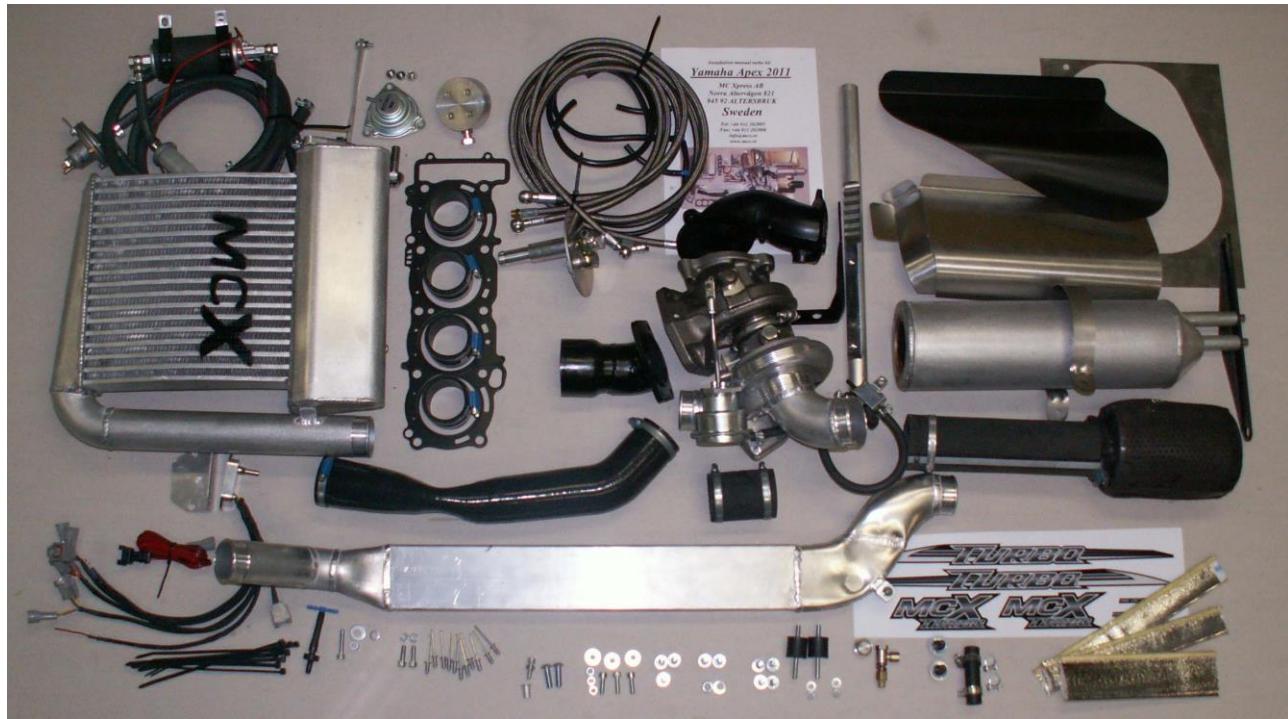


Installation manual turbo kit

Yamaha Apex 2011-15

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- Supreme of the extreme !

Yamaha Apex turbo

Thank you for choosing the MC Xpress turbo kit to fuel injected Yamaha Apex
The turbo kit is designed for racing use only.

The turbo kit is designed to give you the best performance possible together with reliability.
During the development work we have tried to keep the snowmobile as stock as possible to make
the installation easy and to keep the sled as untouched as possible.

Read this manual carefully before you start with the installation.

We hope you will get much joy with your new investment.

The turbo snowmobile is only recommended to be used by experienced riders and for racing use
only.

- This turbo kit greatly enhances the performance of the vehicle it is installed upon!
- Professional training should be received by anyone that operates this modified vehicle.
- Installation of this turbo kit may void any warranty that is provided by the vehicle manufacturer.
- A one (1) year warranty is provided on the kit parts only. This warranty does not cover any other parts even if the damage is caused by the installation of the turbo kit.
- MCXpress AB, its distributors, dealers, nor installers will not be held liable for any personal or physical damaged obtained in association with the installation or use of this product.

By installation or purchase of this product, the end user and or installer agree that the end user has been informed of this information.



Apex 2011 turbo high altitude simulation test in our SF901 dyno.

Small parts supplied with the kit:



1. 10 pc cable ties
2. 3 pc M6 L20 allen bolts, 12 mm long spacer and two washers for spacing out the oil tank
3. 2 pc M6L20 allen bolt and two M6 nuts for EFI-box installation to aluminium stay
4. 2 pc M8L25 allen bolts to alu bar under the turbo.
5. 3 pc M6L20 allen bolt+nuts and big washers to fuel pump and fuel pressure regulator
6. 2 pc of rubber mounts to front fitting of intercooler/plenum
7. 2 pc of minaba hose clamps to T fitting on air breather hose from turbo
8. 9 rivets to heat shield on the right side of the turbo
9. 2 rivet to EFI-box support bracket.
10. 1 rivet nut and M6 L20 allen bolt +washer, heat shield beside the turbo
11. 3 M8L20 bolts +washers, exhaust pipe to muffler installation
12. 2 M8L20 bolts +3 washers + one nut, turbo to exhaust pipe installation.
13. 4 M8L20 bolts +washers, exhaust pipe to turbo installation.
14. 2 M12x1,5L20 bolts and 4 washers, steel bracket to turbo installation
15. 1 M18x15 lambda plug
16. 2 12-20 hose clamps and one 70 mm long hose D16, front of plenum installation.
17. 4 M8L20 allen bolts and washers to muffler clamp and stay.
18. 1 set of parts to turbo oil outlet of the engine/ oil pressure sensor adapter.

Before the installation

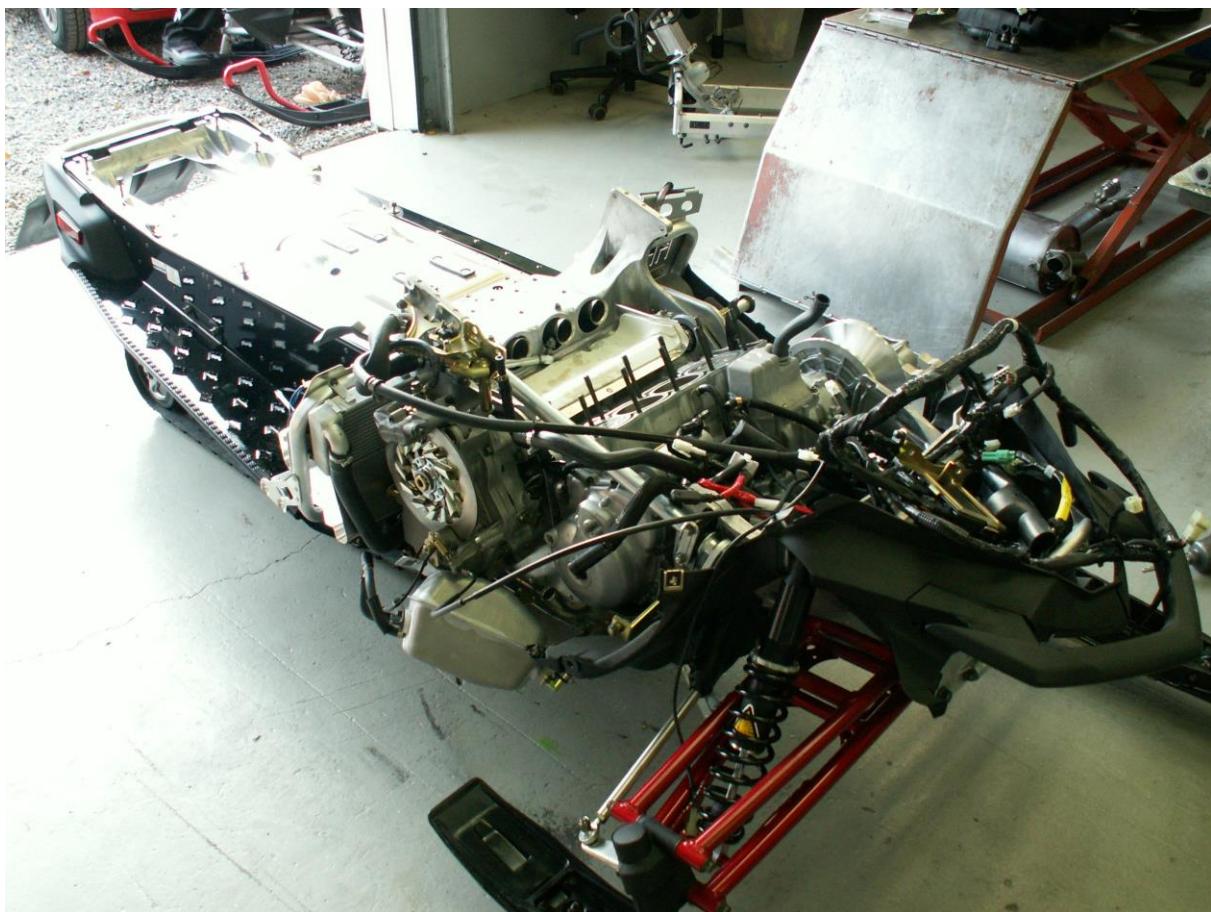
To make the installation as efficient as possible, we recommend you to follow these instructions.

Remove the seat, muffler, hood, plastic fairings, fuel tank and some other parts until the snowmobile looks like the picture below. (**When installing the 200 hp turbo kit, the cylinder head shall not be removed, so the labour described below shall not be done on when installing this kit**)

Drain the cooling water from the engine through the water hose on the right side of the engine. Save the cooling water in a clean pan to refill it later.

Remove the aluminium frame on top of the engine.

Before removing the cams and cylinder head, you have a nice opportunity to check the valve clearance before removing the camshafts. The clearance shall be 0, 11-0,20mm on intake and 0, 20-0, 26 mm on exhaust. If the engine is new or has very short mileage, this is not necessary.



(Picture from 2006-2010 model Apex)

Lowering the compression ratio

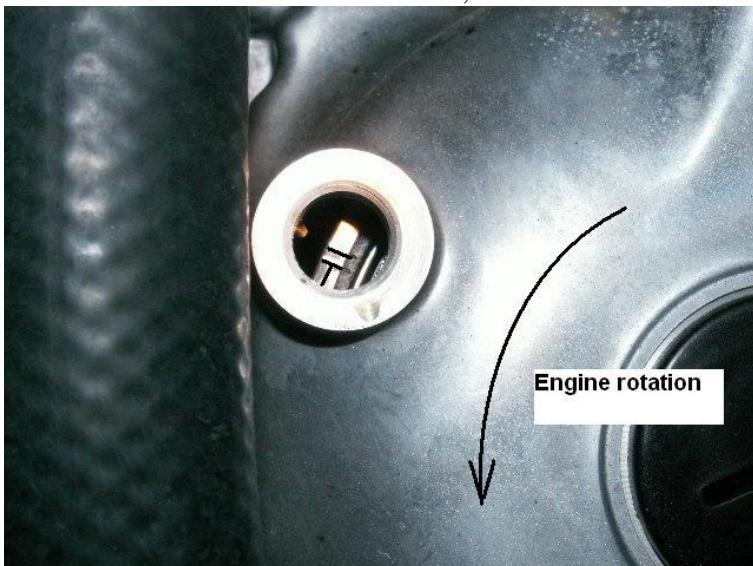
To compression ratio has to be lowered by two reasons.

1. When the turbo is producing pressure, the compression pressure in the cylinder and combustion chamber will be much higher than on a natural aspirated engine. This can cause detonation and serious engine damage.
2. It is possible to let the turbo produce more turbo pressure when the compression ratio on the engine is lower.

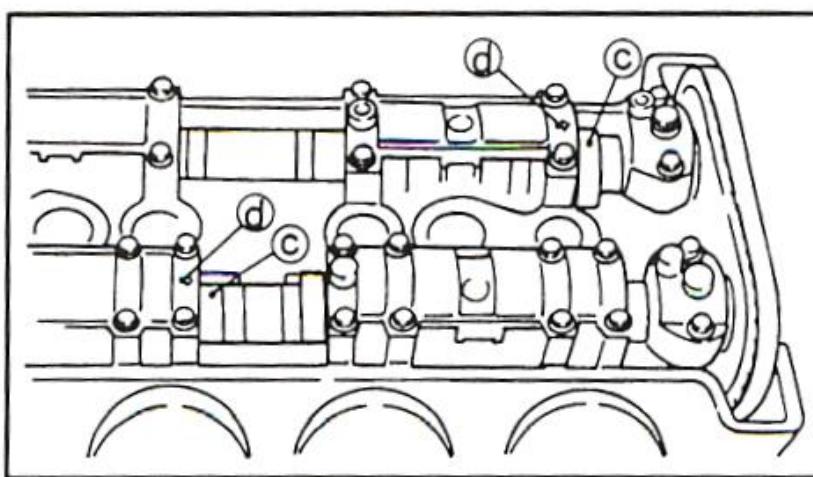
So the comp. ratio is lowered to make the engine both reliable and powerful.

First of all,

Take off the valve train cover. Now,



Rotate the crankshaft until piston number one and four reaches TDC (See upper picture)



Remove the valve train cover. Note how the marks on the camshafts are located on both intake and exhaust before you remove them. Remove the screws “all together” so you don’t hurt the camshafts. Note how the upper camshaft bearing are located before you lift them away. But first start by removing the cam chain tensioner.

The aluminium frame on top of the cylinder head has to be removed before the cylinder head is removed. If the valve clearance has to be adjusted, do it now.

Remove the cylinder head.

Remove the stud protectors if your sled is equipped with stud protectors.

To be able to do this, drill out the rivets and remove the heat protected aluminium plate on top of the secondary clutch shaft. (See picture below) You will find the rivets for the stud protector profiles under this shield.



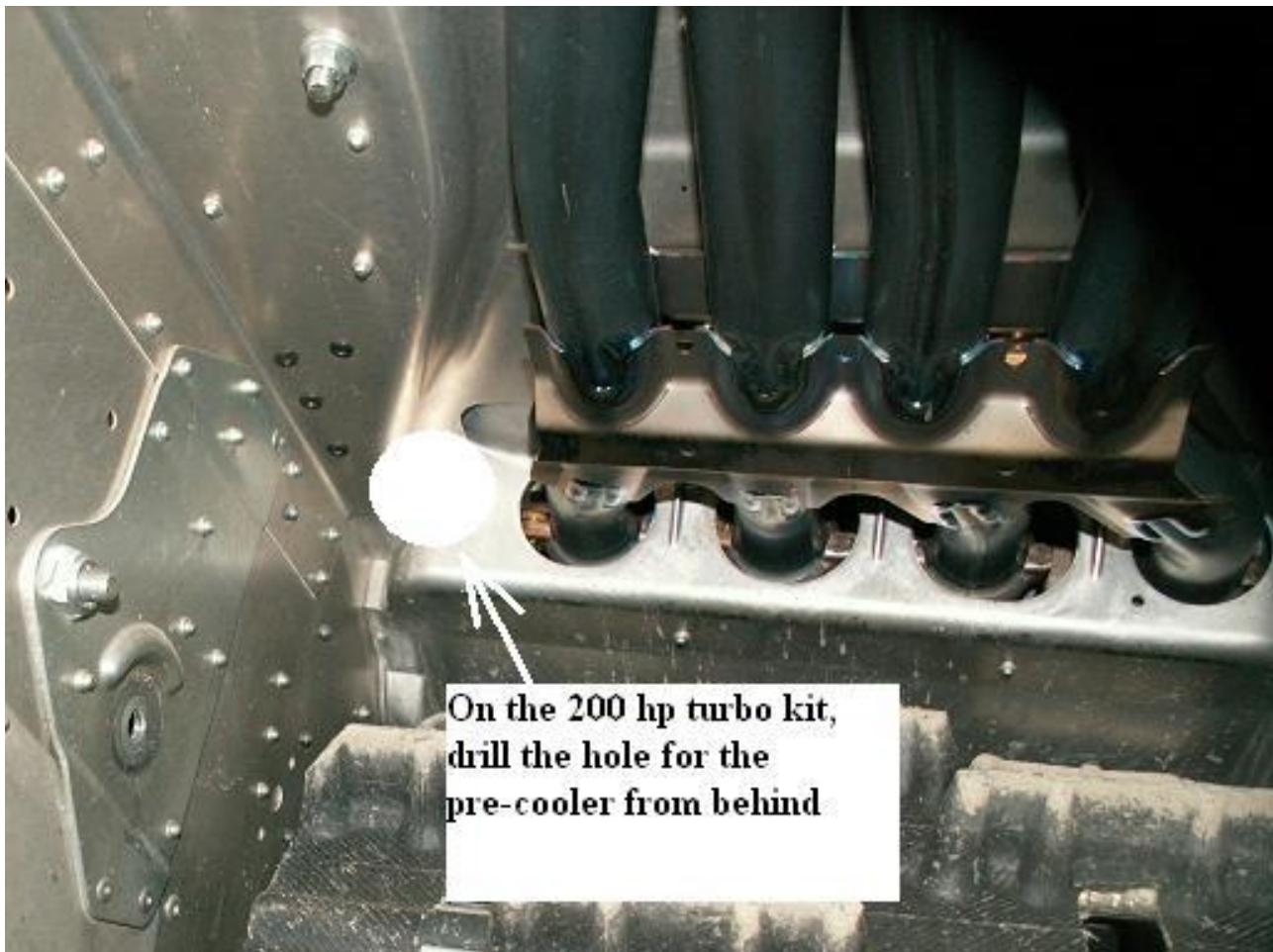
If your snowmobile has stud protectors in the tunnel, remove them by cutting out the rivets.

