

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.

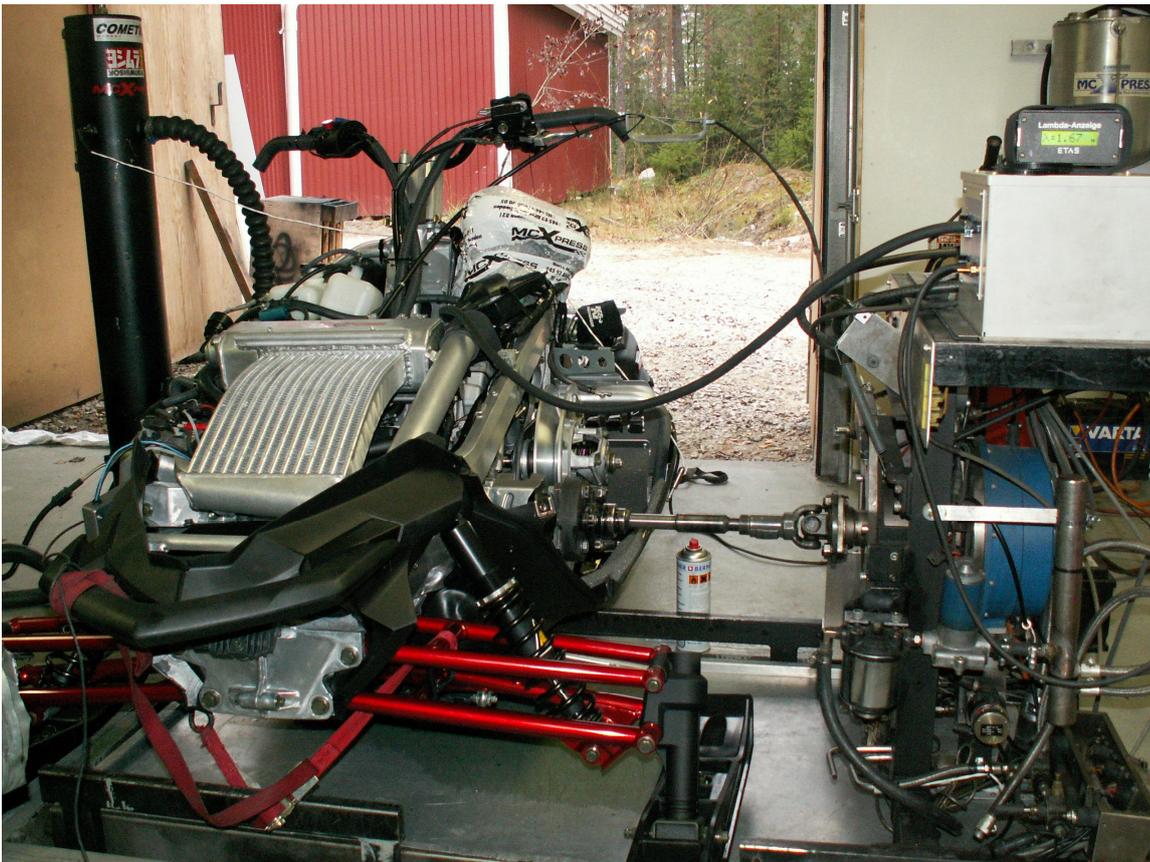
Read this manual carefully before you start with the installation.

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 turbo tested in the SF901 dyno

Before the installation

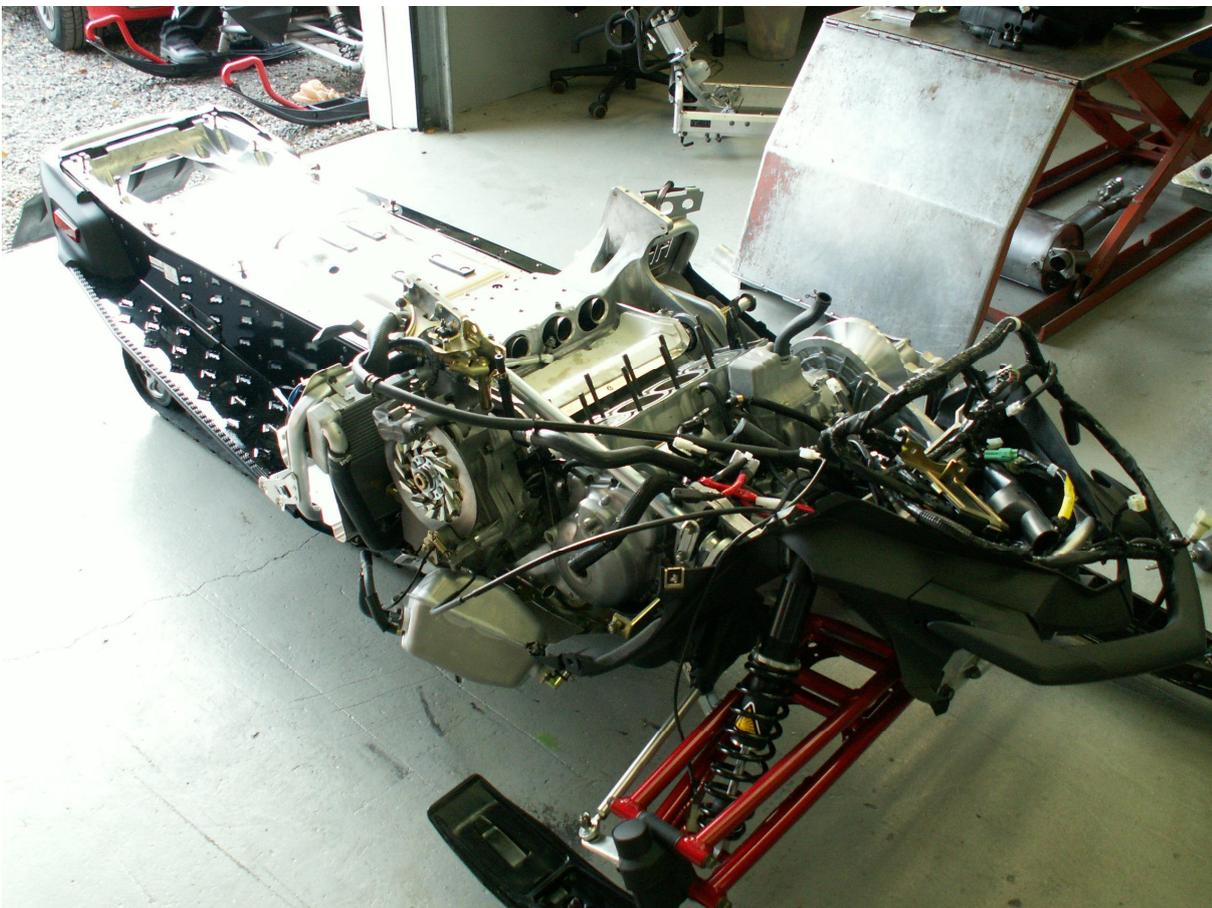
To make the installation as efficient as possible, we recommend you to follow these instructions.

