

It is possible to remove the turbo from the car without taking the whole exhaust manifold off first, but access to the bolts/studs is limited, and I have found that it is far easier to take everything off as a single assembly, and work on it on the bench. It gives far easier access to everything! (and there is no need for the turbo to come off the manifold anyway for the re-build procedure)

Of course, if you have double jointed hands, small fingers, and bent spanners it isn't necessary to take everything off.

It is (theoretically) possible to leave the exhaust manifold, wastegate manifold and turbine housing all in the car, and just separate the centre cartridge of the turbo (4 bolts with the big 'L' shaped brackets) and lift just those bits out – but it won't be easy, and use of a blowlamp to heat the metal in situ is best done very carefully! (and if/when you snap a bolt, then it may all have to come out anyway).

Besides which, I am assuming that most people who want to re-build the turbo will also be considering porting the wastegate and/or fitting a PCE.

The procedure for removal of the manifold is basically as per the workshop manual, but a quick résumé of the process is produced anyway for your delectation:-

The heat shields are the only embuggerance factor, once they are off, then the rest is 'what you see, is what you need to move' - take the engine lift bracket off to allow the top heat shield to slide out towards the gearbox, take the pivot bolt out of the power steering pump and drop it down an inch or two so you can get to the left hand (viewed from outside the car) manifold nut.

Take the turbo to air filter & turbo to charge cooler pipes off.

Take the dipstick tube away from the block (unscrew under the manifold).

Disconnect the water pipes to turbo, and the oil feed pipe (all banjo bolts). (water/coolant will go everywhere!)

Disconnect the bracket which holds the downpipe/pre-cat dustbin to the block.

Disconnect the exhaust pipe (3 nuts/studs)

Disconnect the wastegate actuator pipe (small bore - usually a very tight fit on the spigot - easiest way is to cut it with a Stanley knife just shy of the turbo - there should be plenty of excess length to fit it back later).

Disconnect the water pipes at the electric pump thingy which circulates water when the engine switches off (to give you manoeuvring room).

Undo the nuts which hold the manifold on (14mm - they aint tight!) - some might bring the studs with them - no problem, the studs have to come out anyway!

Remove all the studs (E8 star socket) - again, they aint tight - as a tip, leave the left hand one in (by the Power steering pump) as the manifold is 'slotted' and it will help when it comes to replacing it all.

One awkward area is the 3 or 4 nuts/studs between the turbo and the manifold, it's a matter of access really, as you start to unscrew them, they move towards the turbo and then you can't get a spanner on them. You need to unscrew each one as far as possible and then pull the turbo toward the front clam a bit – allowing the nuts studs to come out a bit more, and repeat.

This is part of the reason for leaving the left hand one in - it will give you a 'pivot' to swing the manifold out a few millimetres or so, to continue undoing the nuts. More importantly, they should be less than finger tight once they start to move, but with the weight of the manifold on them they will need a spanner. If you can manage to lift the manifold a bit (using the 'pivot' stud again), then it may become a whole lot easier.

Now the only thing holding it in place should be the oil return pipe....

this just pulls off a straight pipe into the engine sump (springy clip thing, not a proper hose clamp - you'll see what I mean when you look at it 🤔)

Then you can manoeuvre it to the right (gearbox end), twist it a bit to get the wastegate actuator out from behind the clam, and lift it away!

Job done!

(it gives you a good chance to clean up all the cr@p and oil which will have leaked out of the CAS seal and down the side of the block which you never knew was there! - and the 1/4" of cr@p which has collected on top of the prongeron)

Once it is all on the bench, it is time to separate the bits.

As a bit of advice, follow 'standard' procedure for separating heavily corroded steel from cast iron – give everything a good soak with WD40 (or other releasing fluid) and give it time to penetrate. It will help if you heat up the cast iron casting with a blowlamp before getting a spanner on the bolts – this will help to release the corrosion and slightly expand the casting. There will undoubtedly be heat transfer to the bolt, but the cast iron will still expand more than the steel due to the nature of the materials – as long as you don't keep the blowlamp on the bolt itself, and don't overheat it.

Starting with the heavy stuff:-

If you are fitting a PCE, or wishing to hollow out the pre-cat of an S2, you will need to separate the big bits! –

Undo the 4 bolts and 2 nuts which hold the pre-cat housing (dustbin) to the wastegate manifold.