Cover the engine-cylinders with a blanket or similar to avoid dirt from the drilling to fall down in the engine.

The pre-cooler shall later be installed on the left side inside the tunnel. To make this possible some modifications needs to be done.

Drill a hole like the picture below about diameter 60. (=about 2,5")





Pre-cooler installation

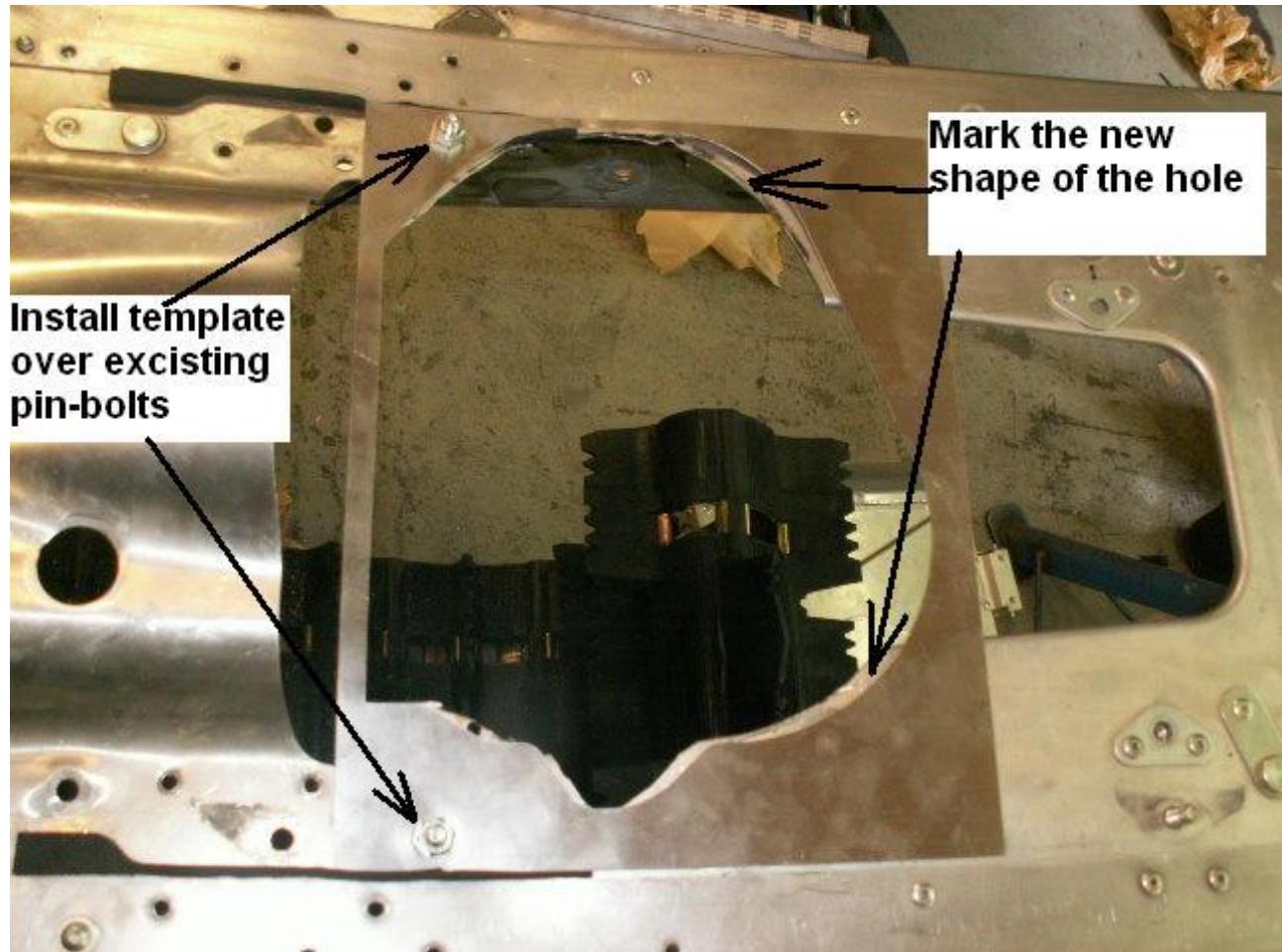
The turbo shall be placed just behind the fuel tank.

The existing hole in the chassis must be enlarged a little to make space for the turbo and exhaust pipe. We recommend to enlarge the hole before the pre-cooler is installed

Place the aluminium template supplied with the kit like the picture.

Mark with a pen the new shape of the hole.

Use a jigsaw or similar and cut like the marking.



The pre-cooler leads the compressed air from the turbo to the engine.

It cools down the air thanks to the air, water and snow that cools down the pre-cooler.

The air fins inside the pre-cooler make this very efficient.

Lift up the chassis to make space between the track and the tunnel.



The pre-cooler shall be installed as high and as much left as it is possible in the tunnel.
Install the pre-cooler. Adjust the size for the front hole you made earlier if necessary.
Drill a hole from under and install the bolt+nut to the chassis.



Install the cylinder head

(This chapter does not involve the 200 hp turbo kit)

Now it's time to install the cylinder head.

Clean the surface carefully before installing the new thick head gasket.

The cylinder head nuts (M10) shall be tightened in three steps, first 20Nm, then 35 Nm and finally 50 Nm. Start from the centre of the cylinder head and move towards the ends.

The m6 bolts shall be tightened 10Nm.

When installing the thicker head gasket, the cam timing will be a little different than stock.

On the exhaust cam, it's only better with the new setting, but the engine makes more power if you turn the intake camshaft back to its normal position.

It is made like this: Note how the sprocket is installed on the cam.

Make a scratch between the centre of the cam and the sprocket.

Remove the sprocket from the cam and make the holes a little longer by grinding them.

Install the sprocket again and move the sprocket about 1, 5 mm farthest out of the sprocket.

This will mean about 0, 8 mm at difference where the scratch is located.

Note the direction you shall turn the sprocket compared to the camshaft (See picture below)



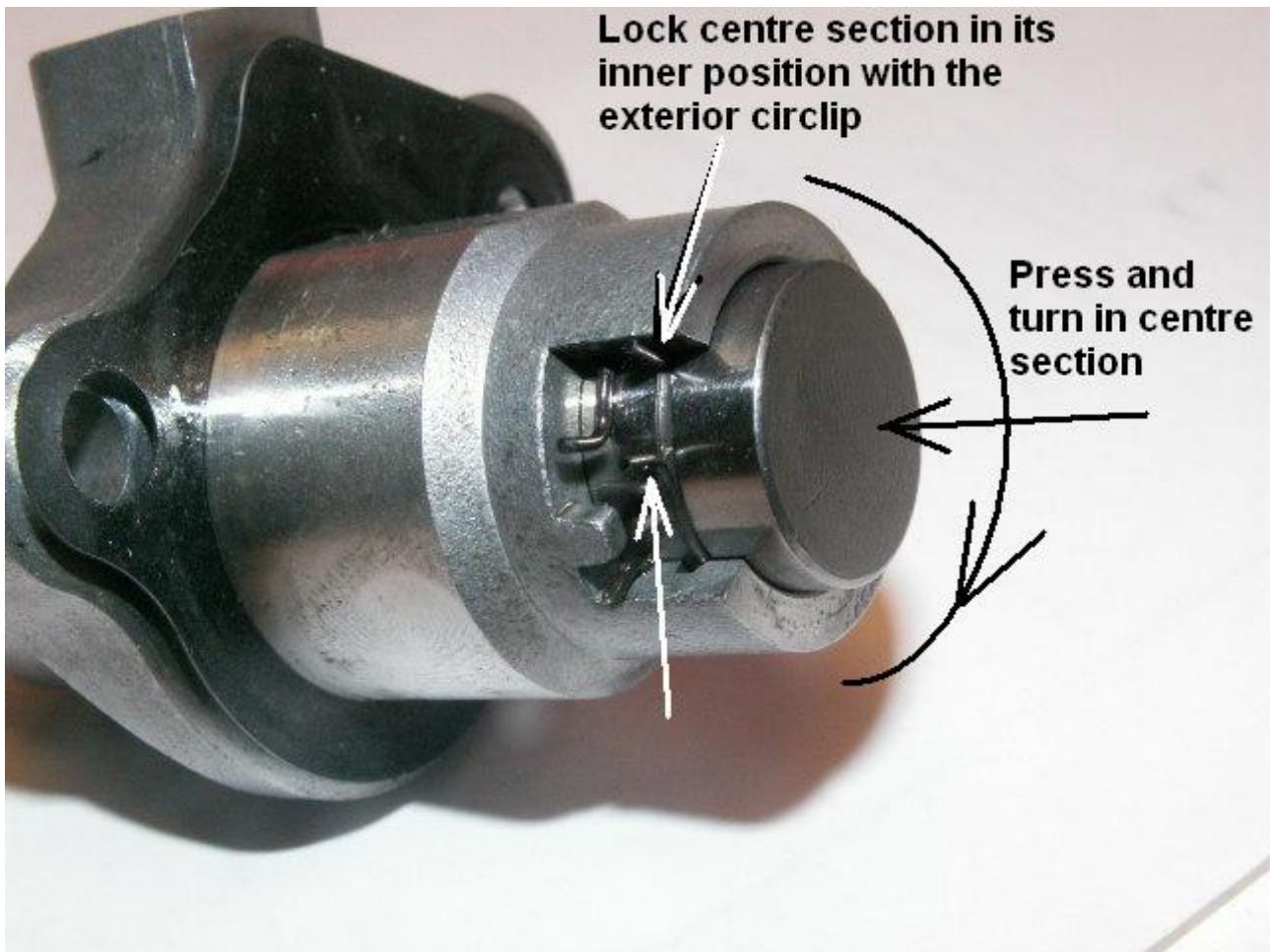
Make sure piston number one and four are in TDC before installing the cam shafts again.

Install the cam bearing crews "all together" to avoid the cam shafts to be damaged.

Apply engine oil on the bearing surfaces. Make sure the cams are installed after the right marks.

The torque shall be 10 Nm on the M6 bolts. Make sure the cam chain doesn't jump during the installation.

When installing the cam chain tensioner, press and turn the centre section to its inner position. Press the circlip together until the centre section stays in place in its inner position. Install the tensioner to the cylinder head.



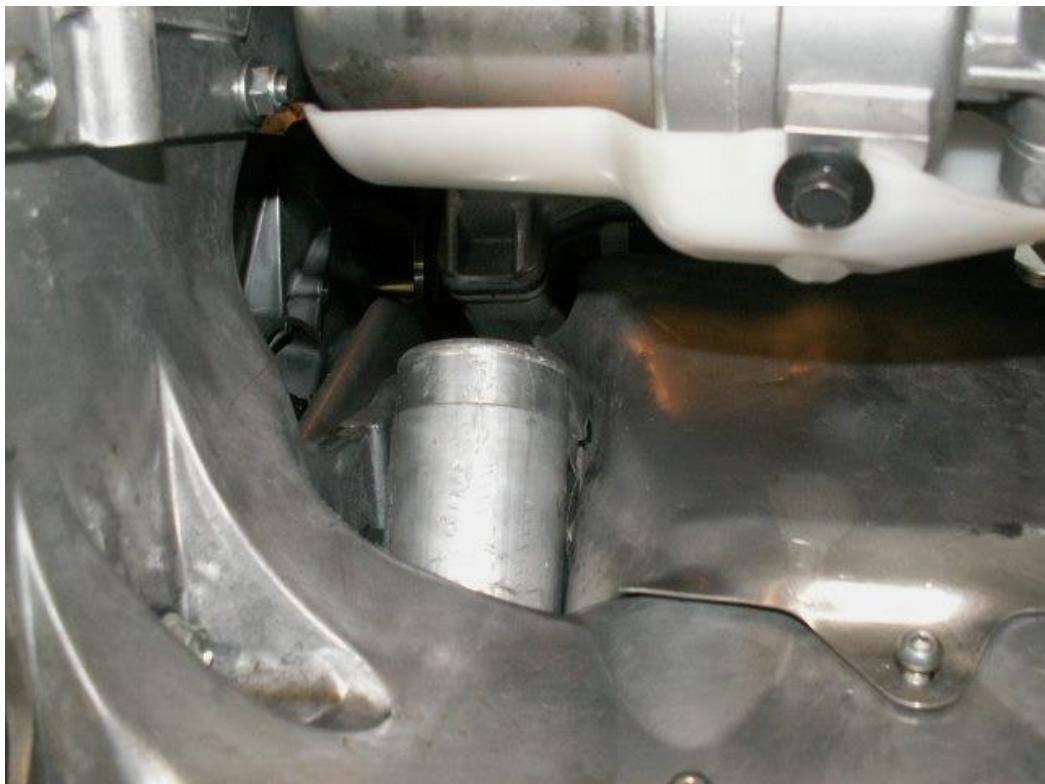
Rotate the crankshaft of the engine a couple of turns and check the cam setting once again.

CAUTION

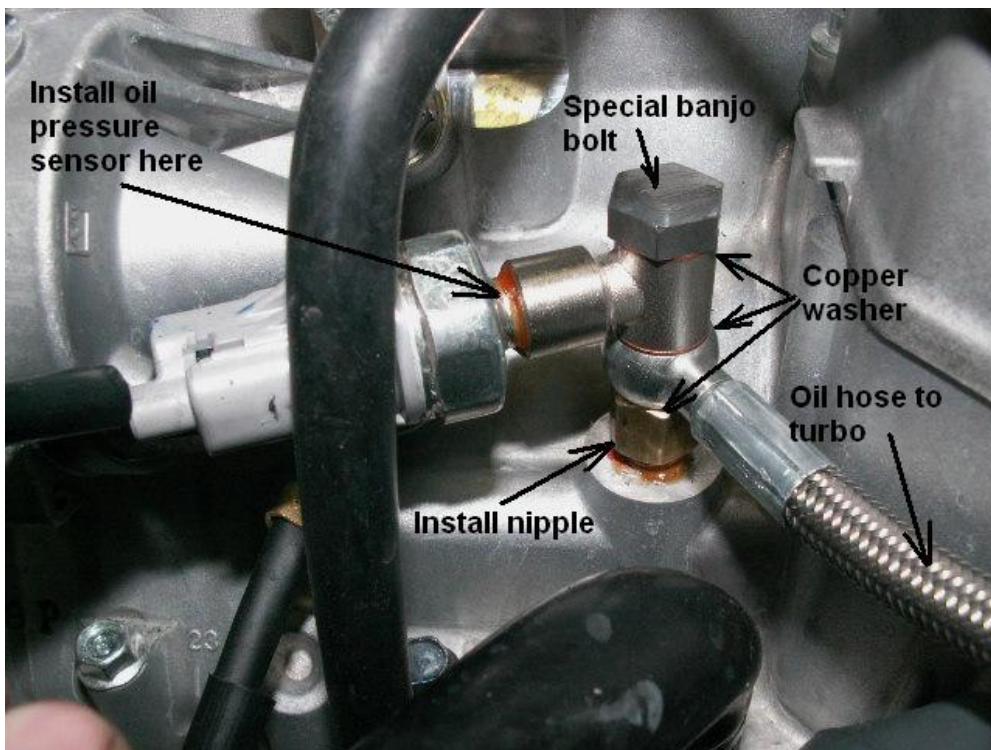
Check the valve clearance again to make sure all the chims are proper installed.
(If one shim has moved from its position in the upper valve spring retainer when the cylinder head has been off, **engine failure will follow.**)

Install the valve train cover, the four exhaust outlets, the aluminium frame and refill the water again.

Install the heat shield above the exhaust manifold. You have to cut a little (or make a dent) on the left side to make space for the pre-cooler.



Oil hose to turbo



Remove the oil pressure switch and install the nipple. Use thread sealant.

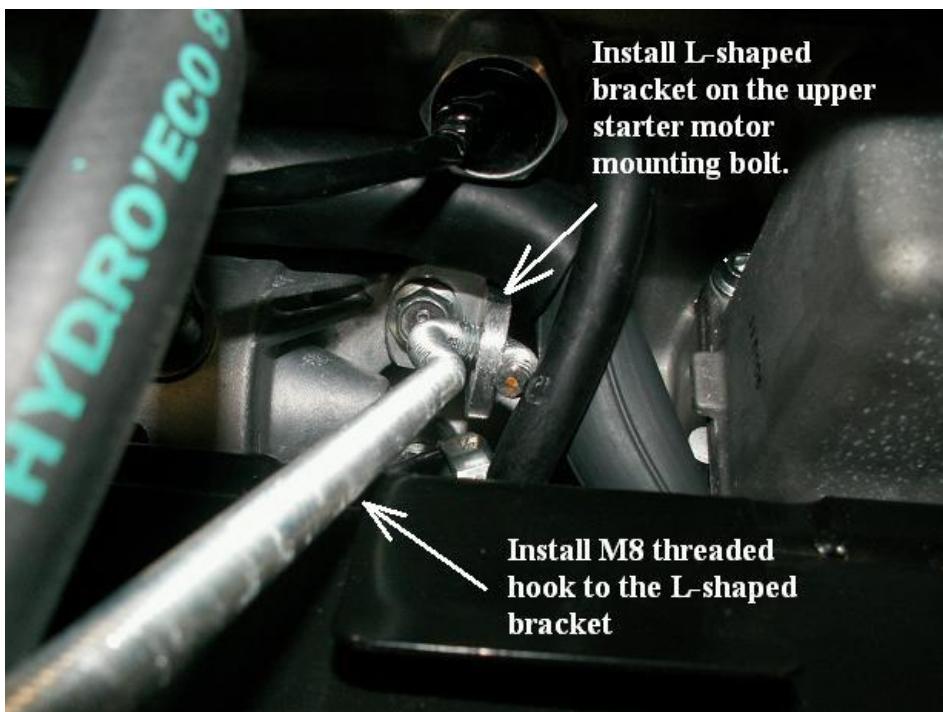
Install the oil pressure switch on the T. Use thread sealant here too.