Remove the seat, muffler, hood, plastic fairings, fuel tank and some other parts until the snowmobile looks like the photo below

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.



Lowering the compression ratio

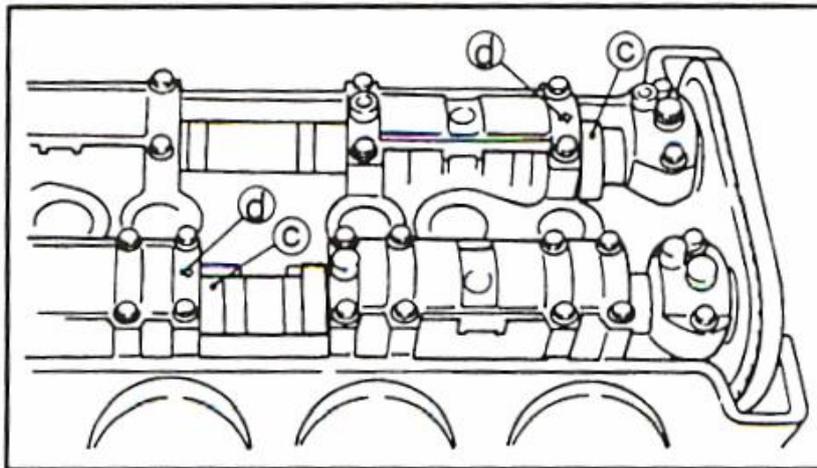
To compression ratio has to be lowered by two reasons.

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 picture upper left)
 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.

Install the pre-cooler

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.



Drill out the rivets and remove the heat protected aluminium plate on top of the secondary clutch shaft. (See photo below)



Remove the left aluminium profile under the tunnel by drilling out the rivets. (This profile is not installed on the mountain models)
Cover the engine-cylinders with a blanket or similar to avoid dirt from the drilling to fall down in the engine.

Drill a hole like the photo below about diameter 60.



The pre-cooler shall be installed as high and as much left it is possible in the tunnel. To make it possible remove both rivets on the steel bracket (see arrows on left photo below)



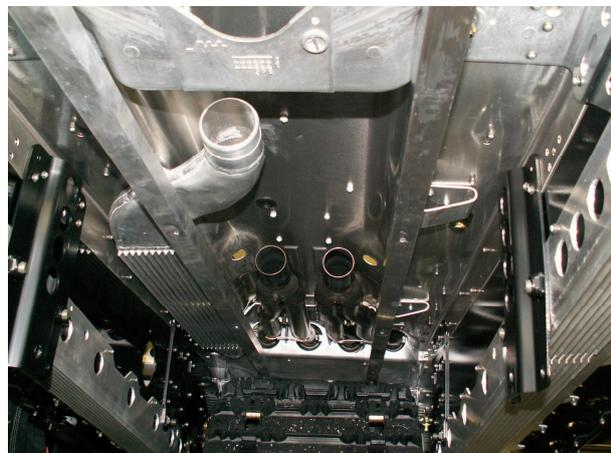
On the Apex Mountain, we recommend to cut away the left side of the stay to make as much space between the track and the pre-cooler as possible.

Try in the pre-cooler in its position. Adjust the size of the front hole by grinding it until you are satisfied. Drill a hole from under and install the pre-cooler to the chassis by the screw supplied.



On the Mountain models, we recommend to Drill out the four left rivets on top of the Pre-cooler and replace them with four M5 Screws supplied with the kit. The nuts shall be placed up. Cut the screws as low as possible after installation

Remove the two stays on the left aluminium profile before you install it again.
Use rivets supplied with the kit. (Not on Mountain models)



Install the 325 mm long P2 hose to the pre-cooler with a hose clamp.
Install the heat protection aluminium plate on top of the secondary clutch shaft again by using new rivets.



On the 2006 model Apex Mountain, we recommend installing a shield like this picture. Contact your local MCX dealer or MC Xpress directly.

Install the cylinder head

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 photo below)



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

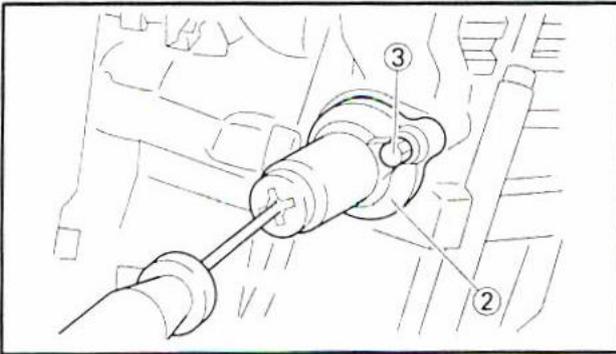
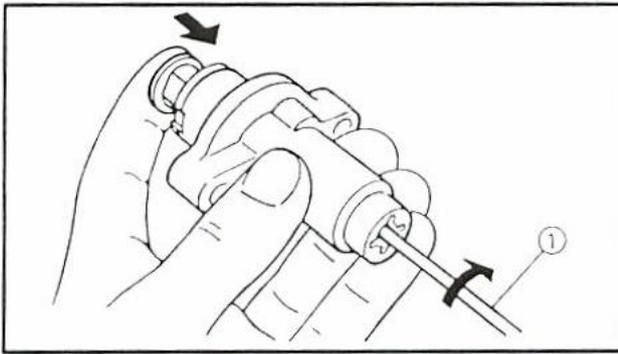
Install the cam bearing crews ðall togetherð to avoid the cam shafts to be damaged.

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, wind it to its inner position with a screw driver.

After installing the tensioner, use the screw driver again and relief the spring inside and make sure the tensioner starts to work.



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 shims are proper installed.