If any of the bolts snap (2 of mine did!), then you will need to carefully drill through them and re-tap the threads – bear in mind that the bolts/studs are High Tensile, and will quickly dull a drill bit – use sharp good quality bits, and don't let them get too hot in use (use a lubricant whilst drilling – either white spirit or WD40 works okay). Start with a smallish bit (3mm) and expand the hole up to 6.5mm – all the bolts/studs are a standard M8 thread.

Next step is to remove the wastegate manifold. Due to the nature of the locking nuts used, they will invariably strip the thread off the studs when you try and undo them – the studs will probably be rusted into the turbo and not unscrew.

Once you have undone the nuts (or snapped the studs!), the wastegate manifold will come off, (retain the copper multi-layer gasket for re-use).



You will need to remove the studs if you have ruined the thread (due to the nuts), and they can be replaced with either OE parts (from SJ's or wherever) with the standard nuts (not a cheap option) – or a stainless steel stud/nut set (available from Geordie Bling services – Geoff Smith) – Matt (Nitroman) has used stainless bolts on his – but make sure they are the correct grade due to the tensile strength required. Final option is to use some standard M8 threaded bar (High Tensile) and flange nuts – but this will have less strength due to the fully-threaded design.

There are different ways to get the broken studs out – sometimes using 2 nuts locked against each other on the exposed thread will unwind them, sometimes a pipe wrench or molegrips is enough, but I usually end up welding a steel bar at 90 degrees to the stud, allowing the weld to cool, and then unwind it. This is when you will be glad the turbo is still on the manifold – it gives you more to hold onto whilst applying enough force to undo the studs!

By now, you should have bits which look something like this:- (except the broken studs will be out! – if you don't actually break any, there is no real need to remove them, unless you wish to replace them anyway – but it will give much better access to port the wastegate).



Next remove the 'C' clip which holds the actuator rod onto the wastegate pivot, and carefully detach the rod – you will now be able to see just how free the wastegate is (it may be a bit seized, or have 'rough' travel) – simply moving it a few times over its full travel distance will soon free it up, and remember, in use it doesn't have a full 90° opening anyway – the rod only moves about 20 mm max.

There are other articles on actually porting the wastegate, but, basically, the OE hole is ~16mm diameter, and it needs to be opened out to ~20mm with a drill-mounted grinding stone of the correct diameter. Take your time, keep it at a flat angle, do not allow the stone to get too hot or the actual stone will become detached from the metal shaft as the glue melts!

30 minutes of drill-time is usually about what it takes!

## Rebuild an IHI RHB5 Turbo.

This is going to describe how to rebuild the turbocharger.

The dynamic seal is composed of two parts. The seal plate (the big flat round thing) and the piston (the little cylindrical thing). The piston should contain two piston rings. They're little split rings just like on a piston in a motor

### Turbo Disassembly

The key to a successful turbo reassembly is **marking everything** during disassembly. Make sure to do this as you go along. Before disassembling the compressor and turbine housings, make them with either a pen or a scribe a little line with a scribing tool. I recommend the scribe rather than the pen, because you will be hitting lots of stuff with parts cleaner that likes to take off pen marks.

Step #1: Remove the oil inlet banjo fitting and the water banjo fittings. (You should have left them in the car earlier anyway!) Life's just easier with them gone, It's your choice whether you remove the oil drain pipe – but I did. Now is a good time to remove the wastegate actuator capsule with its bracket.

Step #2: Remove the turbine housing. It is held on by four bolts. One of the little darlings doesn't have enough clearance between it and the water fittings to pull it all the way out until after you've got the turbine housing loose. Be careful with these bolts as they may be stuck in pretty damn hard. Personally I broke one off during my disassembly, which led to removing it with me redrilling and retapping the housing.

The turbine housing will most likely be stuck to the centre section. Once you have the four bolts out, you'll most likely have to do some tapping with a (rubber) hammer (Gentle tapping, RUBBER hammer, or WOODEN drift – do NOT hit cast iron with a metal hammer (like Monty did) or you'll have a load of broken scrap metal.

I also gave mine some heat with a small blowlamp to encourage separation. If you use heat, only heat the turbine housing, not the centre section. You're trying to get the turbine housing to expand (not the centre section!).