Install the oil hose to the turbo and the banjo bolt and copper washers like the picture.

Install the L-shaped bracket on the upper starter engine bolt.

Install the M8 hook that shall go between the engine and the air box plenum.

This stay will prevent the air box from blowing off under turbo pressure.



Install the aluminium frame above the engine again.

Oil pump installation

The oil that has lubricated the turbo must be pumped back to the engine.

An oil pump shall be installed on the right cover of the engine.

First of all, remove the plastic side cover and the oil tank.

Drain the oil tank before removing it.

(It is also possible to just move the oil tank to the side without draining it)

Remove the centre bolt that holds the flywheel,

Inside the stock flywheel bolt it's located a steel pin. This pin shall also be removed.

Install the new flywheel bolt supplied with the kit. Tightening torque is 120 Nm.

Install the pump shaft and the 3mm pin.

Install the oil pump and tighten it like the photo below. (You can use two M5 screws)

Use the stock O-ring from the plastic-cover between the pump and the cover.



Check so the oil pump shaft is a little loose and can be moved in and out a little.

Install the pump gears and the small 3 mm pin.

Caution: Lubricate with motor oil the pump gears before you put the pump together.

Install the O-rings and the centre section ring with the M12 thread facing rearwards of the oil pump.

Install the endplate with the four M5 screws.



Install the oil tank again. Because of the oil pump, the oil tank has to be moved a little. Install a new 30 mm long screw and a 10 mm thick alu-spacer on the upper left position. A thick washer shall be installed as a spacer between the oil tank and the bracket on the lower right side.



EFI-box installation

The stock fuel injection is not designed for turbo use.

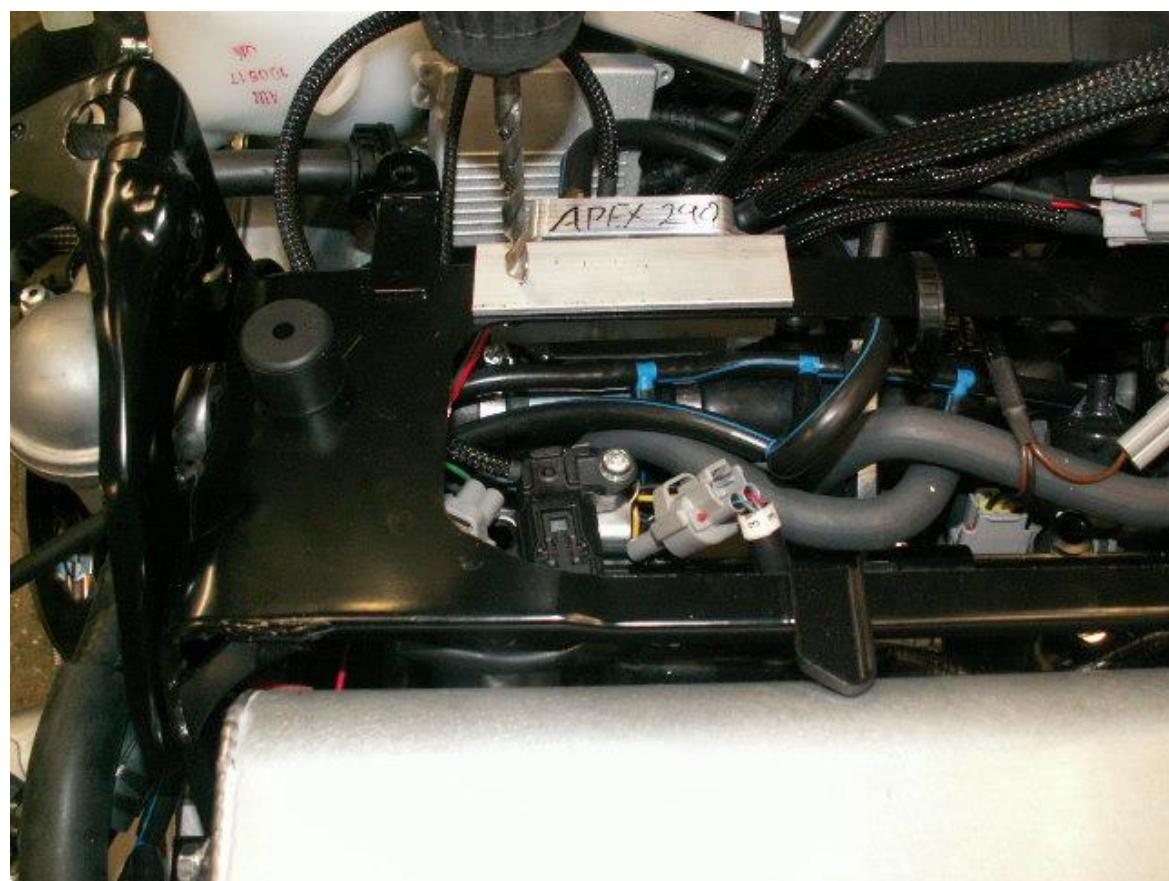
A new external EFI-box will control the stock injector opening time so the air/fuel ratio will be right at any load and at any altitude.

This is MCX:s 5:th generation EFI box supplied with this kit.

The EFI-box also controls the turbo pressure through the TCV-valve back at the turbo.

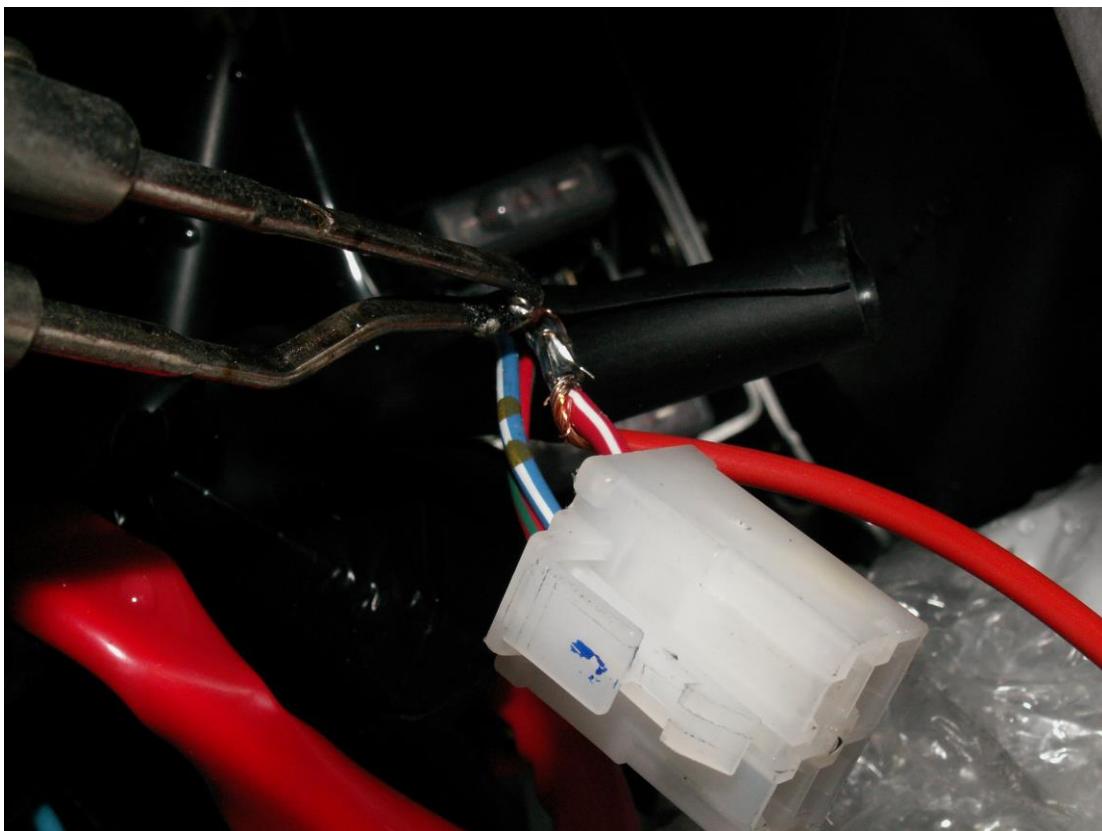
A pressure sensor is located inside the EFI-box. A hose from the throttle bodies shall later be connected to the EFI-box.

1. Install the alu-stay to the EFI-box in a proper place to the headlight stay like the picture below.
You can install the EFI box to the stay later.



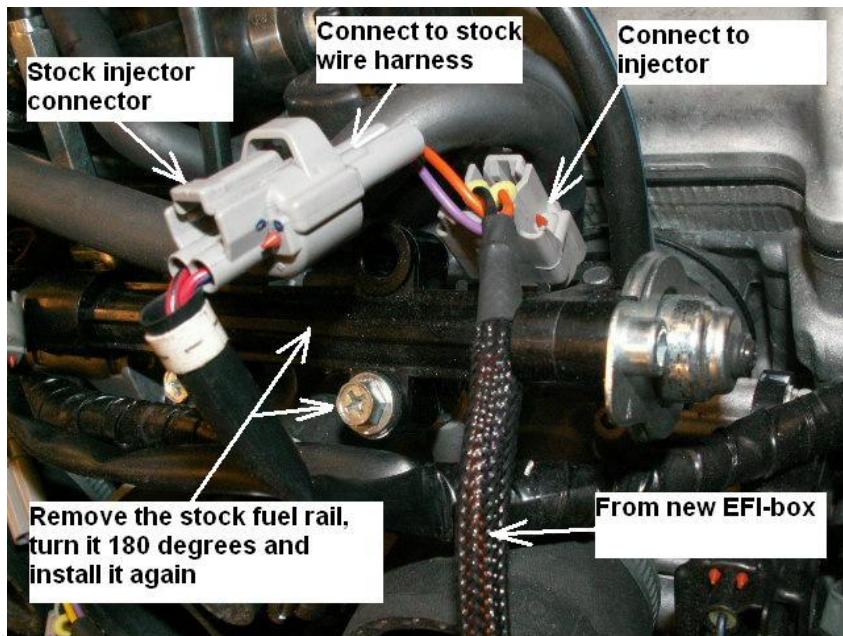


2. Connect the black ground wire to the chassis.



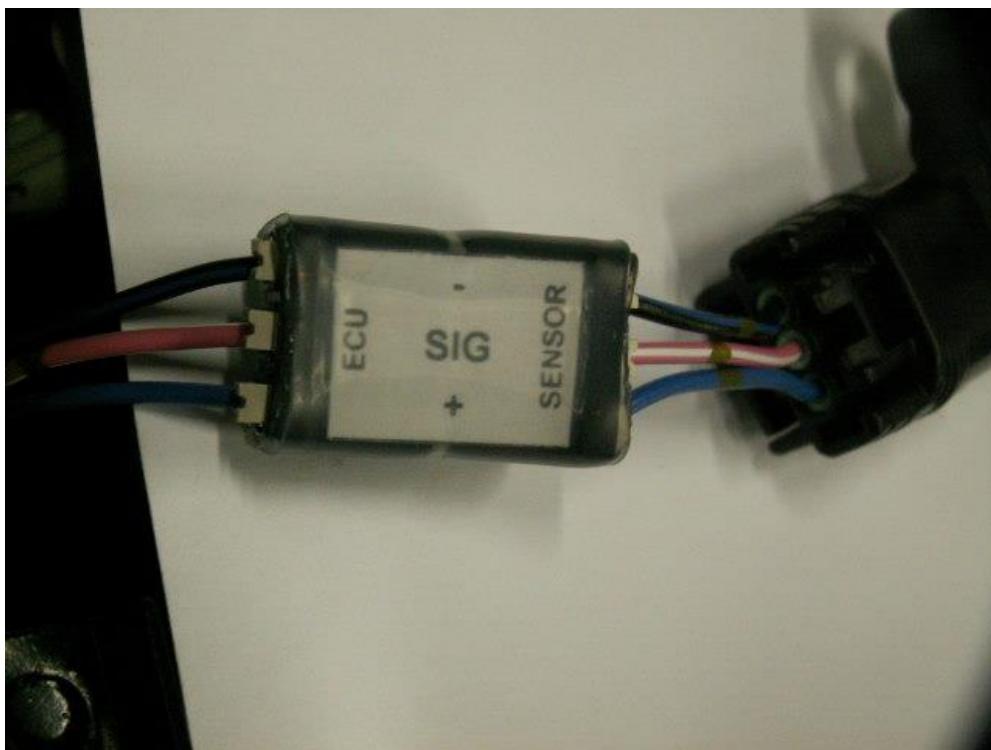
3. Connect the red +12 V wire to the starter solenoid red wire with white tracer.

You find it beside the battery. Remove some cable insulation and use solder to get perfect connection. Insulate carefully.



4. Remove the stock connectors to the injectors and plug them into the wire harness from the new EFI-box like the picture.

You can connect any wire from the new EFI-box to any of the four stock injectors. (Later, plug in the connector to the TCV (Turbo control valve) located on the hose to the wastegate actuator back on the turbo.)



The stock ECU reacts with an error code on the dashboard if you pressurize the stock MAP sensor. To avoid this when the turbo starts to boost, install an electronic unit on the wires going to the stock MAP sensor located on the throttle body. It is important that this unit is turned the right way so the text sensor is pointing against the MAP-sensor.

Relocate the fuel inlet

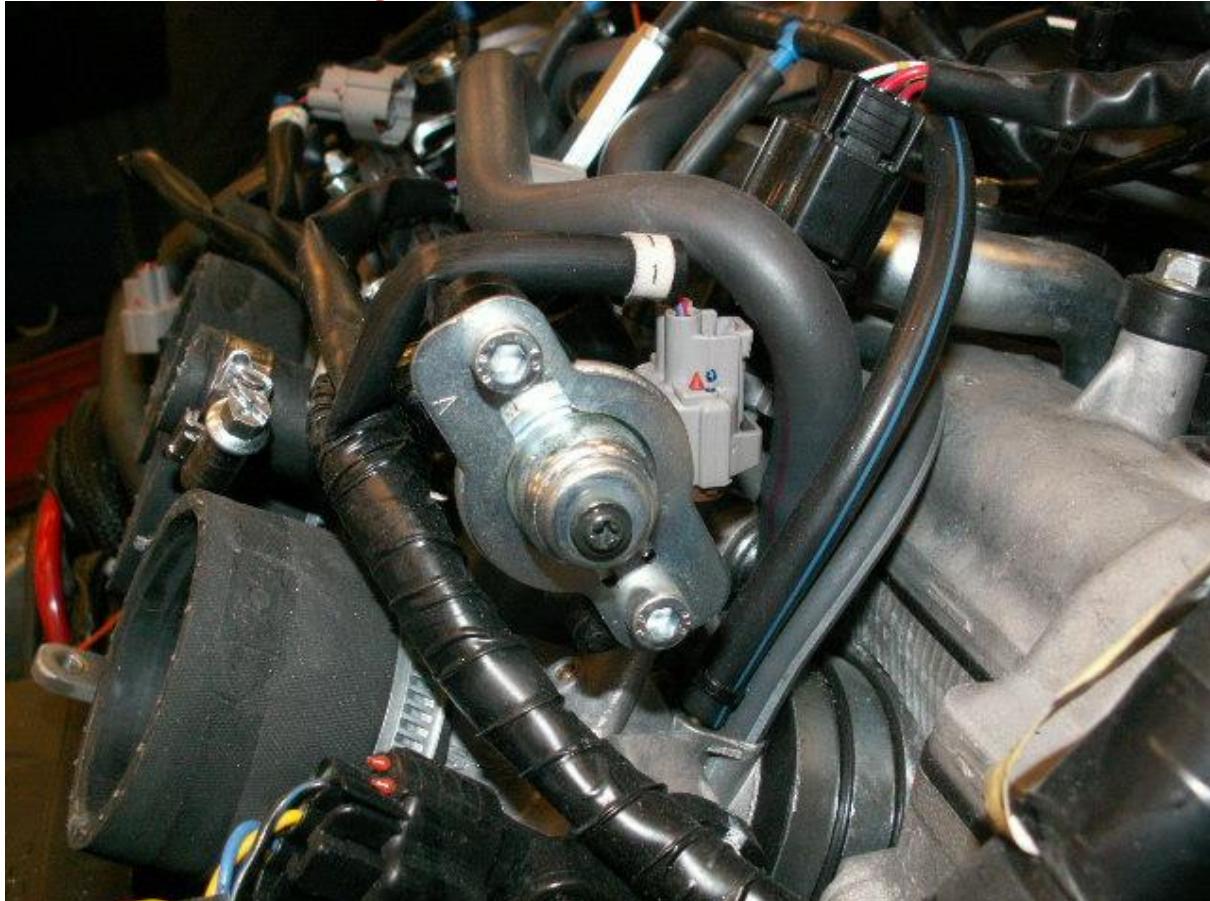
The fuel inlet to the stock fuel injectors must be relocated. (see last picture)

Seen from the drivers view of the snowmobile:

The stock fuel inlet is located on the left side pointing rearwards.