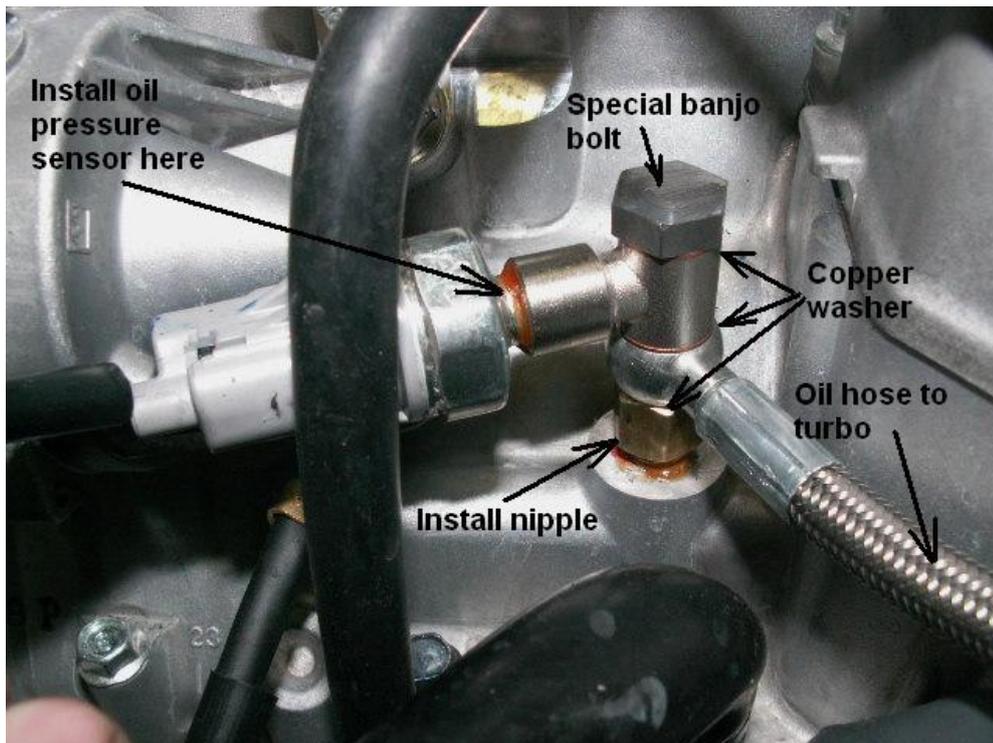
(If one shim has moved from its position in the upper valve spring retainer when the cylinder head has been off, **engine failure will follow.**)

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

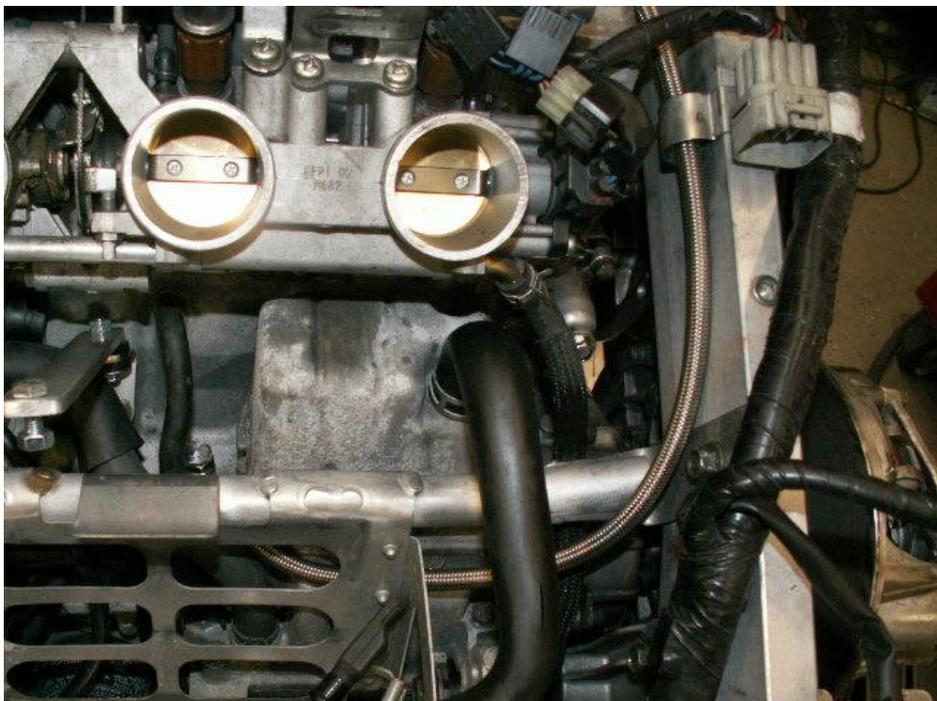
Install the heat shield above the exhaust manifold. You have to cut a little on the left side to make space for the pre-cooler. Install the pressure hose from the pre-cooler and the plenum to the pre-cooler now.



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.

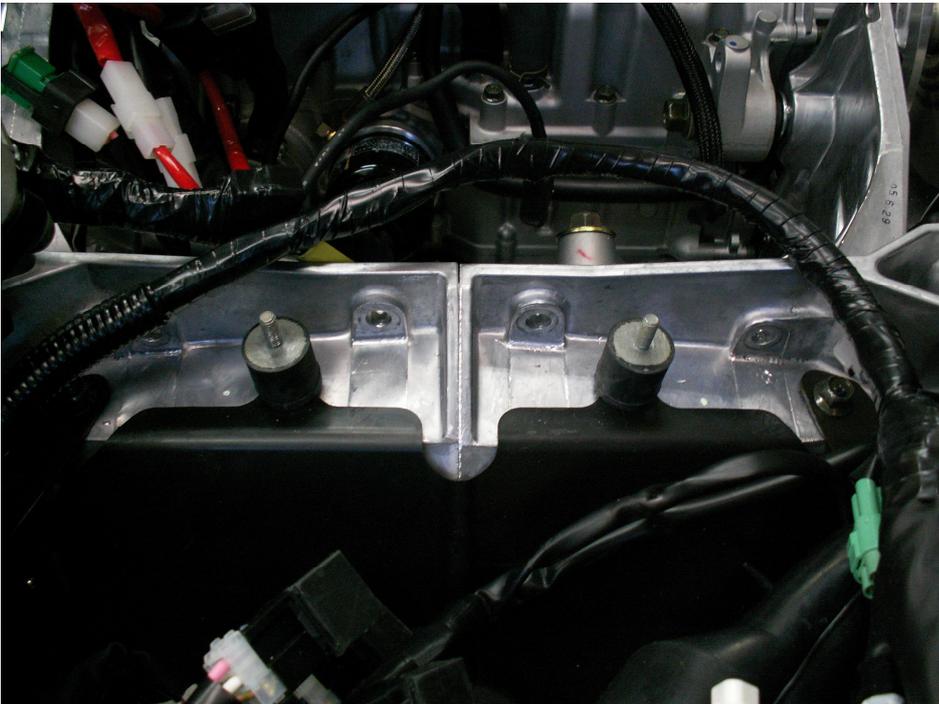


Install the turbo oil hose and route it like the picture.

Install the L-shaped bracket on the upper starter engine bolt.
Install the bracket 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 two rubber stays like the photo below. (for the intercooler)



Install the aluminium frame above the engine again.

Oil pump installation

The oil that has lubricated the turbo has to 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.

You don't have to drain the tank, just push it to the side so you can remove the right engine cover.

When removing the engine cover, be careful so you don't hurt the gasket.

Remove the centre screw that keeps the flywheel, and replace it with the new one supplied with the kit. Tightening torque is 120 Nm.

