# TOP 10 TURBO FAILURES

## We take a closer look at the top ten culprits for turbo failure, why they happen, and how to prevent them

Turbos used to be fitted to exotics only. But these days almost every diesel car has one and most manufacturers offer force-fed petrol engines in their range. On top of that, PPC readers (and writers) are forever nailing them onto their projects.

So we spoke to the guys in the know at CR Turbos and asked them to show us what the 10 most common turbo failures are, why they occur, and how to prevent them from happening in the first place.

'Turbos don't die, they're killed,' they said. 'A well cared for turbo will outlast the car it's fitted to, but the temptation for people to fiddle with them, turn up the boost, and try to extract more power means the finger of blame is all too often, and quite wrongly, pointed at the turbocharger.'

Seems the turbo might well be the part that fails, but the failure is almost always caused by something else wrong with the engine.

So let's have a look at the top 10 reasons for a turbo failing.

## 1 OIL CONTAMINATION

Oil contamination is probably the biggest turbo-killer of all. Nearly half of the turbos CR see show the tell-tale signs of oil contamination. Or to put it another way, bits of crud in the oil which score the bearing surfaces. The precision-machined bearing surfaces should be totally smooth and have a shiny surface, but they look more like a ploughed field.

Often the oil arriving at the turbo is unfiltered. As a result little particles of debris that engine parts have shed as they wear or bits of old gasket from its last rebuild float around in the oil system and eventually end up in the turbo. The bearings within a turbo work to exceptionally tight tolerances and it doesn't take much for these bits of debris to block oil ways and reduce the flow of oil to vital components. And considering the turbine shaft can be spinning as fast as 150,000rpm, that lack of oil will spell disaster in a matter of seconds.

**HOW TO PREVENT...** Change the oil at half the recommended service interval and fit an inline turbo pre-filter.

## 2 THRUST FAILURE

Turning the boost up is fun! Most remaps feature a modest readjustment of the fuelling and a healthy increase in boost pressure too. Everything behaves as it should on the dyno, however six months later (or less) you have a smoky turbo. Feel the shaft and it will have the tell-tale 'in-and-out' play, all of which points to thrust bearing wear.

In many cases the thrust bearing is only just adequate for standard pressures (remember the standard 270deg thrust bearing in a Garrett T3 is only good for around 10psi). As the compressor wheel spins it effectively tries to pull the shaft wheel out of the front of the turbo. This is prevented by the thrust bearing, but start spinning that compressor wheel faster by asking it to produce more boost and that thrust bearing will start to struggle to contain it, lubrication becomes marginal, and rapid wear takes place.

**HOW TO PREVENT...** Before asking a tired old turbo to do even more work, have it overhauled and checked over. If you are planning to run increased levels of boost have an uprated thrust bearing fitted too. It's cheaper to do it before you've broken it.

## 3 BURST COMPRESSOR WHEEL

This is more common on modern diesel engines where the turbo is working much closer to the edge of its performance envelope, and incredibly high boost pressures are involved, but it is still a failure that can happen on any turbocharger.

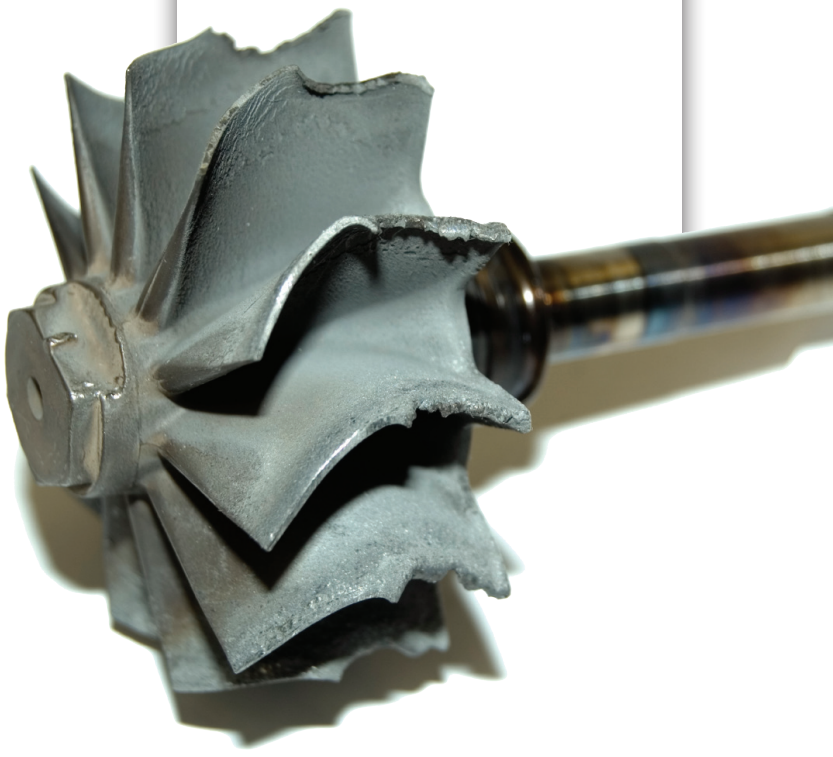
The culprit is known as 'overspeeding', and can actually cause the compressor wheel to burst! The rotational speeds involved become so high that the material actually detaches from itself. The cause will usually be an air leak somewhere. Whether it's a split hose, a leaky joint, or in a lot of cases the plastic end caps of the intercooler, somewhere it will be leaking air. The turbo spins faster and faster trying to maintain a constant pressure in the inlet manifold, it overspeeds, and boom!