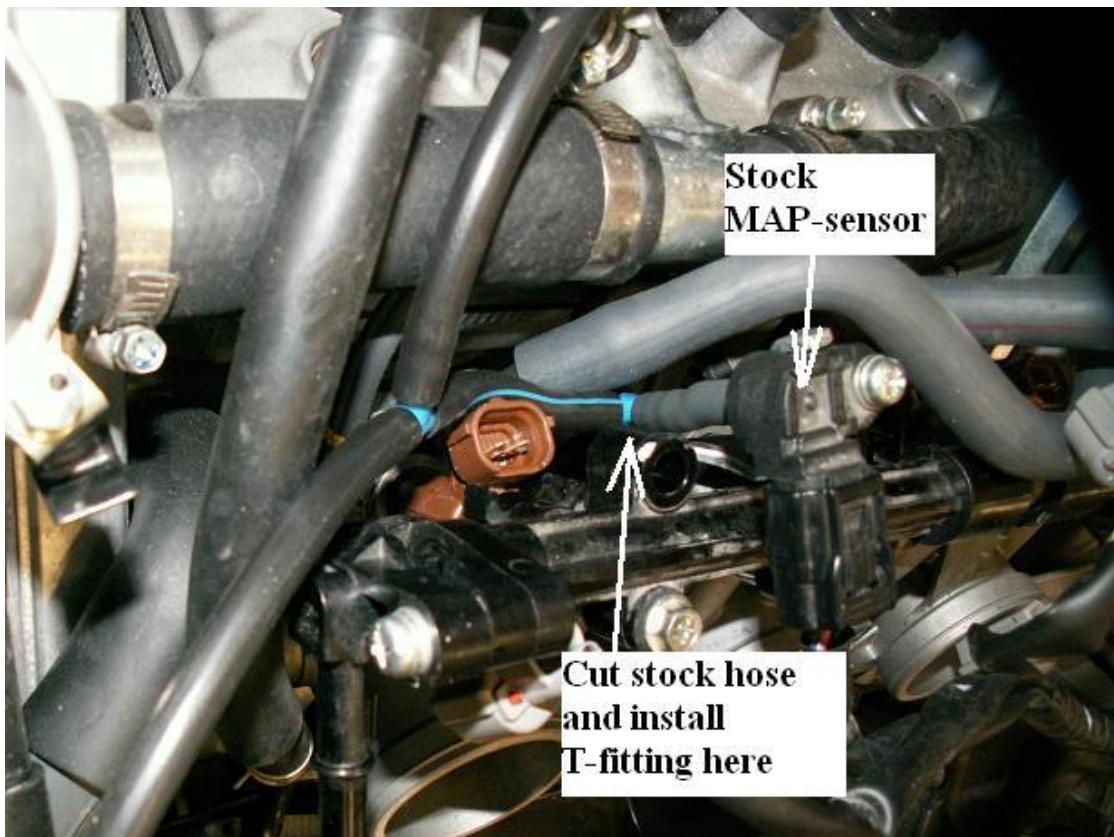
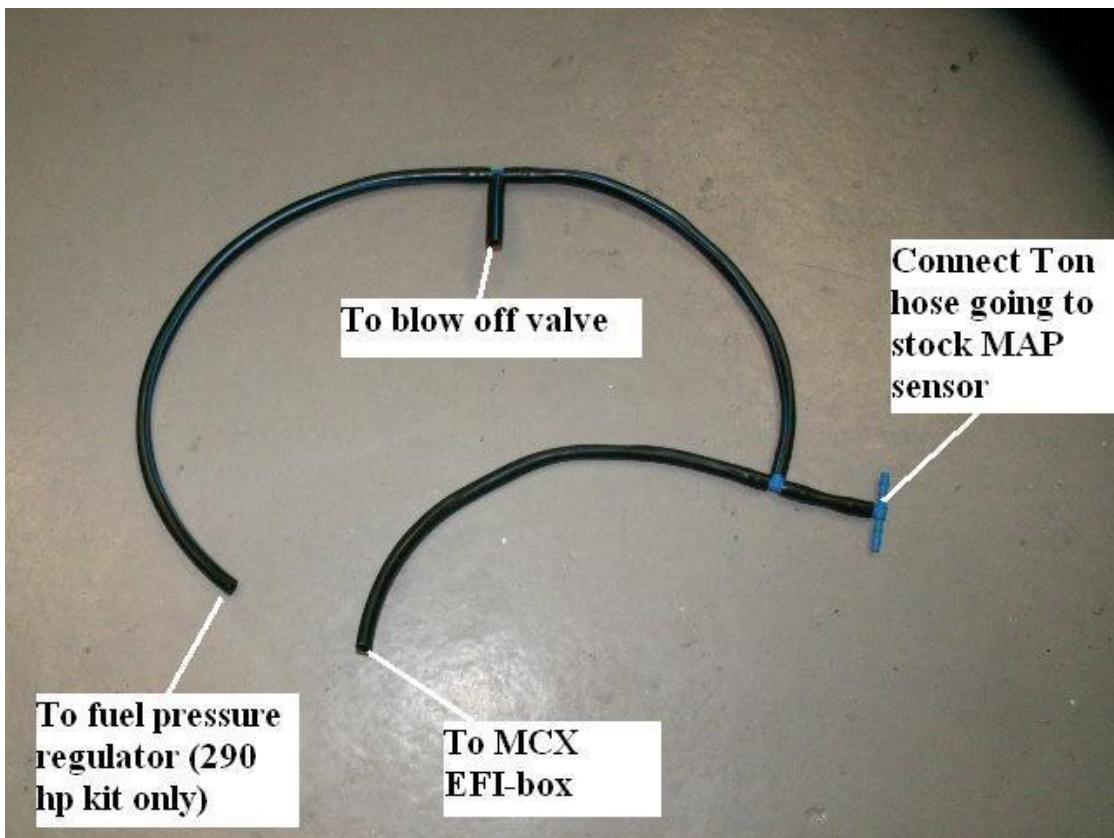
Remove the stock fuel rail and turn it 180 degrees so the fuel inlet will be pointing forward on the right side instead. This will make space for the pressure hose coming from the pre-cooler to the intercooler.

(On the 200 hp kit, the fuel hose between the fuel tank and the fuel rail must be replaced by a longer hose supplied with the kit. Remove the fuel quick connectors from the stock hose and install them on the new longer hose.)



Now the pulse damper will be located on the left side (seen from the drivers view)

Vacuum hoses

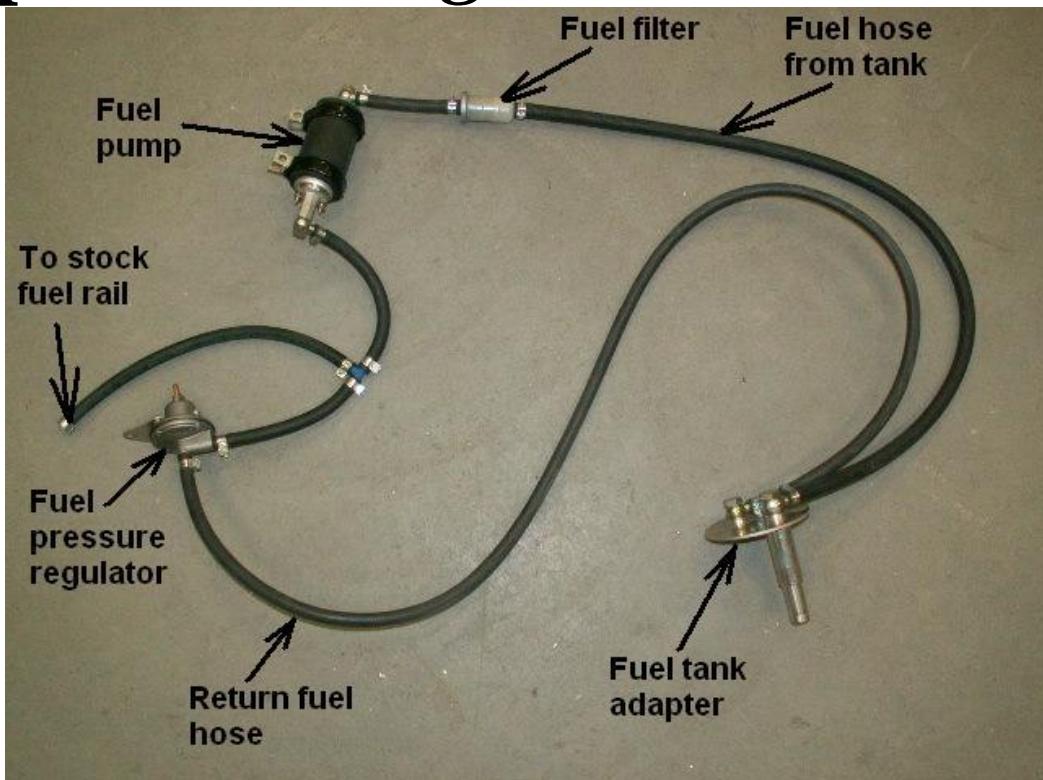


Install the vacuum hoses harness like the pictures.

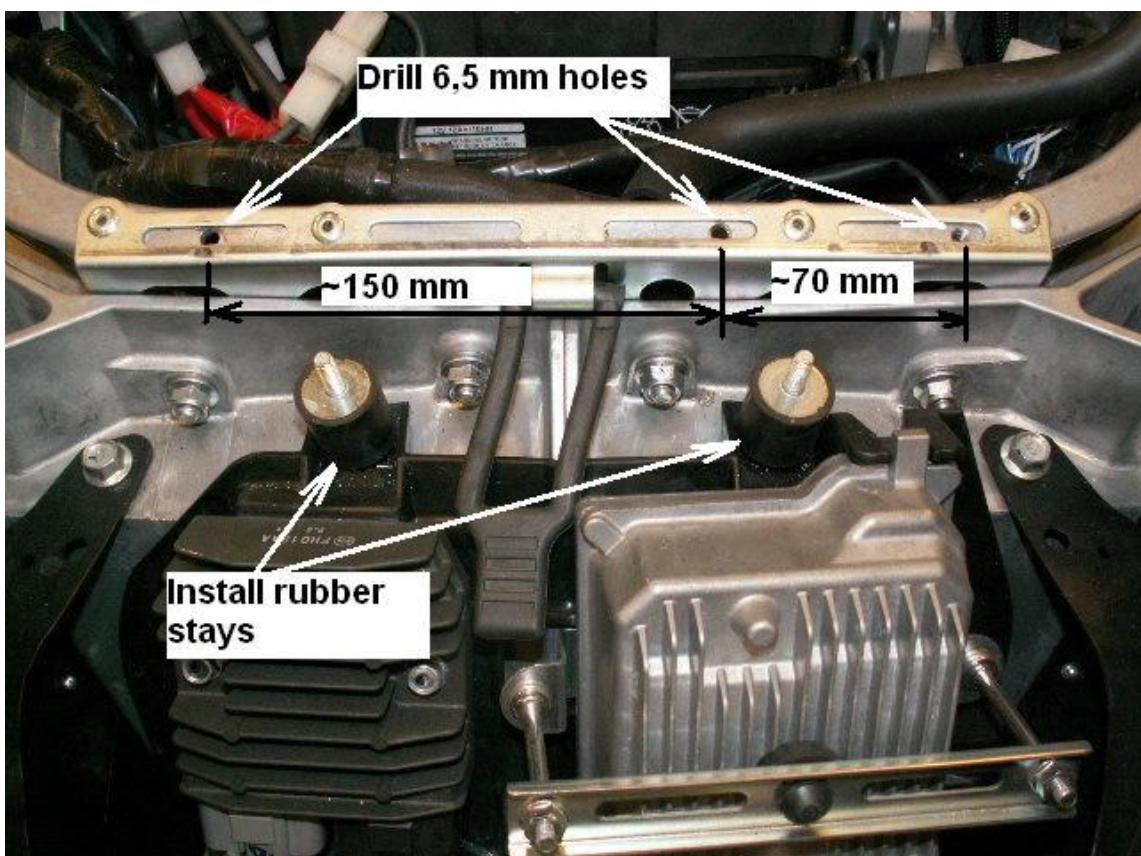
Later connect the hoses to the EFI-box, blow off valve and to the fuel pressure regulator.

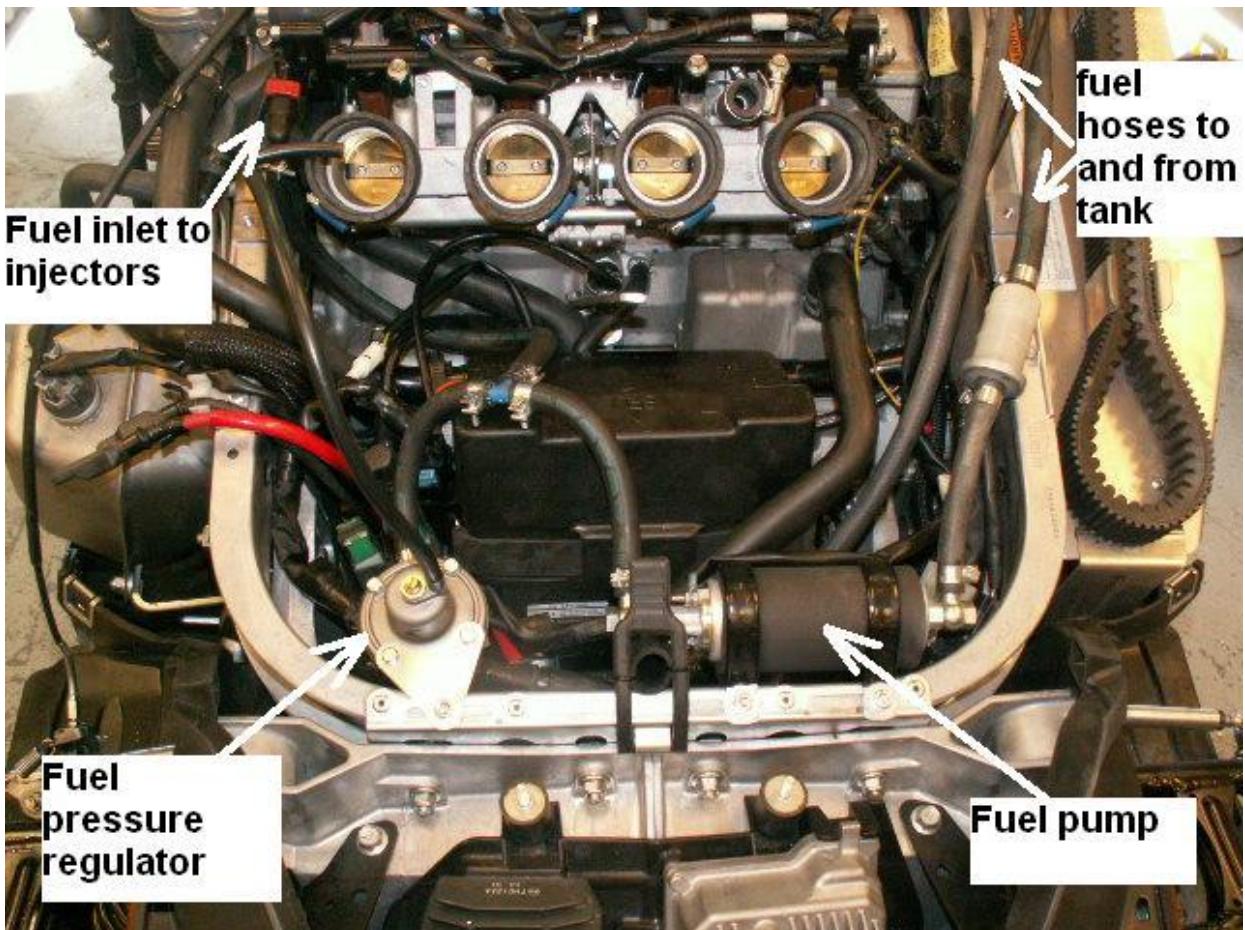
Install fuel pump and fuel pressure regulator

(Only 290 hp version)

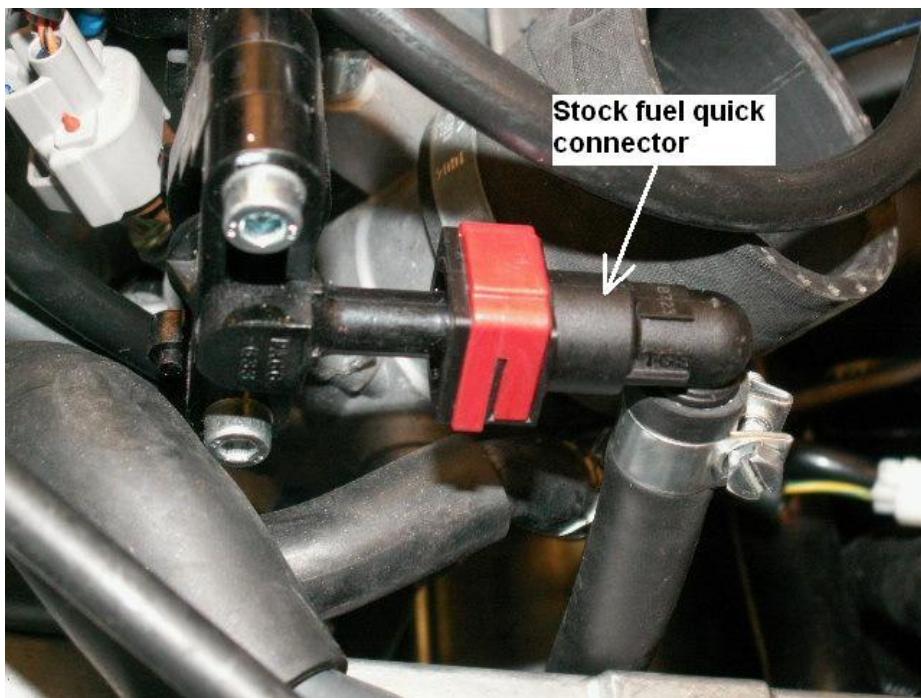


The new fuel pump and fuel pressure regulator shall be installed in front of the engine.
 Drill three 6,5 mm holes like the picture.
 Install the rubber stays for the pre-cooler/intercooler.