(Inside the stock fly-wheel screw it's located a steel pin. This pin shall also be removed.

Some of the lubrication oil inside the crankshaft has before the turbo installation cooled down the generator. Now, the return oil pumped back by the oil pump will do the same.)

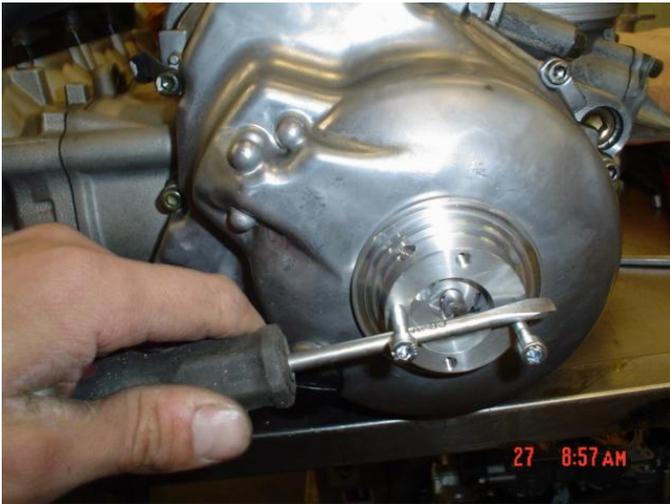
The centre hole of the washer has to be grinded up a little.

Install the engine cover again.

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.



Install the pump gears and the small 3 mm pin.

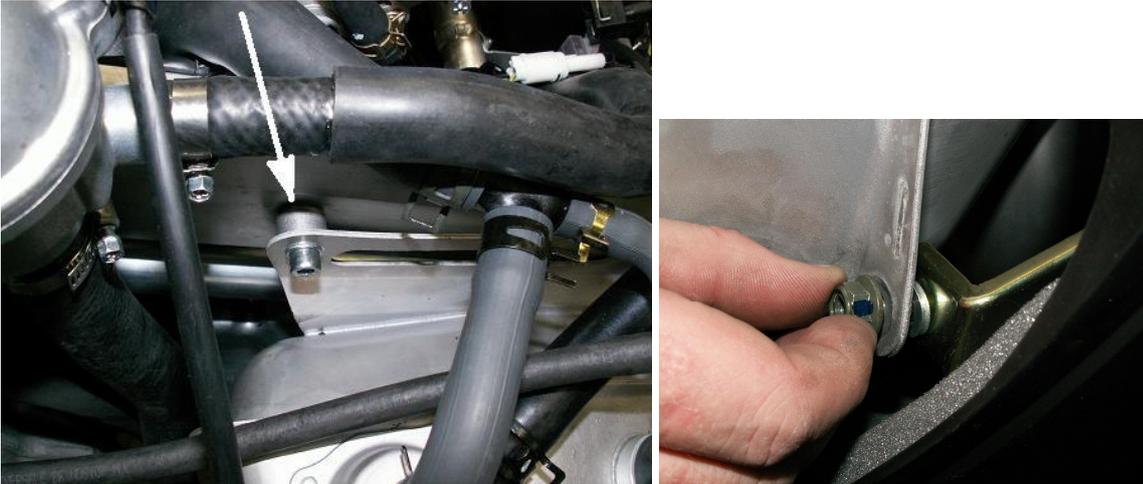
Caution: Lubricate with motor oil the pump gears before you put the pump together.

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 bolt 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.

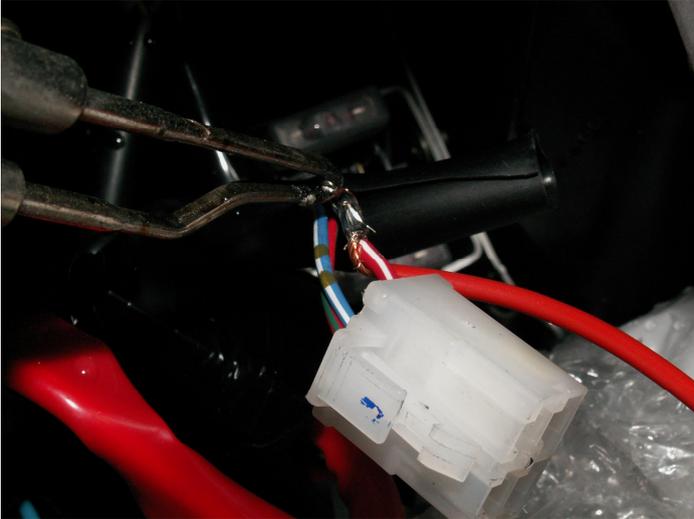


EFI-box installation

The stock fuel injection cannot deliver enough fuel. Four extra injectors are installed in the plenum. These injectors are controlled by an EFI-box supplied with the kit. Install the new EFI box in front of the steering stem like the picture. Connect the ground wire from the EFI wire harness to one of EFI box screws. A pressure sensor is located inside the EFI-box. A hose from the throttle bodies shall be connected to the EFI-box. (more info on page 16)



The EFI box will also control the turbo pressure and power through the TCV (=Turbo control valve) located behind the turbo. Another pressure sensor is located inside the EFI-box. This sensor informs the EFI-box about the altitude you are running at and raises the turbo pressure thanks to the TCV the higher you go to maintain the performance of the engine.