[Note: The reason we remove the turbine housing BEFORE the compressor housing is that the turbine housing is the more difficult of the two to remove. You want to leave the compressor side nice and protected while you're beating on and cursing at the stuck turbine housing....]



Turbine housing (with broken bolt) remains attached to manifold..... Centre cartridge with compressor housing still attached.



Step #3: Remove the compressor housing. This is simple in comparison to the turbine housing. There's just 6 little bolts (8mm spanner) around the perimeter of the compressor housing to remove – 3 hold the wastegate actuator in place, and 3 are separate. The turbine housing may be siliconed in, and might be a little hard to remove. Once that's done, we should be left with just the centre housing:

Step #4: Check the condition of your compressor wheel – hopefully it will be re-usable, but check for obvious chunks missing, bent or split.

Mark rotating part positions. This is **critical** if you intend to reassemble your turbo without balancing it first. The turbine shaft is balanced to a very precise standard. If you take it apart without marking it first, you will be screwed unless you intend to rebalance it. You need to mark the position of the compressor wheel relative to the turbine wheel. There's several ways you can do this. You can either mark them with a pen, or (lightly) scribe a line into them. The problem with the pen is that you will be dumping them in solvent to clean them up, and the solvent will take off the pen marks.

The critical thing is that you must be able to line up the compressor wheel with the turbine wheel. Once you take the nut loose, the compressor wheel will be free to turn.

Also take a look at your nut. It may be ground on one side for balance. If this is the case, you might also want to mark the alignment of the nut to the rest of the parts. Presumably, you will be torquing the nut to spec later on, but in my opinion marking these parts is important enough that you really can't mark too many things – that said, the re-build kit will include a new nut anyway.

Step #5: Remove the compressor nut. It has a reverse thread on it. So make sure to turn the nut backwards from the way you'd normally remove a nut. Otherwise it'll just get tighter and tighter and you'll get more and more confused.



Step #6: Remove the seal. The seal is held on by three torx screws (T10). Once you removed the screws, it will most likely be stuck on because it will have been siliconed in place. You can remove it by threading some bolts into the two other holes in the seal plate and prying with a screwdriver. Be careful not to damage anything while prying.



Alternatively, I found that by using a couple of old Allen keys it gave good leverage to twist the whole seal round enough to break the silicone 'glue', and then with a forward and backwards twisting motion, by pulling on the Allen keys, the seal plate will come away from the housing.



The piston (with its 2 oil seals) may stay on the shaft, or it may still be clipped into the seal plate – if the seals are worn, it is more likely to stay on the shaft!). It can be slipped off, and then pull the shaft out. **DO NOT TRY AND SEPERATE THE TURBINE WHEEL FROM THE SHAFT – they are a single assembly.**



Check the condition of the grooves in the turbine shaft – they need to be clean and unpitted (is that a real word?).

If they are clogged up with cr@p, then a good soak/clean with carb cleaner may get them good enough to re-use – otherwise it will need a new shaft.

The groove is where the oil seal ring sits, so it needs to be in good condition.



If they clean up this well, you've done better than me!

(it's a library picture of a new unit)

Step #7: Remove the thrust plate. This is held on by four more torx (T10) screws. It shouldn't be siliconed in, and therefore shouldn't be as hard to pull as the seal plate was. If it is stuck, you can tap on the backside of it (very gently) by inserting a rod at an angle through the turbine side of the centre section.



Step #8: Remove circlips and bearings.....

The compressor-side bearing will come right out after you've removed the thrust plate. The turbine side bearing will need a circlip pulled before you can remove it. Getting these circlips out is difficult because they take very small snap ring pliers. I used 2 nails and a pair of pliers! You only need to get the one snap ring out to gain access to the turbine side bearing. You can leave the two centre circlips in.