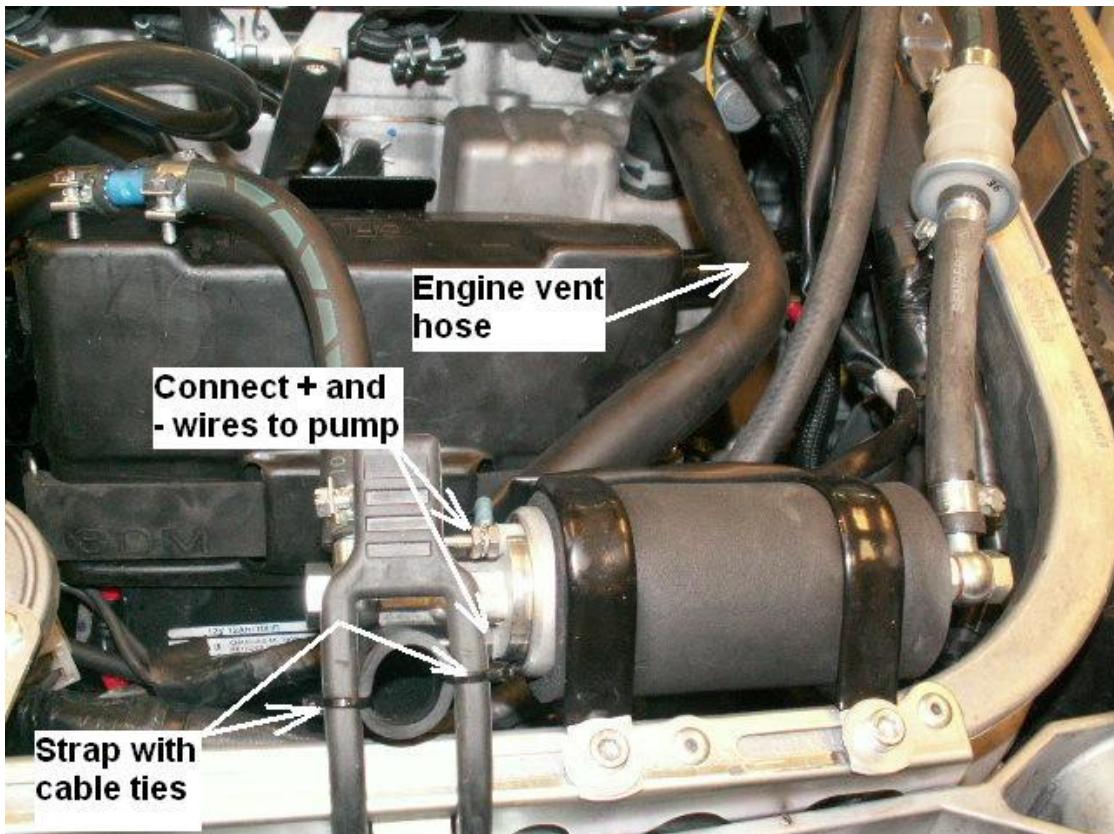




Install the fuel pump and regulator like the picture.



Remove the fuel quick connector from the stock fuel hose. Install the fuel quick connector to the fuel rail hose and install it against the fuel rail.

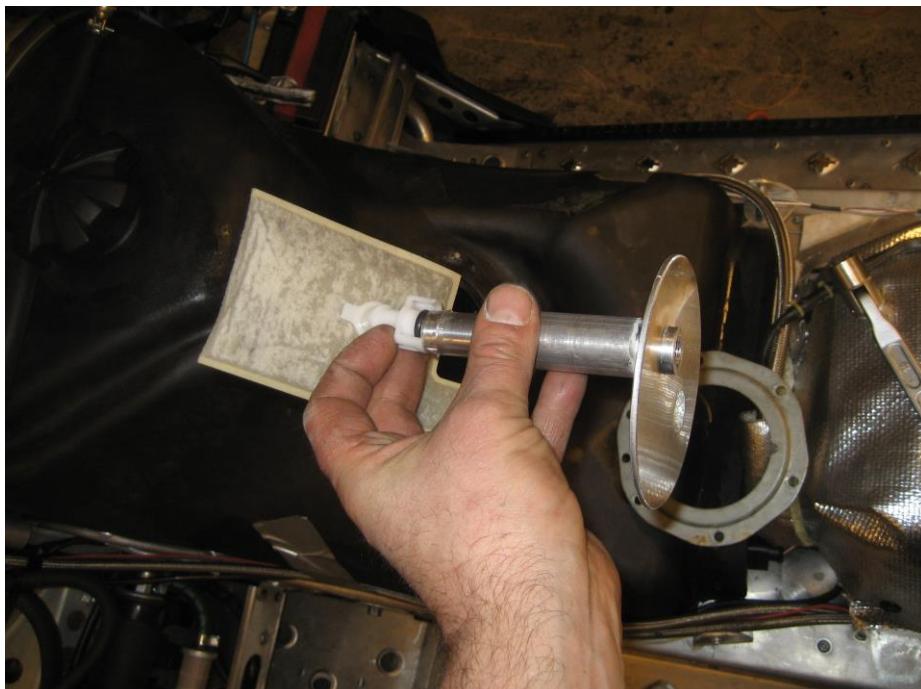


Cut the stock fuel wire to the fuel pump rather close to the connector at the pump.

Install the two electric connectors supplied with the kit to the + and – wires.

Connect the wires to the fuel pump.

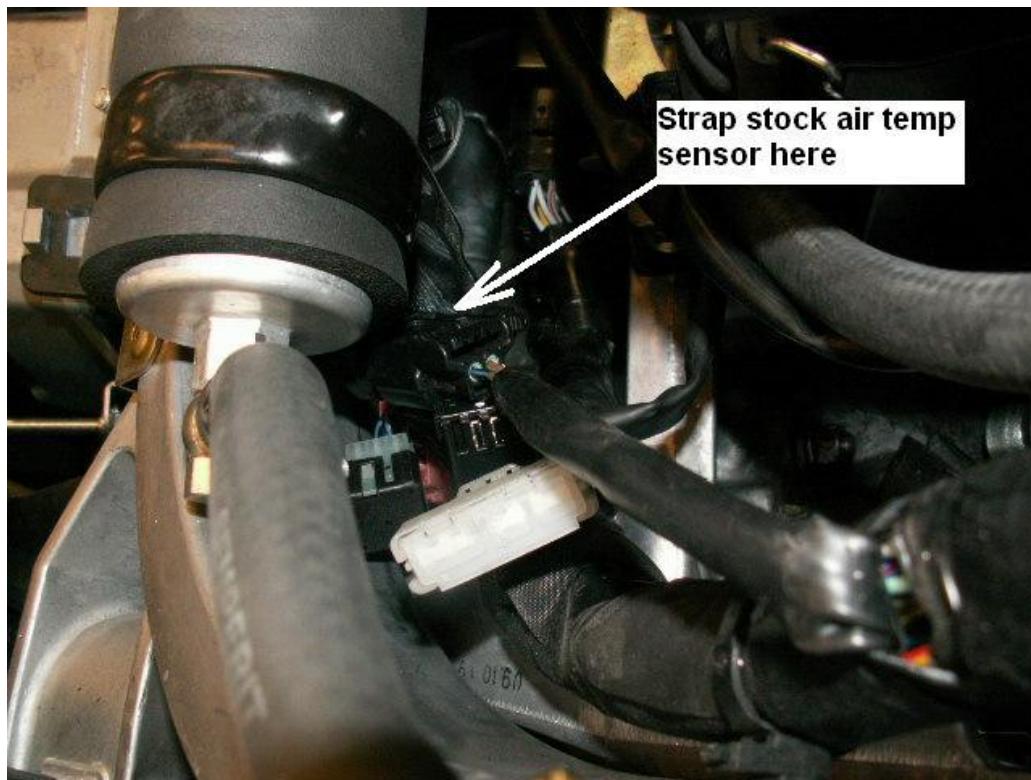
Install a hose from the crankcase breathing system and secure it to the rubber mount with two cable ties like the picture above. Open the stock air box and use the hose you may find inside.



Remove the stock fuel pump assy and replace it with the tank adapter supplied with the kit.

The fuel filter in the bottom of the stock fuel pump assy shall be reused and installed to the suction pipe of the tank adapter.

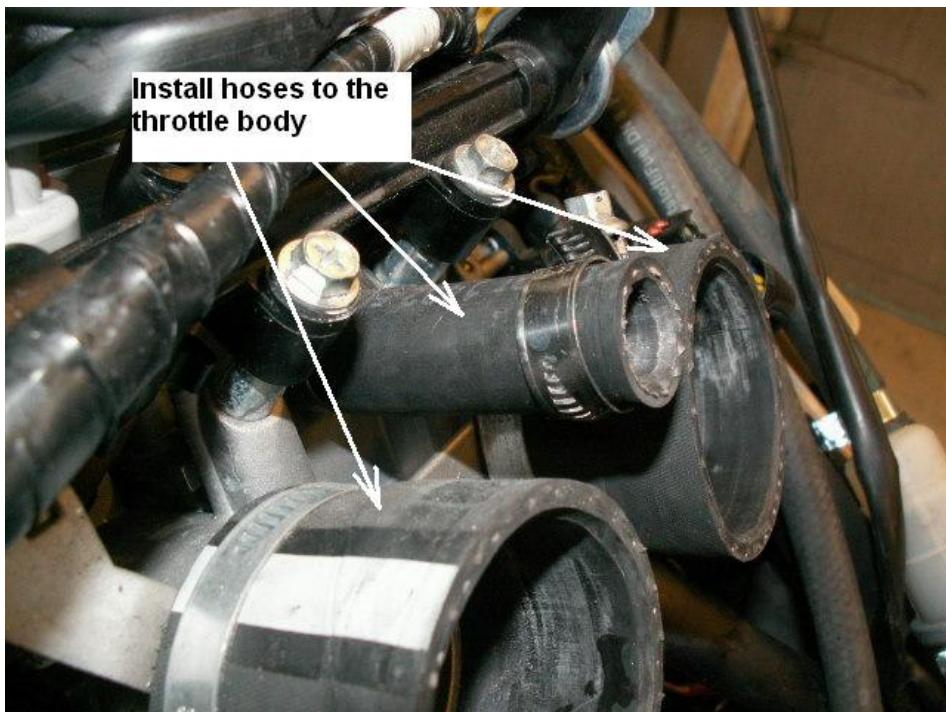
Plenum/intercooler installation



Remove the temp air sensor located on the stock air box.
Connect it to the wire harness and strap it like the picture above.



Modify the stock oil filler cap on the valve cover by cutting off the top of it.
(This will make more space for the hose between the pre-cooler and the intercooler)



Install the 4 hoses with 50 mm diameter and one hose with 12 mm diameter to the plenum.
Tighten the lower hose clamps and put the upper clamps in place.

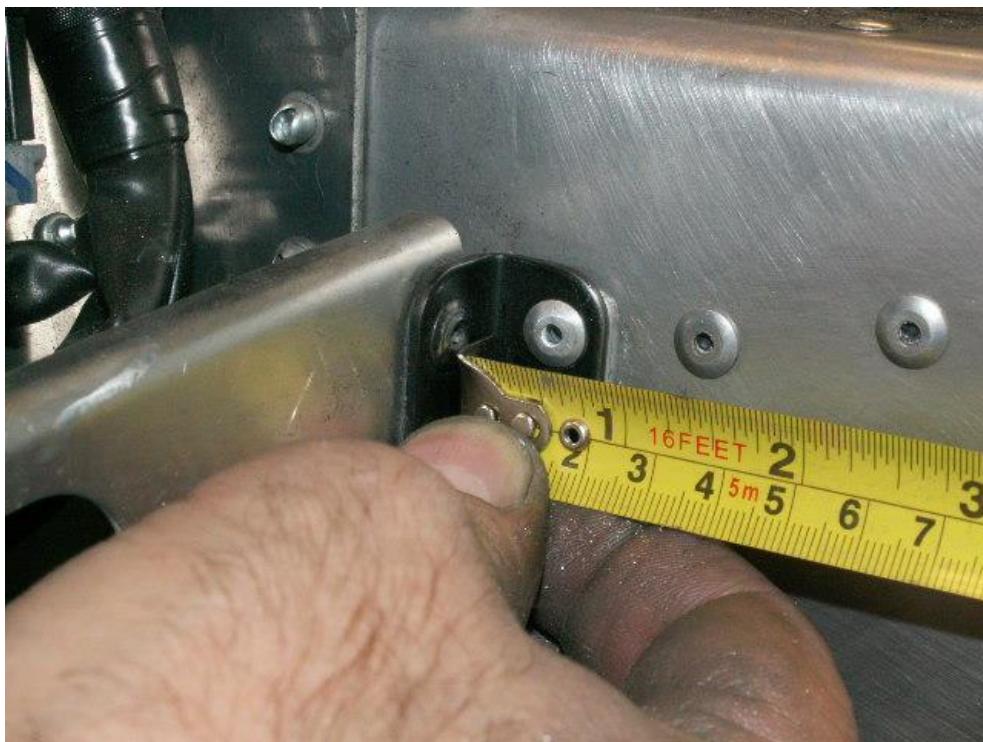
Secure the intercooler/plenum to the both rubber stays in the front and by the threaded M8 hook in the front.



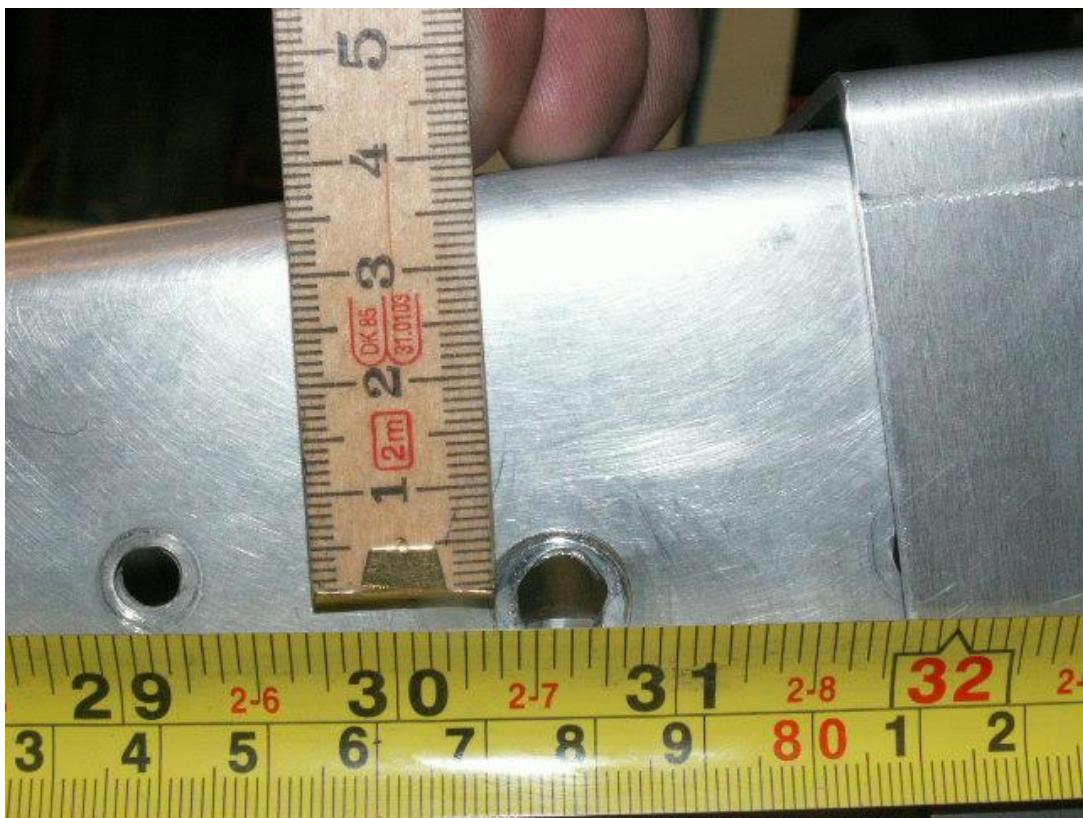
Install the blow off valve on the side of the plenum.
Connect the vacuum hose to the blow off valve. Secure the hose with a cable tie.
Connect the hose from the pre-cooler to the plenum.