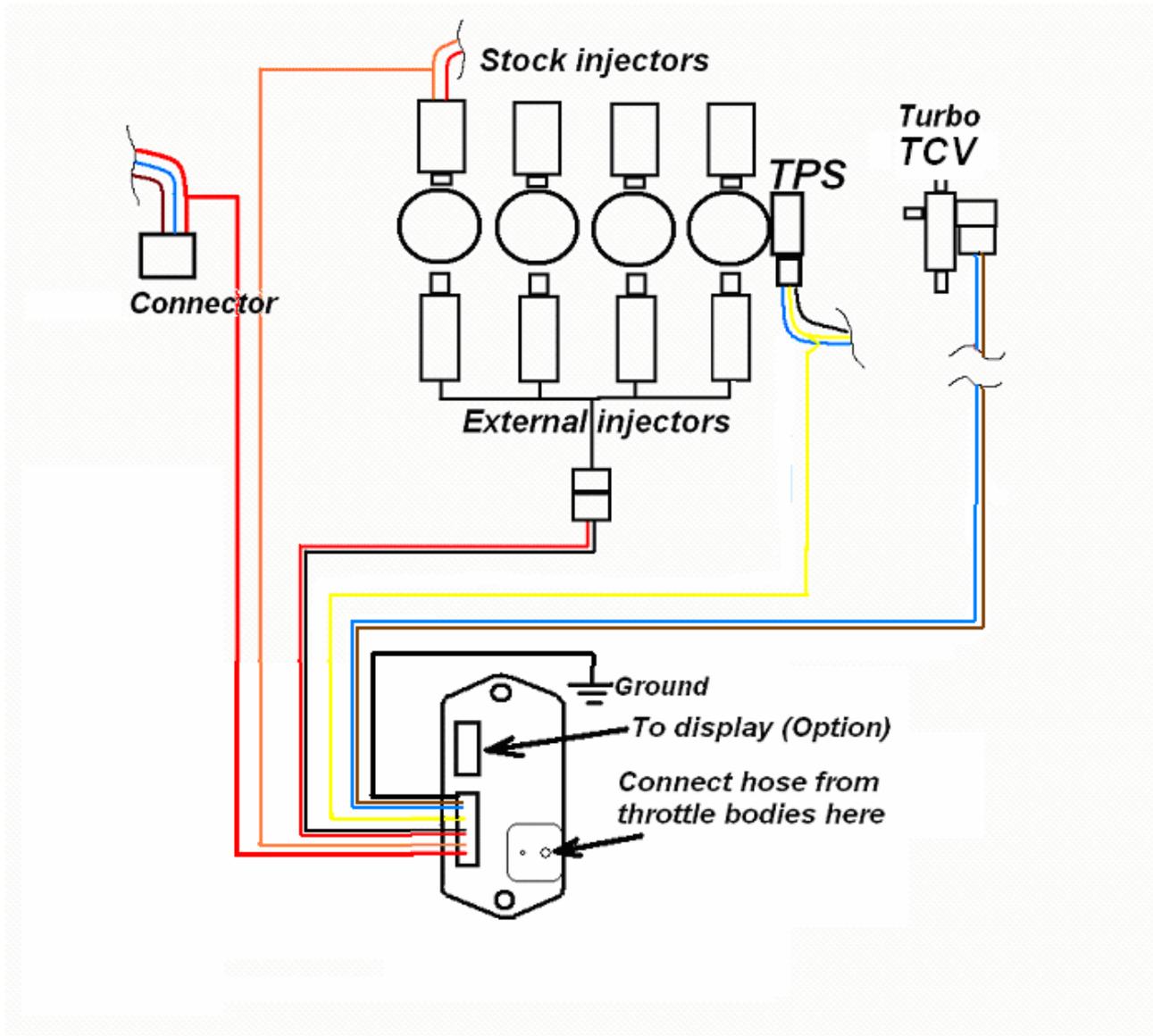


Find the connector to the starter solenoid located on the side of the battery.
The red cable (+) to the EFI-box shall be connected to the red wire with white tracer. (Use solder)



Find the connector on the left side of the frame on top of the cylinder head.
The orange cable (rpm signal) shall be connected to orange cable with black tracer.
The yellow wire (Throttle position) shall be connected to the yellow wire on the stock wire harness.
Use solder to get a good connection.
Plug in the connector between the EFI-wire harness and the plenum injectors.
Later, plug in the connector to the TCV (Turbo control valve) located behind the turbo.

EFI-wire harness



Vacuum hose routing

Install the hoses to the throttle bodies now.

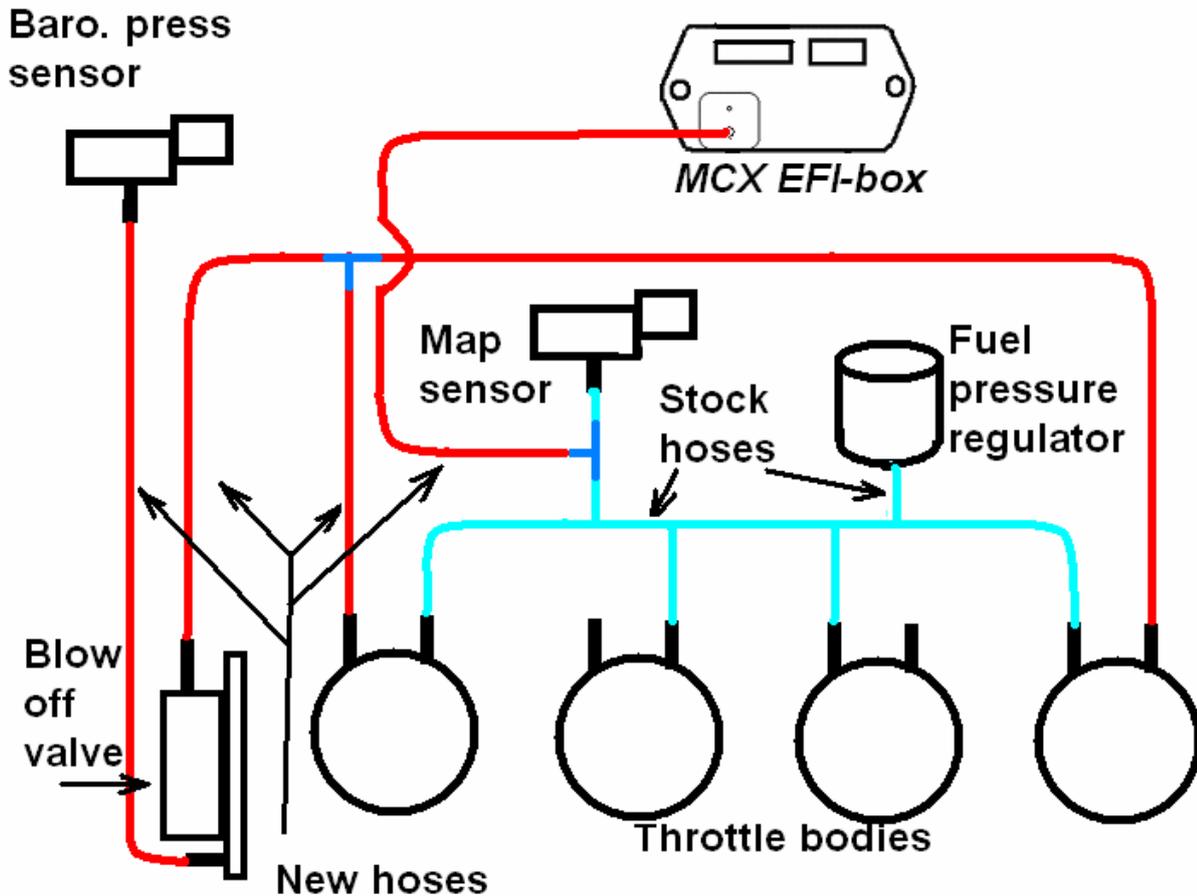
The new hoses are marked with red colour on the schedule below.

The barometer pressure sensor located down in front of the battery shall be pressurised from the plenum air box. We recommend relocating this sensor to a position above the blow off valve.

This will prevent water from freezing in the hose to the sensor.