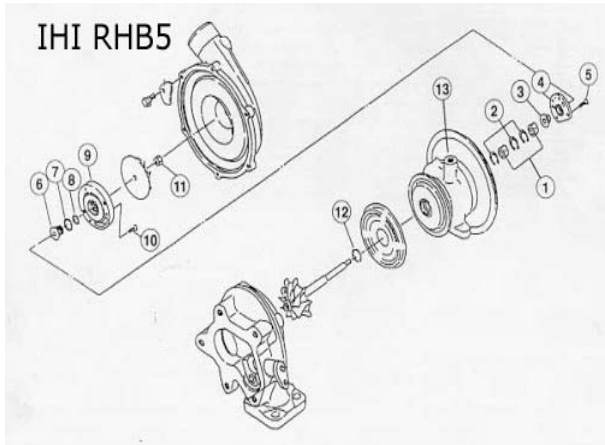
Congratulations. You've taken an assembled turbocharger and converted it into a pile of useless parts.

Before we reassemble everything, it's time to clean up and evaluate our parts.

I used a bowl of cellulose thinners to soak things in, then a scrub with a toothbrush (not mine!), then a 'rinse' with carburettor cleaner – this is a volatile solvent, and will soon evaporate away, leaving a clean set of parts.

Look over your compressor and turbine wheels for any nicks or obvious damage. Any damage to the turbines will mean they are unusable.

This is also time to decide whether or not you want your shaft rebalanced. Balancing is a good idea, but some people may opt to put it back together without having it balanced. In order to avoid balancing, you'd better have marked the alignment of the parts prior to disassembly.



1. Floating Bearings
2. Retaining Clips
3. Mating Ring
4. Thrust Bearing
5. Screws
6. Piston
7. Inner Piston Ring or compressor oil seal
8. Outer Piston Ring or compressor oil seal
9. Seal Plate
10. Screws
11. Compressor Nut
12. Turbine Oil Seal



This is a picture of the rebuild kit I got from E-bay  
<http://cgi.ebay.co.uk/ws/eBayISAPI.dll?ViewItem&ssPageName=STRK:MEW NX:IT&item=320357625316>

Search on IHI RHB5 repair kit for a Fiat Uno / Punto turbo)

Note that your rebuild kit should include (2) replacement bearings – they supply 4 with the kit, but you only use 2, (3) replacement snap rings, (4) replacement thrust plate screws, (3) replacement seal plate screws, (1) replacement compressor nut, (1) replacement thrust bearing, and (1)

replacement thrust spacer. You should also have a replacement piston ring/oil seal for the turbine side of the shaft. Your kit will also include a replacement piston and (2) piston rings/oil seals to go on it.

The old bits !





First you're going to have to have a clean, crack free centre section.

You're going to be working with the 12 pm and 6 pm reference points as seen in the picture.

If you look inside the centre section, you can see the slots that hold the bearing retainer circlips. There are 3 slots inside the centre section, one in the front that the front bearing rests on, 1 in the inside towards the rear that holds the rear bearing, and one at

the very back that holds the rear bearing in place. The front bearing rests on a retainer clip and is held in place by the thrust bearings pilot.

When installing the retainer clips, you can install the inside (middle) retainer clip and the front clip because the bearings will rest on them rather than be stuck inside, it is only when you install the rear retainer clip that the rear bearing will be permanently in place (unless you take it out) and the front bearing will be permanently in place when you install the thrust bearing.

It is very important that when you install the retaining clips, that the split section (for use with snap ring pliers) is at 6pm this will allow for oil drainage.

Now that you have the centre and front retainer clips installed, you can put in the front bearing as seen in the picture, followed by the thrust bearing pilot, followed by the thrust bearing itself:



Keeping the 12 and 6 reference points, the thrust bearing must be installed with the flat section at 6pm. This allows for proper lubrication and oil drainage.



Now you can install the inner and outer oil seals on the piston and install the piston assembly in the seal plate. Make sure you give the bits a squirt of oil (on the piston and oil seals).

The Piston will just push into the seal plate – it has to be lined up square and given a firm push – the oil seal rings will compress as they bear on the sloping faces of the seal plate, and it will 'click' into place.



**VERY IMPORTANT**, make sure that the smiley face on the backside of the seal plate is lined up with the smiley face on the centre cartridge, If you can think of a better word than "smiley face" then feel free to change it!

Use a smear of RTV silicone sealant around the edge of the seal plate.



That's the front bit done – time to turn over

The bearing just drops in against the centre circlip – remember to give it a squirt of oil!



This will be your final snap ring, one in the front holding the front bearing, one in the middle holding the rear bearing, and one on the outside of the rear bearing as seen in the picture.