Turbo installation

First of all a 25 mm solid aluminium bar shall be installed to support the turbo.
Begin with drilling two holes in the chassis.



Measure from this position



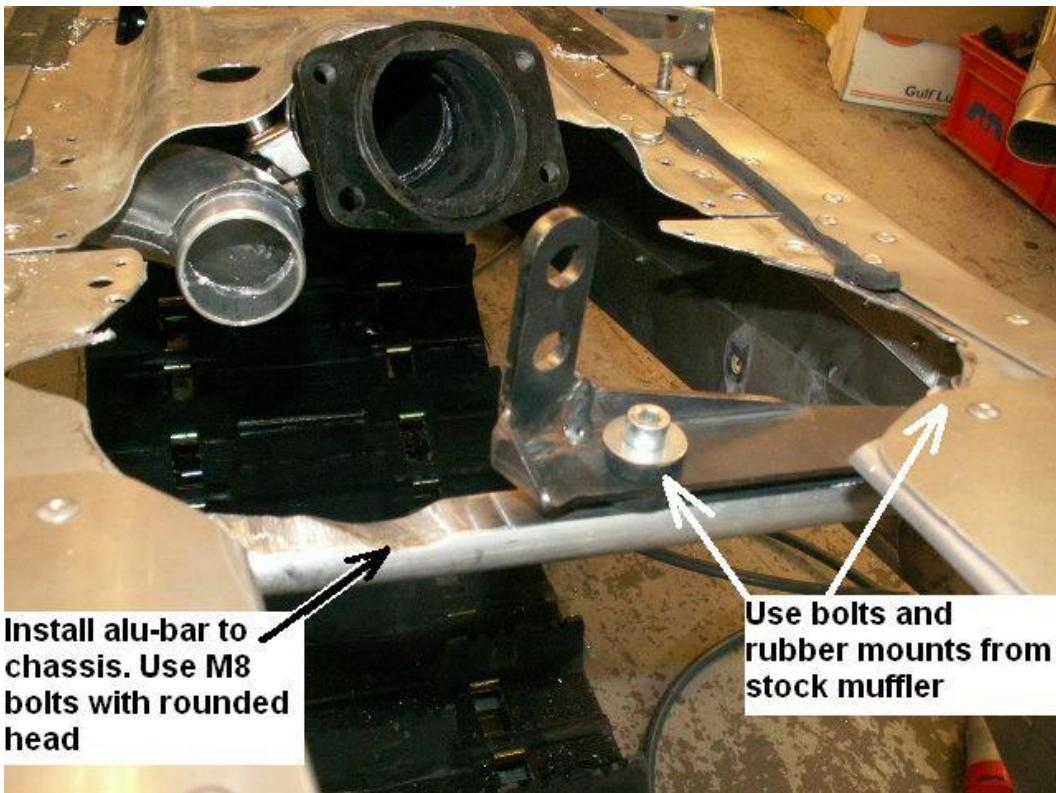
Drill a 8,5 mm hole on each side 778 mm rearwards (30,6") and 38 mm (1,5") down from the upper of the chassis.



Remove the gasket from the stock muffler inlet.
Install this gasket into the short pipe that shall be fitted to the turbo.

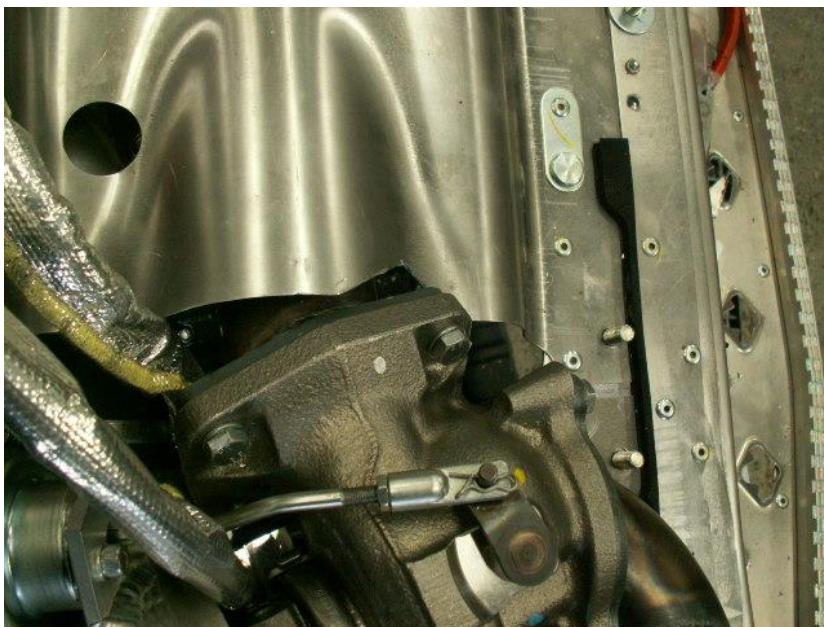


Install the short pipe to the stock exhaust system on the snowmobile.
Tighten the clamp a gently (=loose installation.)

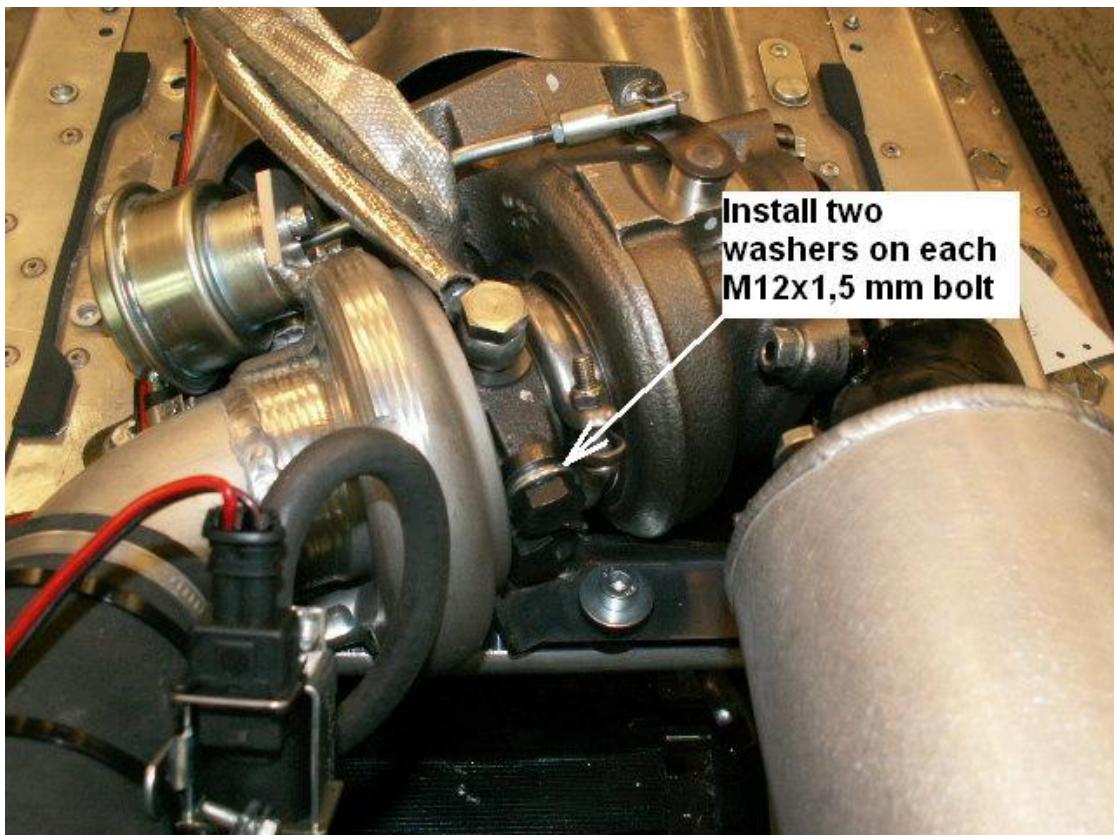
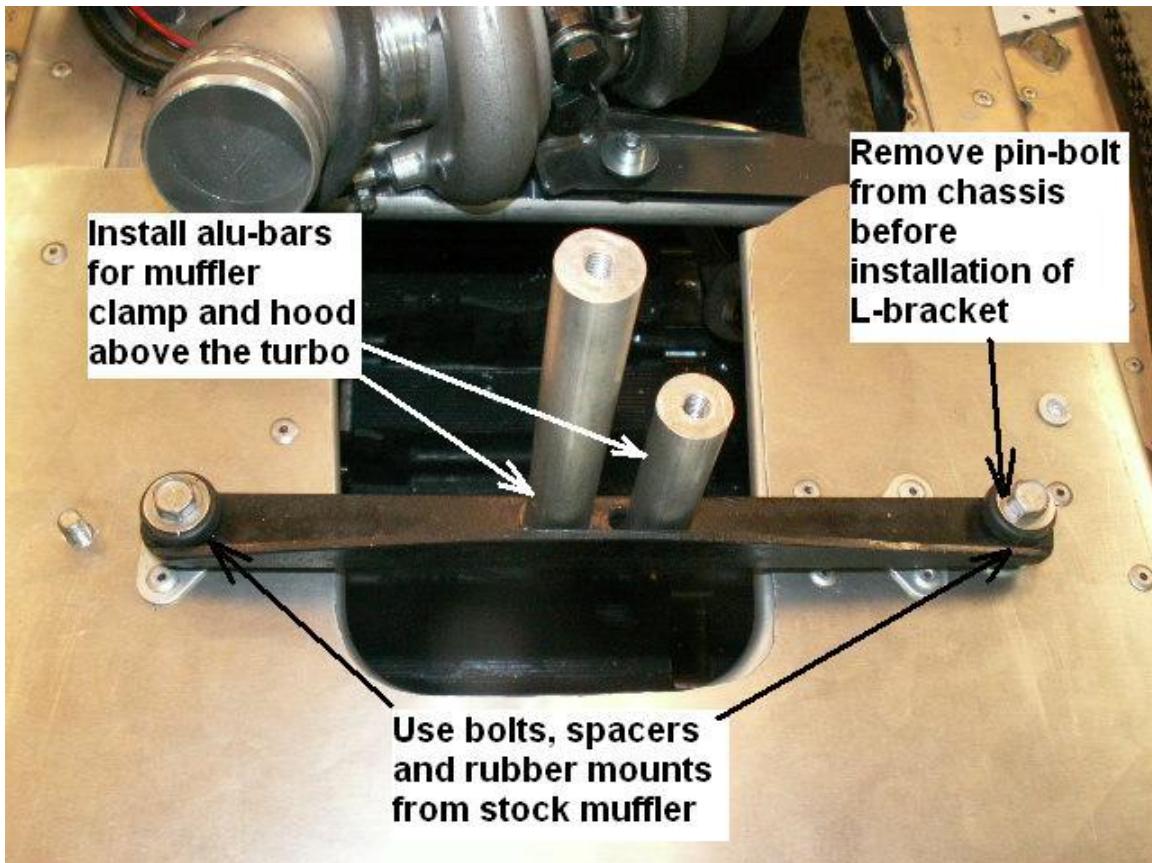


Install the steel stay behind the turbo to the alu bar under the turbo.

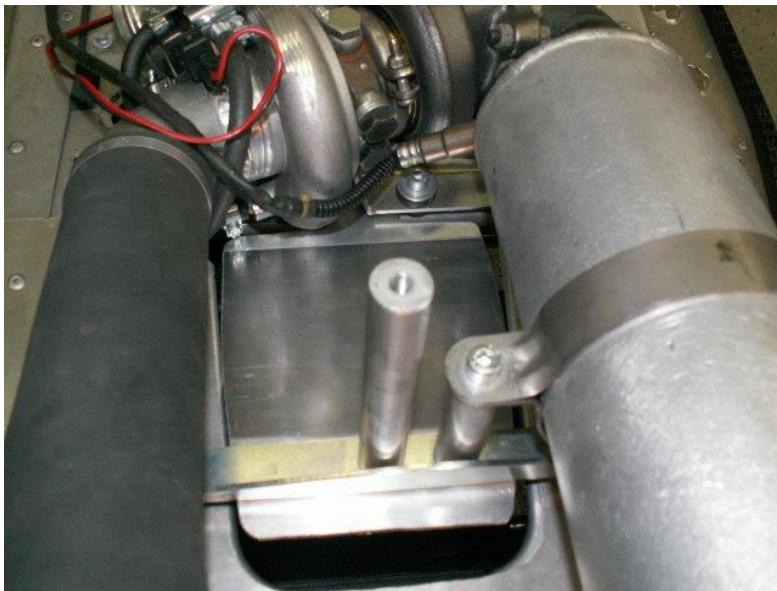
Use bolts, spacers and rubber mounts from the stock muffler. Install the alu-bar to the chassis where you drilled the two 8,5 mm holes. Use the M8 bolts with rounded head.



You have to cut a little in the plate just in front of the turbo.



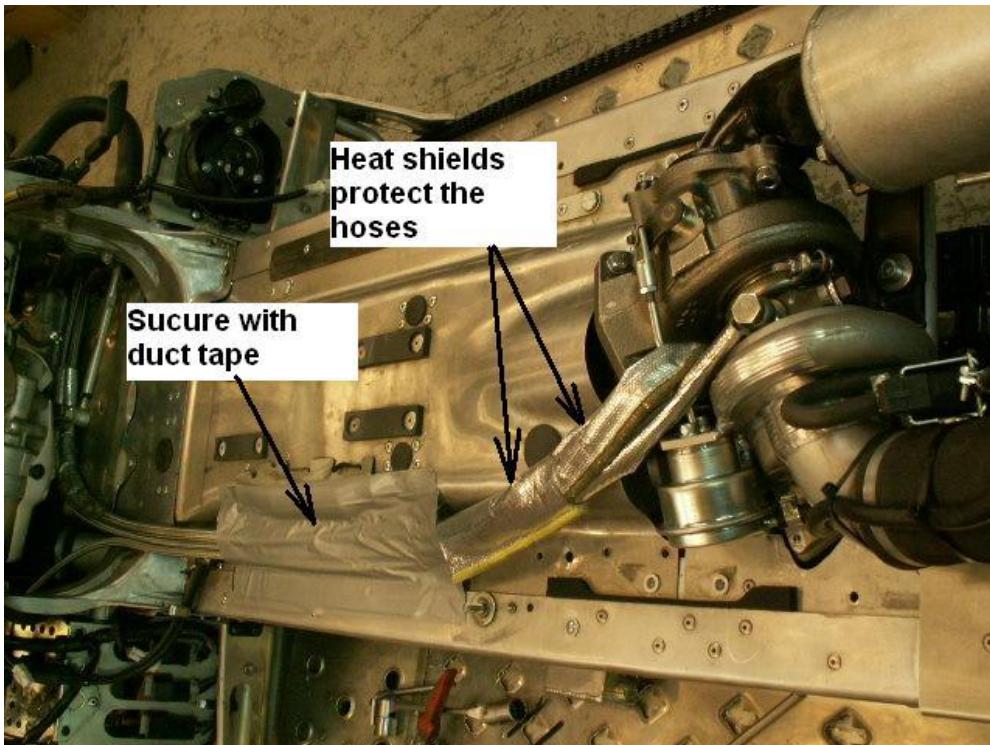
Install the turbo to the exhaust pipe on the front side and to the steel bracket on the rear side.
Use two washers on each M12x1,5 mm bolt.
Install the exhaust pipe to the turbo and then the muffler to the exhaust pipe.
Make sure everything fits fine.
Final tighten everything.



Install a plate behind the turbo like the picture.
(The plate is supplied with the kit)

Hose routing

Install the hose on the inlet of the turbo. Install the air intake with pre-charger snow protector.