Cut the stock hose leading to the Map sensor on top of the throttle bodies and install a T-connector. Pressurise the small nipple on the MCX efi box.

If you want to connect a pressure gauge, install a T on the hose to the blow off valve.



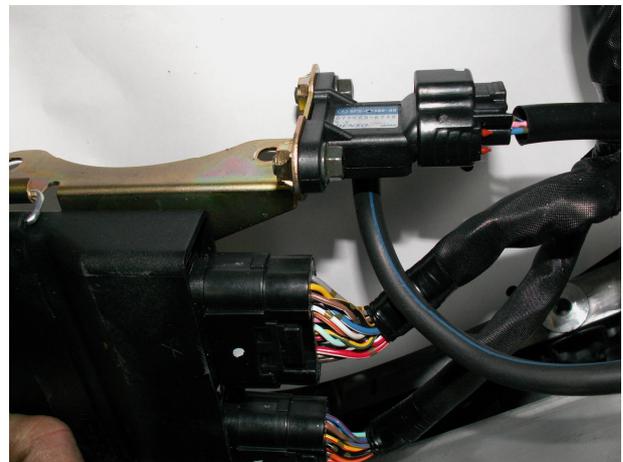
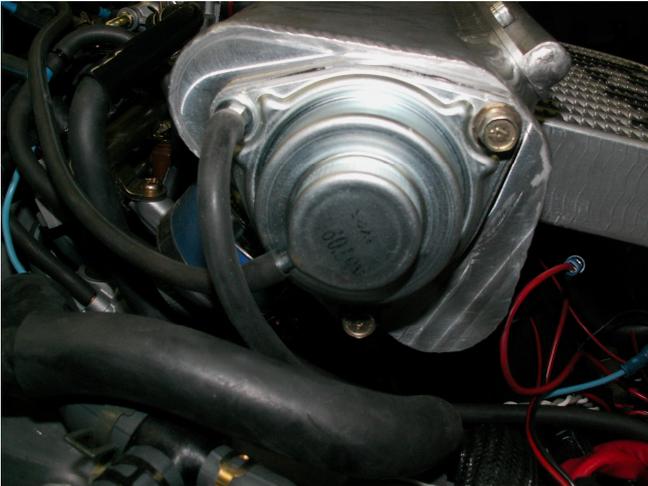
Plenum/intercooler installation

Move the temp air sensor located on the side of the stock air box.
Connect it to the wire harness and strap it like the photo below.



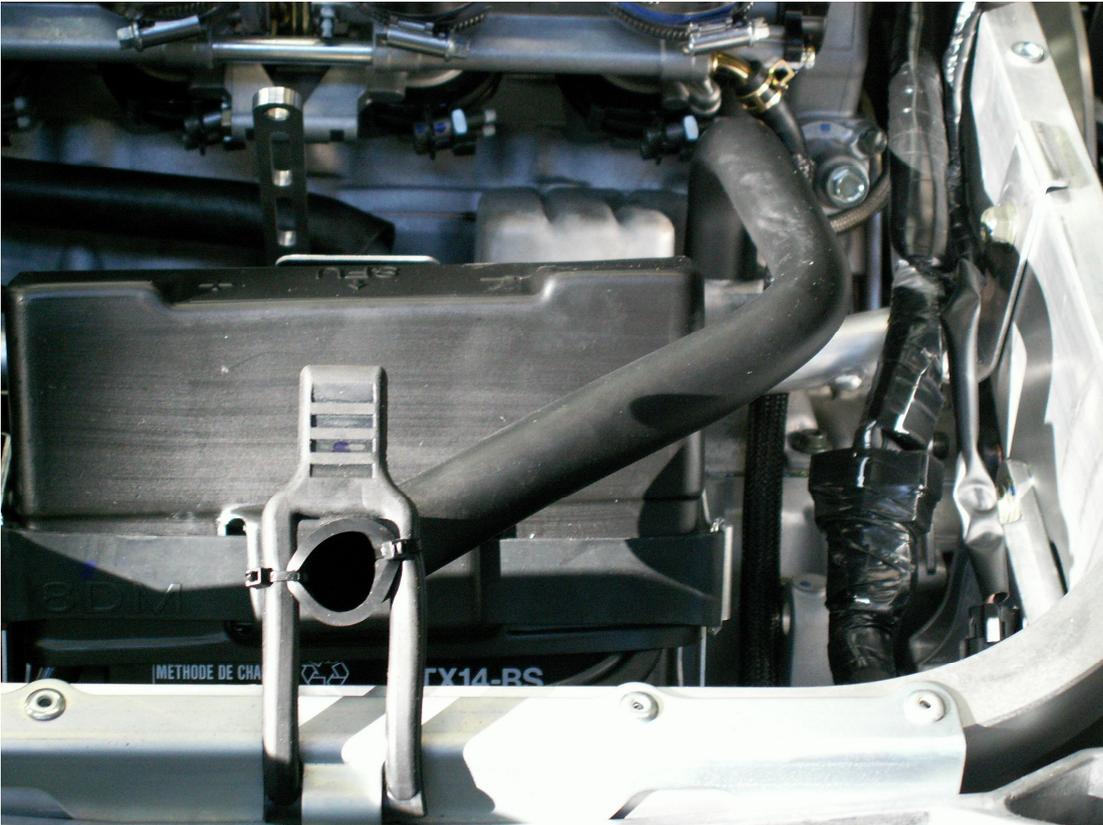
Blow off valve.

Install the pop off valve to the right side of the plenum.



(Stock location of the baro-sensor)

If you often drive at altitudes higher than 1500 meters we recommend pressurizing the stock barometric pressure sensor located in front of the battery. Install a nipple on the blow off valve (see upper picture) and connect the hose to this nipple. We recommend relocating the stock baro sensor to a position higher than the blow off valve. The wires to the sensor must be extended. If you never drive as high as 1500 meters, do not pressurize this baro sensor.