Now you can install the heat shield and the turbine/exhaust wheel and shaft



Don't forget to fit the oil

seal to the turbine shaft before dropping it in





When you install the turbine shaft, you'll find that it won't drop in all the way.

This is due to the turbine oil seal which must compress in order to seat itself properly. Carefully push the turbine until you feel and hear it audibly "pop" and you'll notice that it sits, feels, and looks better. You also won't be able to easily pull the shaft out when you could before.



Now you can hold the turbine with one hand while you install the compressor wheel and compressor nut. You'll need to line up the balance marks and hold the turbine wheel tightly while you install the compressor nut, remember it's *reversed thread* in 8mm:



NOW, you're at the *FUN* part 😊 aligning the centre section in the exhaust housing so it doesn't rub. For one, both parts are cast iron, so they aren't going to seat together as nicely as other metals would, due to them being so rough.

You'll have to gently tap the outer perimeter of the centre section, spin the wheel, listen *and* look at the exhaust wheel in the exhaust housing as it is spins.

If you hear *any* noise, it isn't correct. Continue tapping and spinning until you hear *NO NOISE AT*

ALL. If you get frustrated and think "Oh well, it doesn't *have* to be perfect" think again. If you hear any noise at all, that means that it's rubbing somewhere. If you're spinning it by hand and it's rubbing, imagine what will happen when it's under boost and spinning faster than you ever could by hand....now you see why it has to be perfect.



Now you're at the *more* funnerer part, getting the bolts that hold the L plates back in 😞

If *you* were the person who took your turbo apart, you'll understand how much fun it was to get the bolts out in the first place.

Let me guess? You had to start unthreading the bolts, then tap the L plates out with a screw driver, then tap the centre section from the exhaust side to have enough clearance to take the bolts out the rest of the way because with the centre section attached to the exhaust section, the bolts hit the coolant inlet and outlets leaving you thinking "HTF do I get these out?"

You have to start threading the one bolt before you put the centre cartridge in, make sure that it is a few threads in, and rotated so that one of the flats on the bolt is towards the centre, then the centre cartridge will fit past the bolt, allowing you to drop the L plates into position and fit the rest of the bolts.

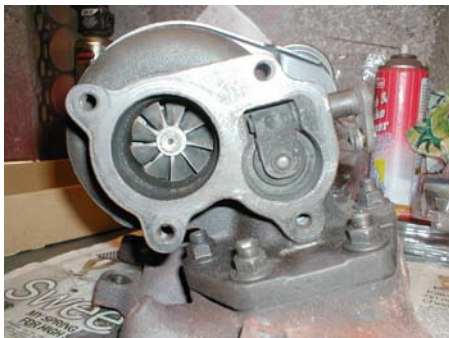


The compressor housing should be clean and unscratched.

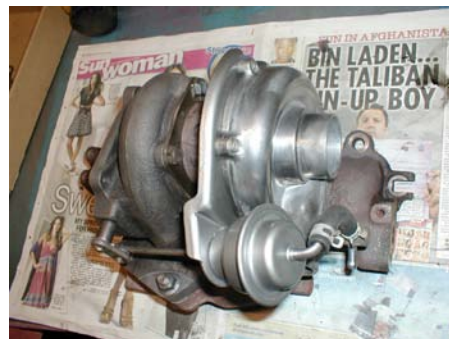
It needs a smear of RTV silicone sealant around the sealing edge.

The PCE attached to the wastegate manifold (use the original copper gasket).

\*\*\*Do not put the studs in yet, or attach the manifold to the turbine housing\*\*\*



When you have everything put back together, you should have something that looks similar to this:



When the assembly goes back into the car, it should look a bit like this:-



It is well worth replacing the copper washers on the coolant and oil feed banjo bolts – they are 10mm washers, and fairly easy to find.



As you start putting the heat shields, brackets, pipe work etc back on, it soon becomes apparent which order they have to go on – I still get it wrong, and often fit stuff in the wrong order! Make sure that you use copper grease on all the threads to make disassembly/reassembly easier.

When you replace the Wastegate manifold/PCE, put it up from underneath, then fit the studs/bolts through the manifold and tighten them into the turbine housing – remember to refit the copper gasket you retained earlier.

The rest, as they say, is the reverse of removal!

Good Luck

*Dave Pink,*

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