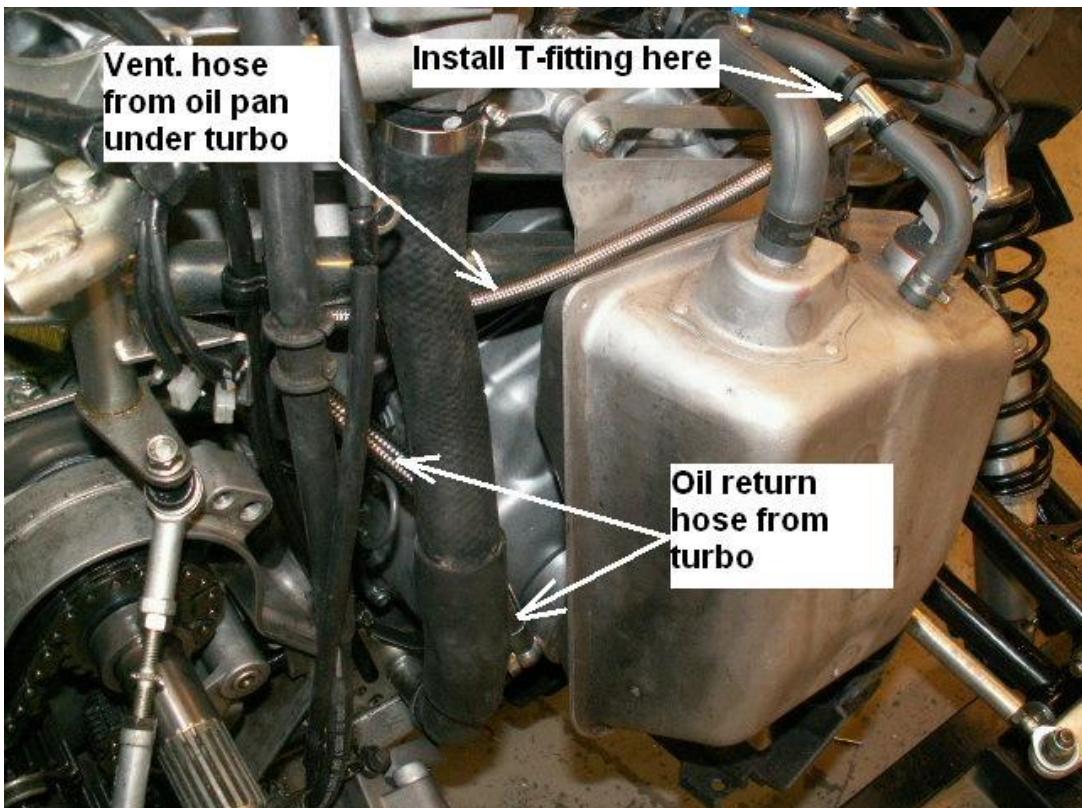
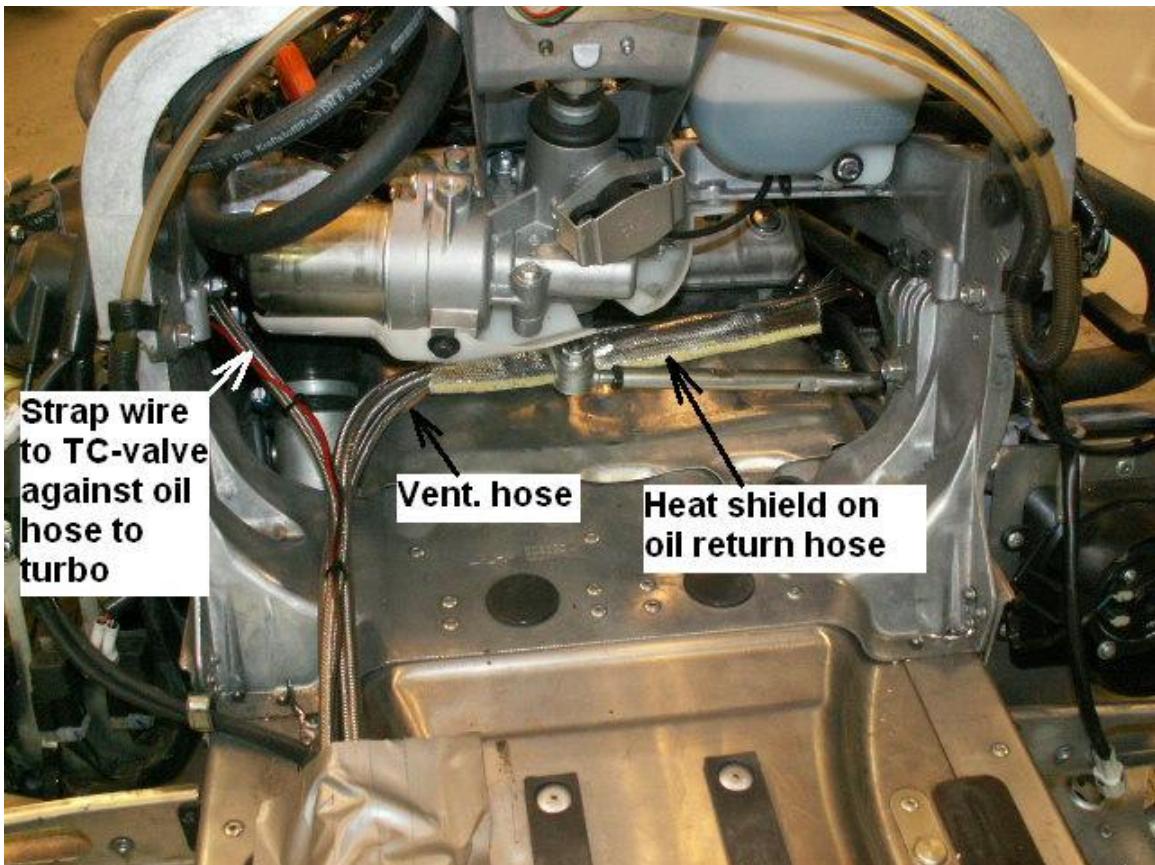


Lubricate the oil inlet of the turbo with motor oil. Install the oil hose (loose installation) on the top of the turbo.

Install the ventilation hose (to the front upper of the oil pan under the turbo) and the oil return hose to the oil pan.

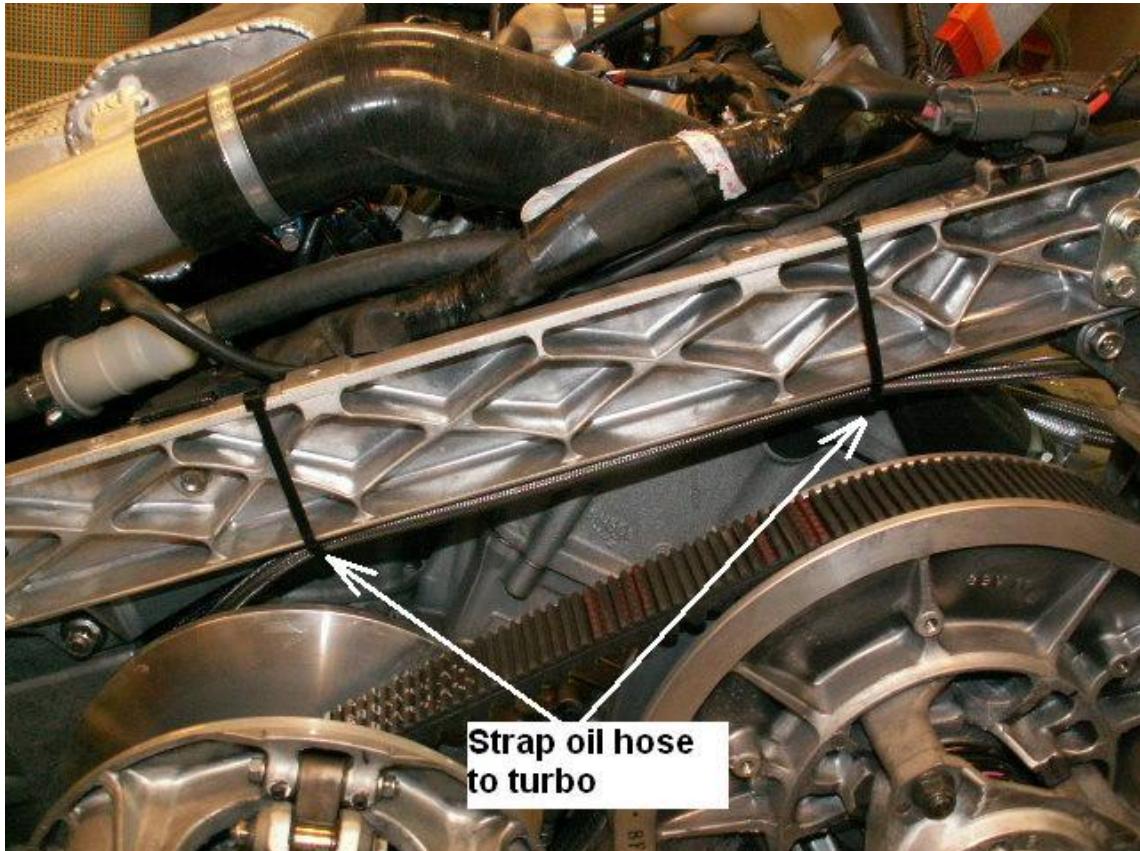
Install heat shields on the hoses like the picture.

Strap the TCV-wire to the hoses.



Install the oil return hose from the turbo to the oil pump on the engine cover.

Install the ventilation hose from the oil pan under the turbo by cutting the small hose on top of the oil pan. Use cable ties.



Preparation before start up.

Install the fuel tank to the chassis. Connect the fuel outlet and return hose to the fuel tank adapter.
Fill up the engine cooling system with anti freeze water.

Make sure you have oil in the oil tank.

Full up the tank with highest octane pump gas available.

Install the head lamp stay and the EFI-box to the stay.

Start up the engine

Start the engine before you put on the heat shield above the turbo. Search for leaks.

Caution: Loosen the oil inlet M12 banjo-screw on the turbo for a second just after you started the engine, just to make sure the engine and turbo get lubricated.

If you don't get oil pressure to the engine and the turbo, pressurise the oil tank with about 10 kPa (1 psi) and start the engine again.

If everything seems to be working fine, install the heat shield above the turbo.

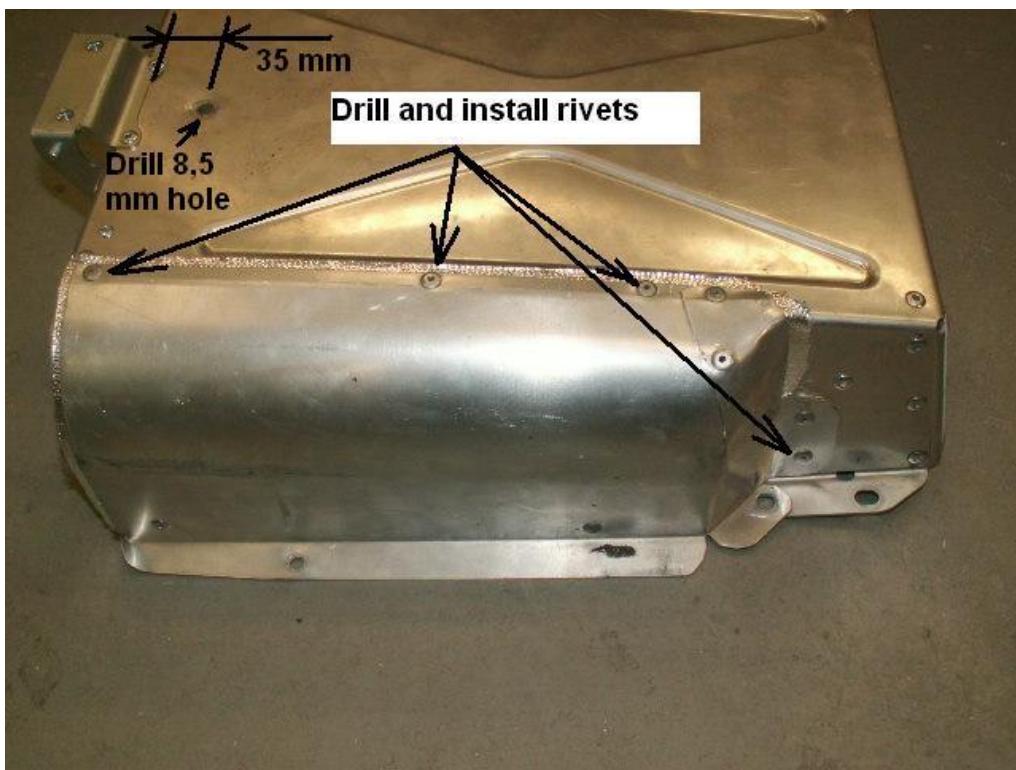
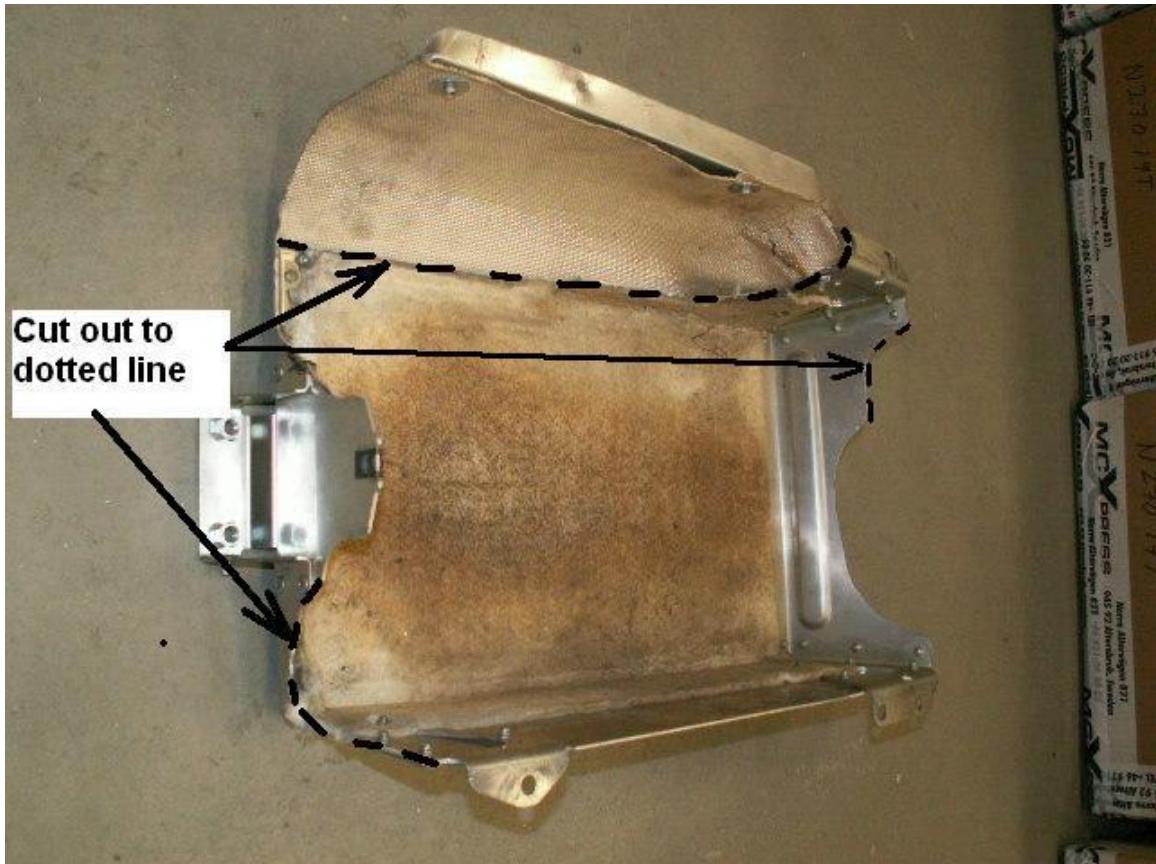
Install the seat.

Also install the front plastic fairings.



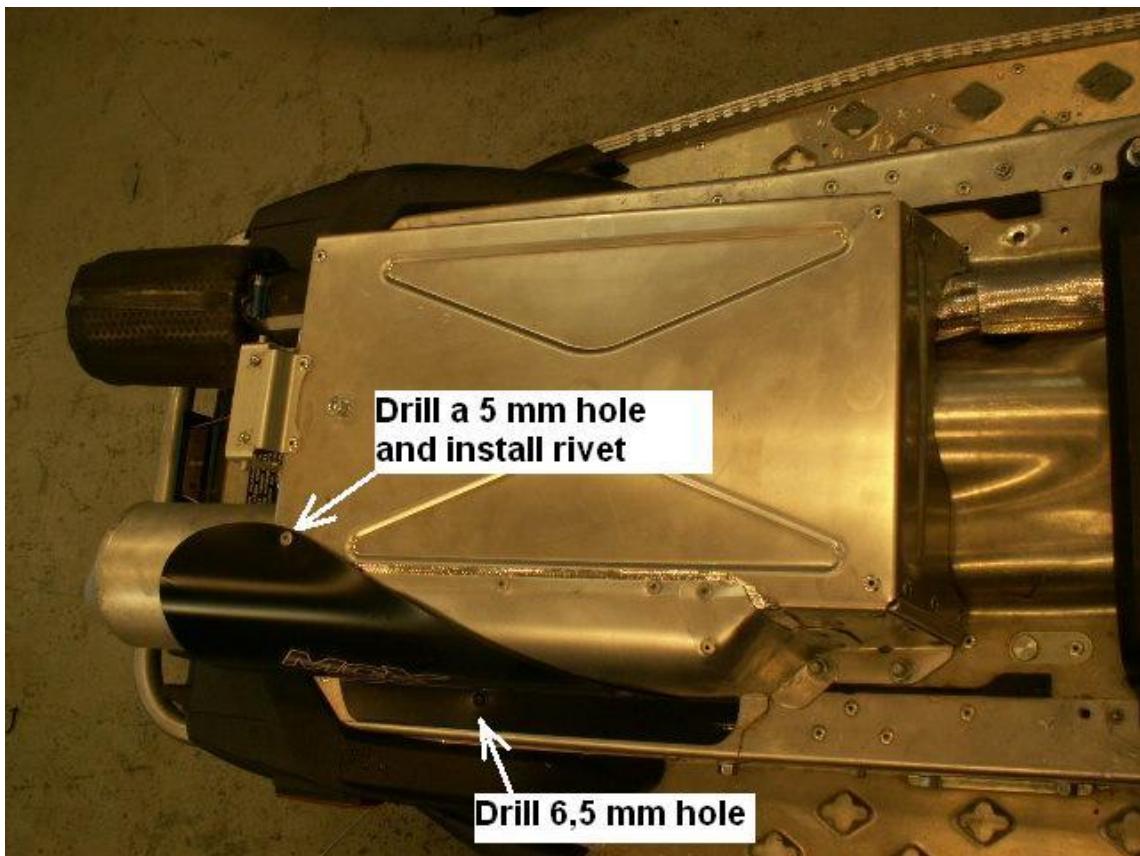
Heat shield above the turbo

The heat shield must be modified a little to make space for the turbo parts under.