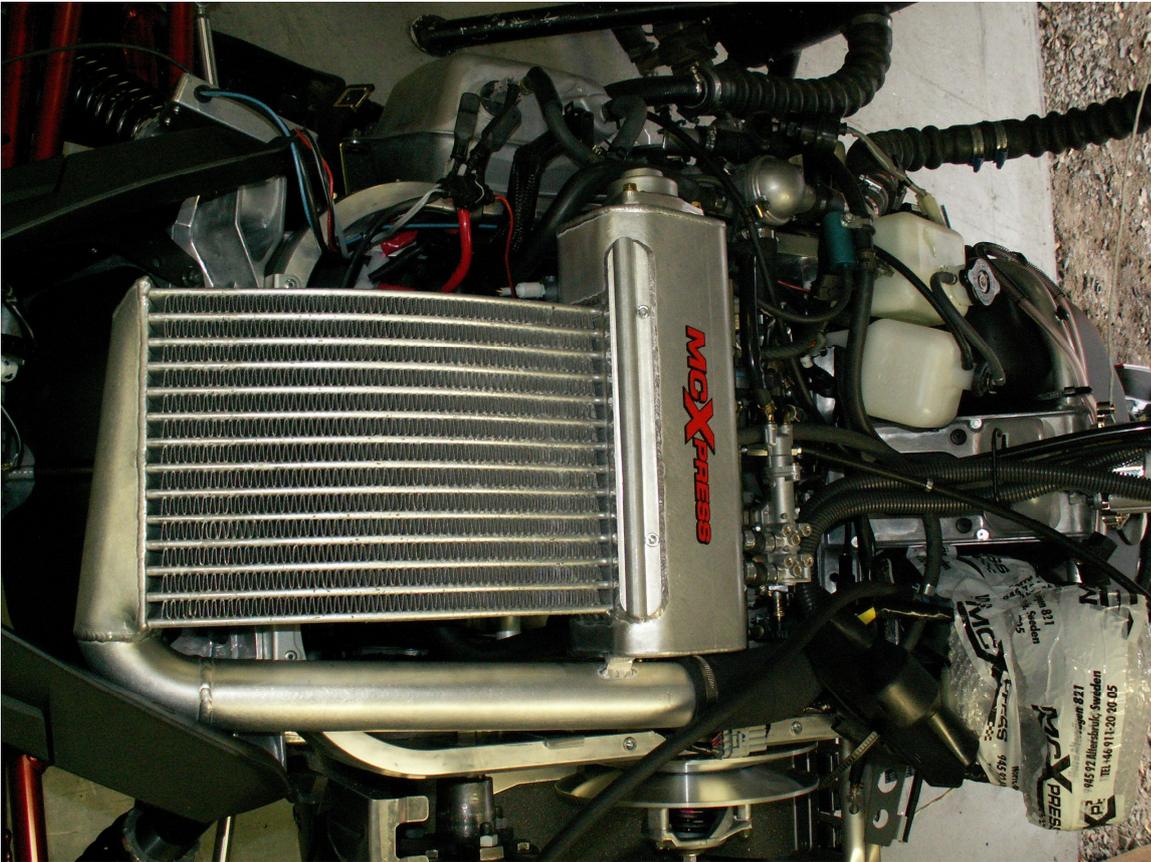
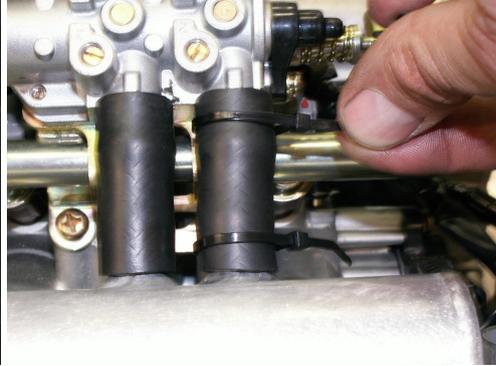
Install a hose from the crankcase breathing system and secure it to the rubber mount with two cable ties like the picture above. Open the stock air box and use the hose you may find inside.

Install the plenum against the throttle body by using 4 hoses and 8 clamps.
Plug in the connector from the extra injectors to the wire from the EFI-box.
Connect the hose from the pre-cooler to the plenum.
Modify the stock oil plug on the valve cover by cutting off the top of it.



Secure the intercooler/plenum to the both rubber stays in the front and via a bracket to the engine in the rear.

Use cable ties for the 14 mm hoses (picture below)



Turbo installation

Now it's time to install the new Y-shaped exhaust tube between the stock exhaust system and the turbo. But first, remove the clamps and the exhaust gaskets from the stock pipe.



Install the turbo

Use the stock rubbers and screws when installing the aluminium bracket to the chassis.

Install the two-plastic side covers and the both coned end caps.

The muffler can be moved a little up and down before you tighten the screws.

The whole turbo can be adjusted a little before you torque both M12 screws that keep the turbo to the aluminium sub frame.

The left side end cap can rather easy be adjusted sideways and up/down with a gently knock with your hand. The aluminium bracket are rather soft.



Warrior and short track models:
Install a shield between the air filter and the turbo to avoid moisture to be sucked into the intake system.



On the mountain models: Install the 60 mm 90 degree hose bend and the pre-charger holder + pre-charger like the picture. Note the TCV-valve location behind the turbo.

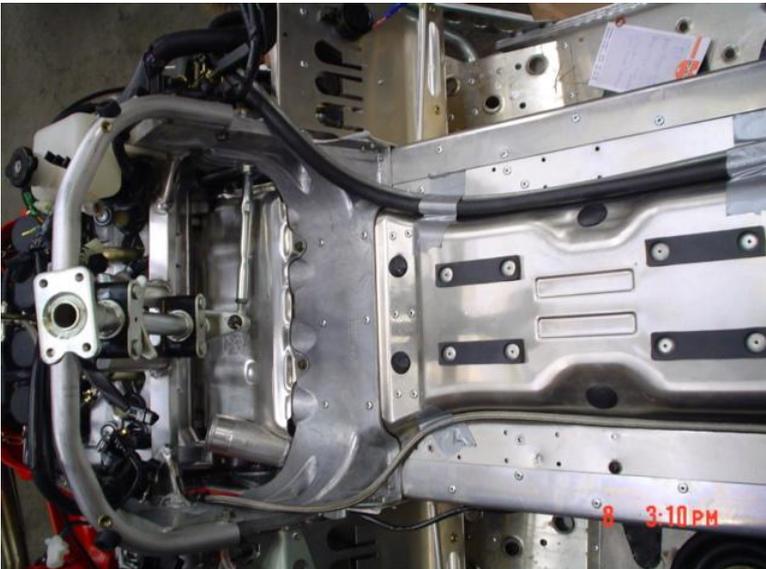
When everything seems to fit, final torque everything. Lubricate the oil inlet of the turbo with motor oil. Install the oil hose to the upper of the turbo.

Install the oil hose between the aluminium oil pan under the turbo to the oil pump.

Install the air hose (with the M10 banjo) from the oil pan via a T-fitting to the hose leading to the oil tank on the left side of the engine. Secure with cable ties.



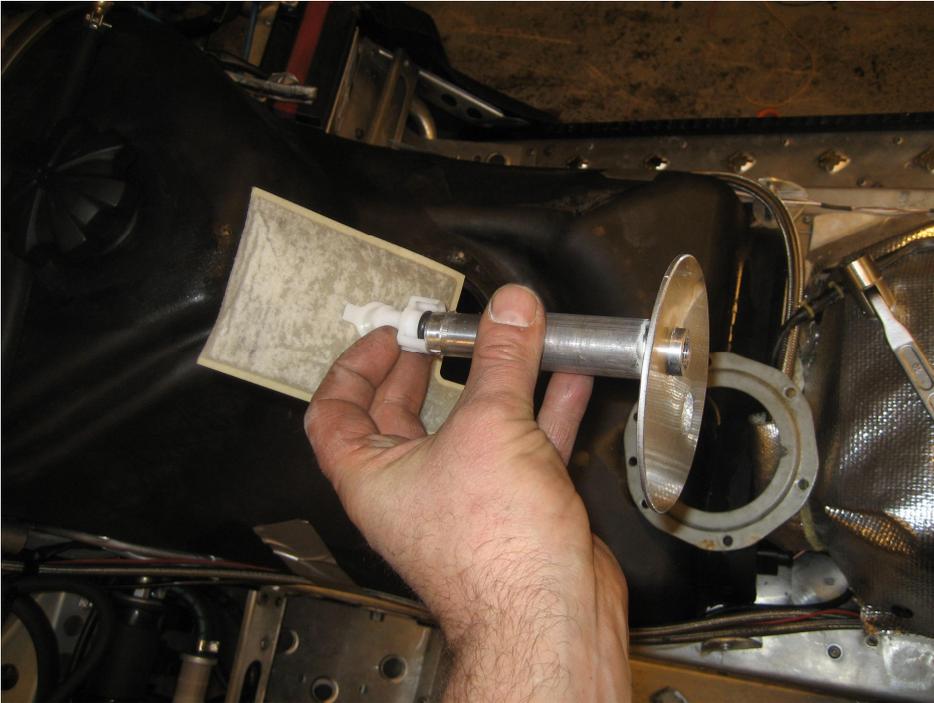
Under the turbo, both hoses shall be heat protected from the turbo through the heat shield material supplied with the kit.



Hose routing recommendation. (Photos from RX1)
Strap the TCV-wire to the oil feed hose.



Fuel tank and pump installation



Take out the stock fuel pump assy from the tank. Remove the stock fuel filter from the bottom of the fuel pump assy and install it on the new fuel in and outlet supplied with the kit. If the O-ring is too big, place it in front of an air heater to get rid of the fuel inside the rubber. This will make the O-ring get its normal size but it can take a while.



Install the fuel tank. Make sure you don't squeeze any hose.



Install the fuel pump like the picture. Install the inlet and outlet fuel hoses. A fuel filter shall be fitted on the inlet hose.

Remove the fuel quick connector from the stock fuel hose and reuse it on the new hose to the stock injectors.



Cut off the wires to the stock fuel pump and install new connectors supplied with the kit. Black shall be connected to the side marked σ on the pump and the red with blue tracer on the side marked +.

Fill up the fuel tank with highest unleaded pump gas available.
Install everything else in the front of the snowmobile and make it ready to start up.

Check so water and oil are filled in 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. The shield has to be modified for the muffler and the air filter.

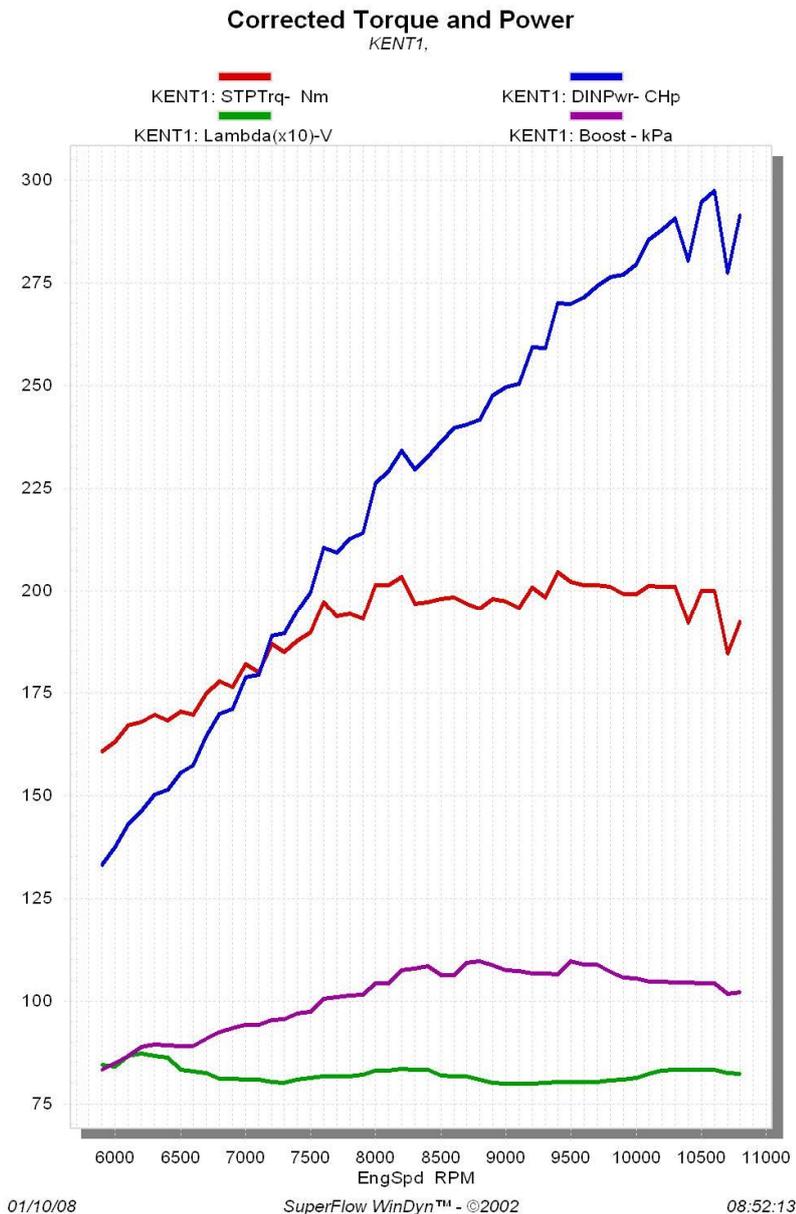
Install clamps for the hoses in the front of the heat shield screws. Install the seat.



Test-driving

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

The turbocharger is set to about 100 kPa turbo pressure (=about 14 Psi). The power will then be about 210 kW at sea level. (=290 hp). The altitude compensation will remain the power at high altitude.



Using higher turbo pressure may cause engine damages.

If higher performance is requested, we recommend low compression pistons from Wiseco or JE or that you use race gas.

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 photo below.



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.



Track modification.

The increased power by the turbo will make the stock drive wheels to spin in the track.

This can be prevented by installing new drive wheels like the lower right photo.

We also recommend opening up the windows and fully clip the track.

This is not necessary on the mountain model.



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, the temperature in the exhaust system (if you also buy the temp sensor for this) and some more things. The display can also data log (=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, 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.