Install the heat extended heat shield to the stock heat shield like the picture.

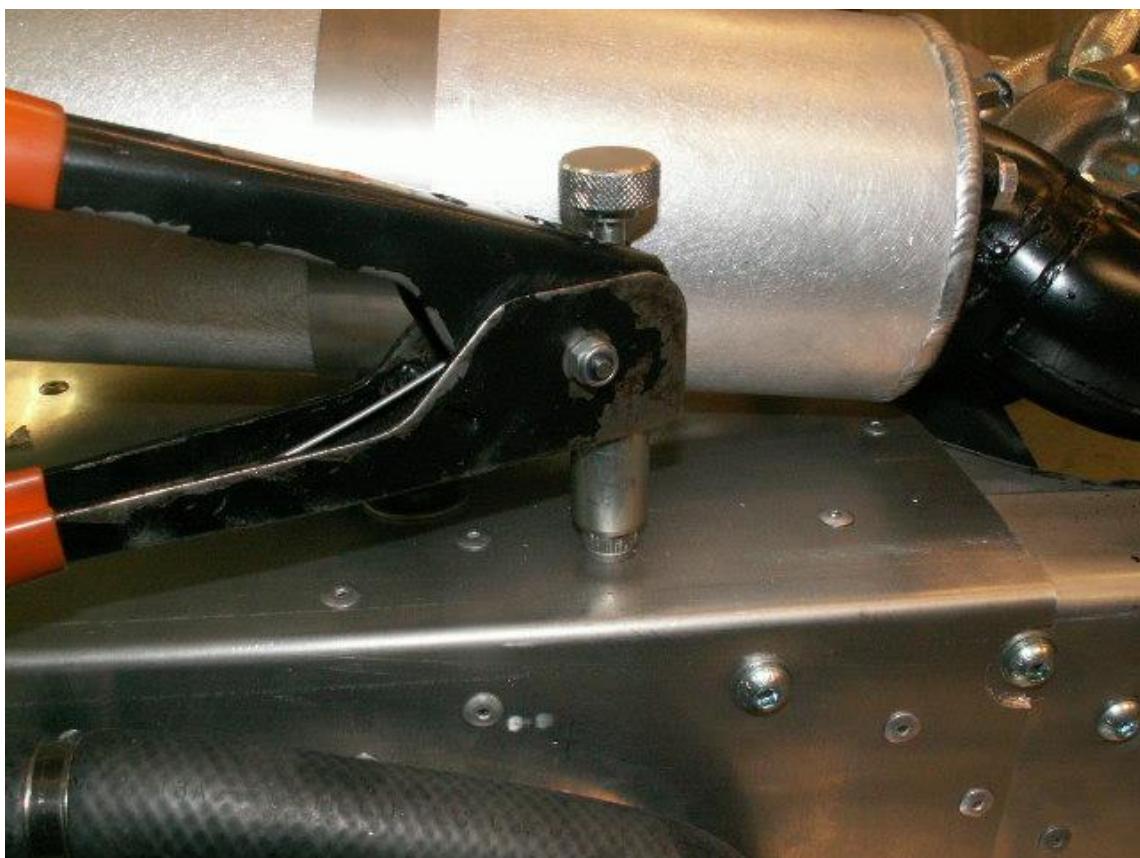
Drill a 8,5 mm hole in the centre of the shield, and 35 mm forward the rear steel bracket.



Put the heat shield in place on top of the turbo.

Hold the black alu-plate like the picture, drill and install the 5 mm rivet.

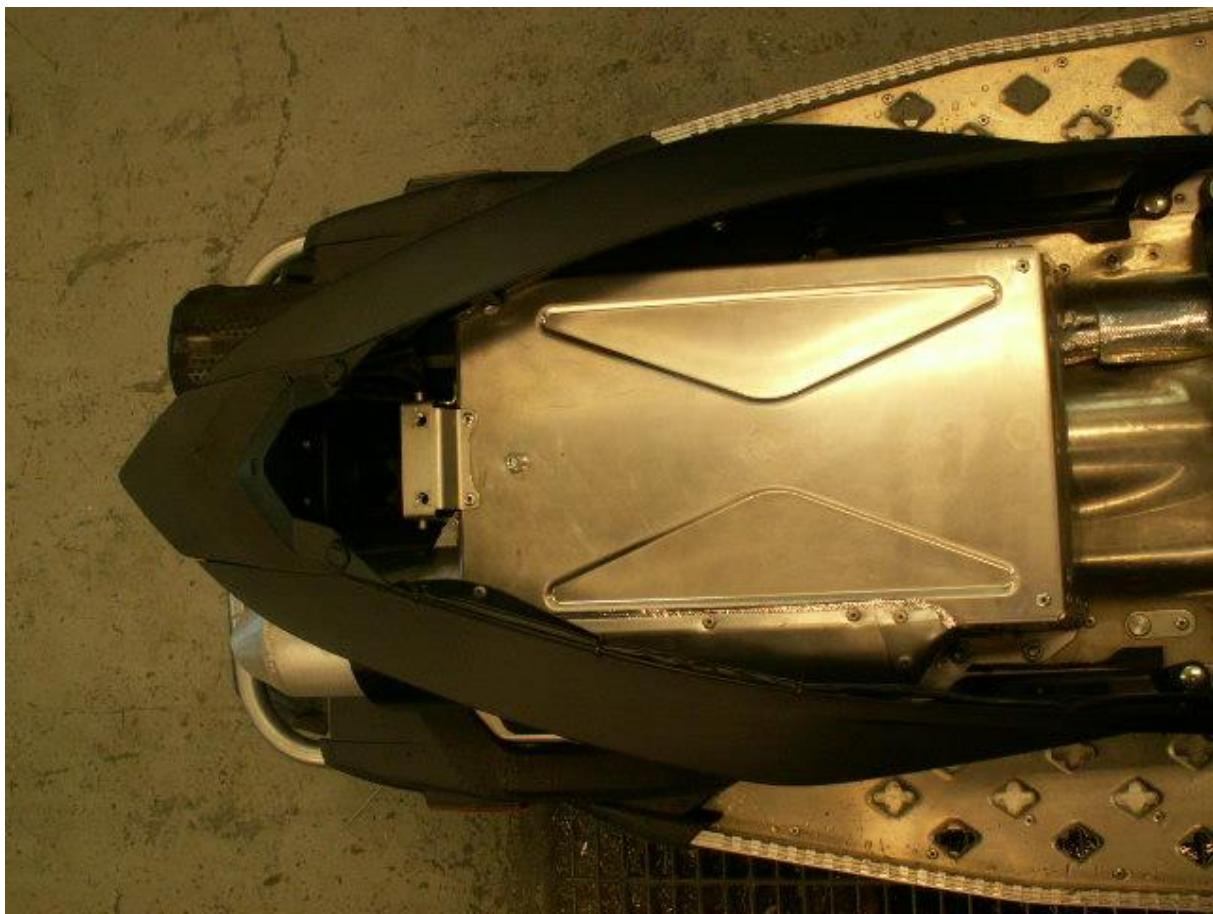
Drill the 6,5 mm hole on the right/rear side through the chassis..



Remove the heat shield and make the hole bigger and install a rivet nut like the picture.



Modify the plastic behind the seat. Cut at the dotted lines.



Install the plastic behind the seat and install the seat.

Test-driving

CAUTION: Always use high octane pump gas. Low octane may cause engine damages.

The turbocharger is set to about 200 kPa absolute pressure (=about 29 Psi).

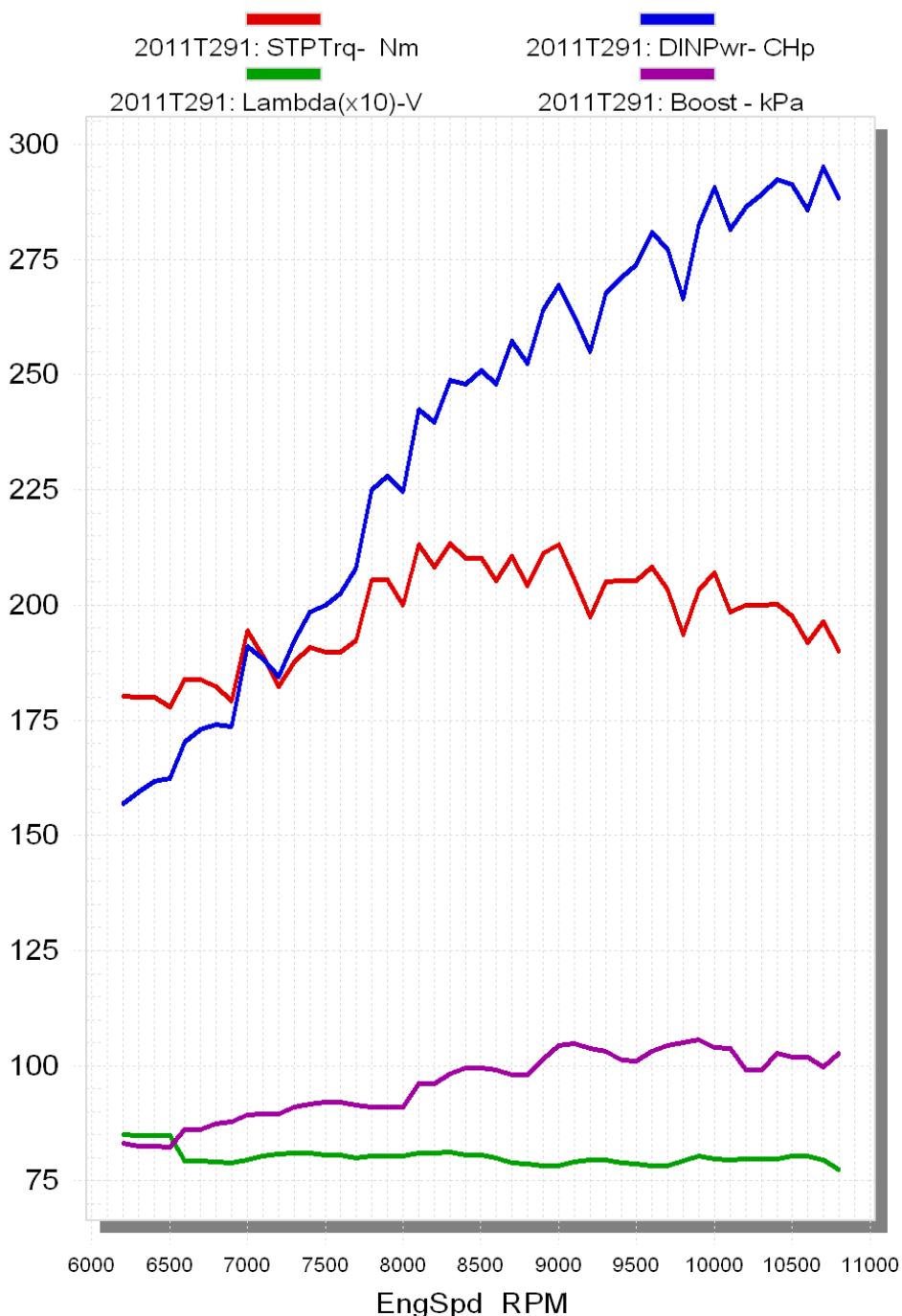
At sea level the baro pressure is about 100 kPa and the turbo pressure 100 kPa. (=14psi)

The power will then be about 210 kW. (=290 hp). The altitude compensation will remain the absolute pressure and therefore the power at any altitude.

At 2000 meters, the baro pressure is about 80 kPa and the turbo pressure 120 kPa. (=200 kPa total pressure)

Corrected Torque and Power

Apex 2011 290 hp turbo,



Using higher turbo pressure may cause engine damages.

If higher performance is requested, we recommend can offer some upgrade parts for this purpose.

When testing turbo pressure, we recommend connecting a gauge.

Connect the gauge via a T, on the hose leading to the blow off valve on the right side of the plenum.

The test shall be made at full throttle. The safest way is to do this in an engine dyno.

It can also be done out in the field. But take it easy.

Test-drive the snowmobile. Be careful in the beginning. Be sure the water circulates in the system.

(Check so the alu-coolers under the footsteps are getting hot.)

Check water level and oil level once again. Check for leaks and control so everything seems normal.

Good to know: Drive gently before the engine has reached proper temperature.

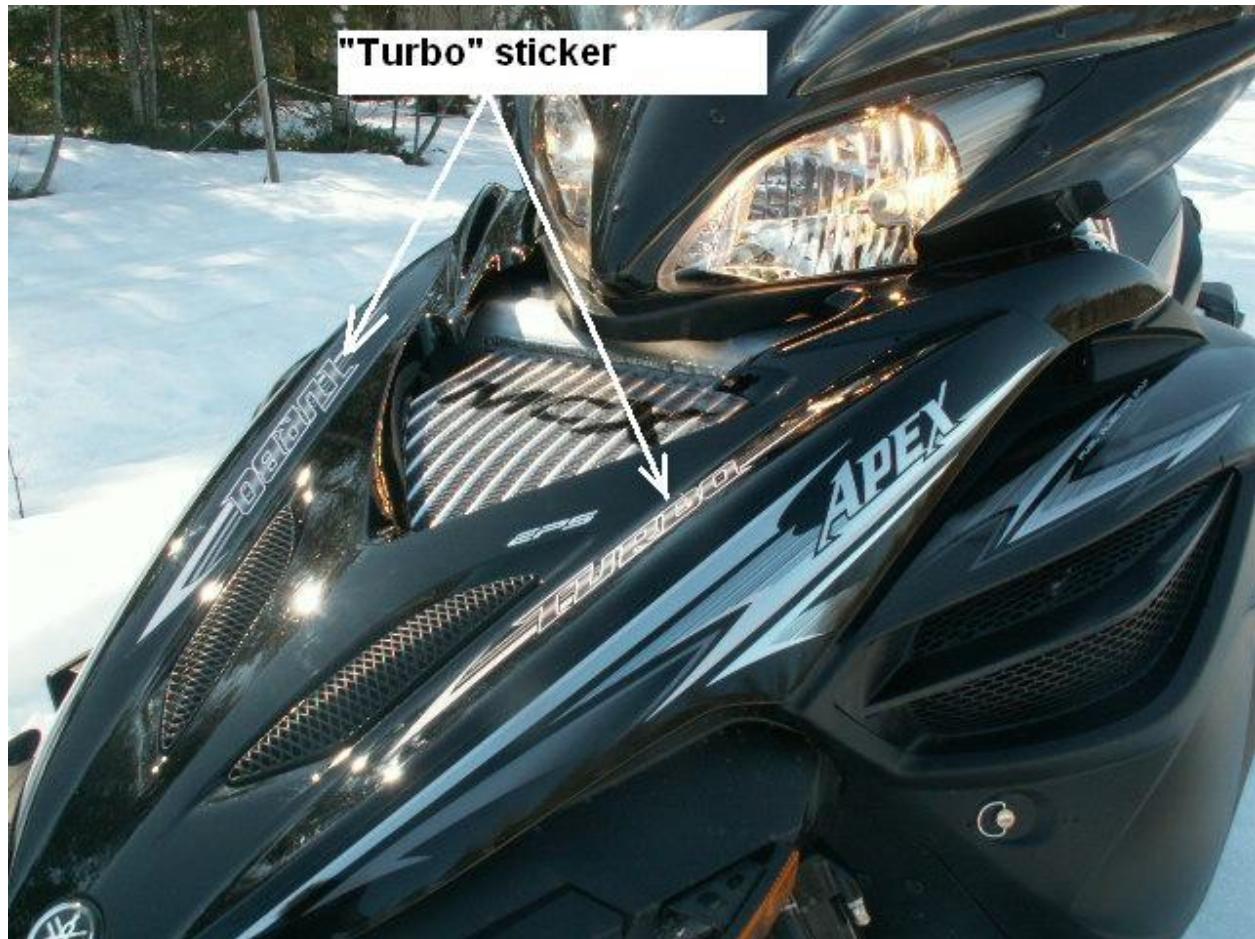
We don't recommend letting the engine idle until it's hot. It's better to drive slowly instead.

When you shall turn off the engine, just let it idle for about 10 seconds.

But drive very gently the last minute before you stop.

Stickers

Install the sticker set like the picture below.





We suggest installing an “MCX turbo” sticker on each side in the rear of the sled.

Remove the stock Apex sticker on the left side.

The small sticker Premium only (for USA/Canada) or 98 octane (for Europe)
shall be placed close to the tank cap.

Options:

The clutch has to be adjusted.

MC Xpress has developed a clutch kit with new weights that is possible to buy as an option.
Recommended max rpm is 10500 to 10800 rpm at full throttle.



Display unit (option)



This display unit is sold as an option to the 2007 and forward model turbo kit to Apex, Nytro and Phazer.

You can choose to watch the lambda value (=or air fuel ratio), the MAP (=manifold air pressure) the RPM and some more things. The display can also data log 10 times every second (=sample data up to 60 minutes driving). This data can via an USB cable be transferred to your PC-computer. From the computer, you can also adjust the air/fuel mixture, the turbo pressure at different rpm and load, the altitude pressure compensation and some other things.

This is a very helpful tool that is easy to use for the people that is interested in technical things.

Snorkel kit (option)



When driving in deep snow, the air intake can be covered with ice and snow. During deep snow riding, we recommend installing a snorkel kit like the picture. (Picture above is from 2006-2010 Yamaha Apex MTX)