**HOW TO PREVENT...** Pressure test any pipework to ensure there aren't any air leaks anywhere. One particular garage CR Turbos spoke to said they had never tested a car yet that didn't have some kind of air leak somewhere.

## 4 EXCESSIVE EXHAUST GAS TEMPERATURES

Turbocharger impellors will cope with temperatures of up to 900˚C for short periods. During rolling road and engine mapping sessions these temperatures can sometimes be exceeded, particularly, on engines which have yet to mapped and set-up correctly. The roller bearing ranges of turbos are even more unforgiving and can fail at temperatures as low as 750˚C. A lot of turbos will be killed long before the car ever sees the road or track. The symptoms of excessive EGTs can range from a severely pitted turbine wheel to a bent turbine shaft. Typically if the EGTs are too high other areas of the engine will start to fail too, and it's not uncommon to see bits of aluminium piston actually melted onto the turbine wheel.

**HOW TO PREVENT...** Use an EGT sensor, ideally feeding straight back to the ECU. If the temperatures go up it will bring everything to a halt before any damage is done.



## 5 IMPACT DAMAGE (COMPRESSOR WHEEL)

This is easily spotted; looking into the front of the compressor cover can often reveal what looks like evidence of mice nibbling on the compressor wheel. In extreme cases the blades on the compressor wheel can be missing completely! This is impact damage in action. It can be caused by anything from dust entering the turbo through poor (or no) air filters, right through to large pieces of debris in the air system from previous failures. A common culprit of this is the compressor wheel nose nut which can travel a long way round the system when the compressor wheel bursts, and often lay dormant in intercoolers and the like until it rears its head again and causes catastrophic damage. Anything that adversely affects the efficiency of the compressor will result in poor performance, noise, and potential failure.

**HOW TO PREVENT...** Always run a good quality air filter and clean it regularly. If fitting a turbo after a previous failure examine all the pipework and intercoolers as bits can be spread over a surprisingly large area, only to then be sucked back in.

## 6 IMPACT DAMAGE (TURBINE WHEEL)

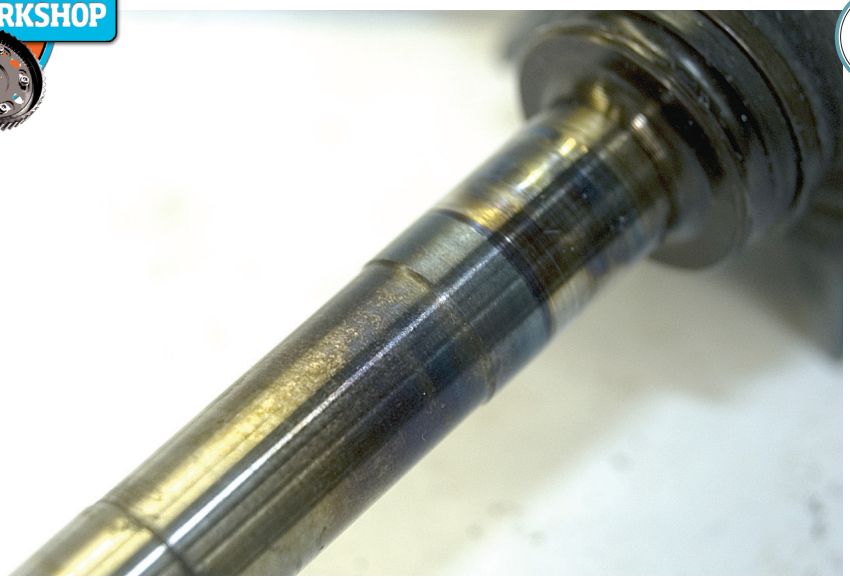
This is similar to compressor wheel impact damage but is caused by bits coming from either the combustion chamber (lumps of carbon, injector tips, bits of valve) or the manifold itself (rust flaking off old manifolds or bits of weld on new manifolds). This debris enters the exhaust housing and is smashed about by the spinning turbine shaft causing considerable amounts of damage. The amount of damage caused is usually linked to the size of the debris in question, but it can cause anything from severe pitting, to knocking off all the turbine blades. The results will be a noisy, inefficient turbo with a very short life.

**HOW TO PREVENT...** Prevention is hard, but visually inspecting your exhaust manifold is always worthwhile whether it's new or old, and always try to ensure the engine is in tip-top condition.

## 7 OIL DELAY

The car shows good oil pressure, yet the turbo failed very quickly? Inspection reveals bearing material wiped all over the shaft, and blueing where heat has built up. These are the common signs of oil delay. From the moment the engine fires up, the turbo will begin spinning very, very fast. If the oil feed pipe is empty and the turbo is un-primed it may take several seconds for the lubrication to reach the turbo, by which time the damage has already been done. This is usually only caused when either the turbo is new, or the engine has just been rebuilt, but if the engine is stood for a long time the oil feed pipe can drain and cause the same problems.

**HOW TO PREVENT...** In the old days spinning the engine over without it firing up was a lot easier than it is now, however taking the time to prime all the pipework and making sure there is a good supply of oil before firing up the engine is still critical.



## 8 OIL STARVATION

This occurs most commonly as a result of an oil pump failure, but iffy pressure relief valves and blocked oil feed pipe and/or banjos can result in the same failure. Sometimes oil pressure can be registering in the engine as perfect, but a blockage is preventing it reaching the turbo. With the shaft spinning as quickly as 150,000rpm it doesn't take long before the absence of any lubrication causes excessive heat build up and rapid wear. This is usually displayed as blueing on the turbo shaft or seized bearings.

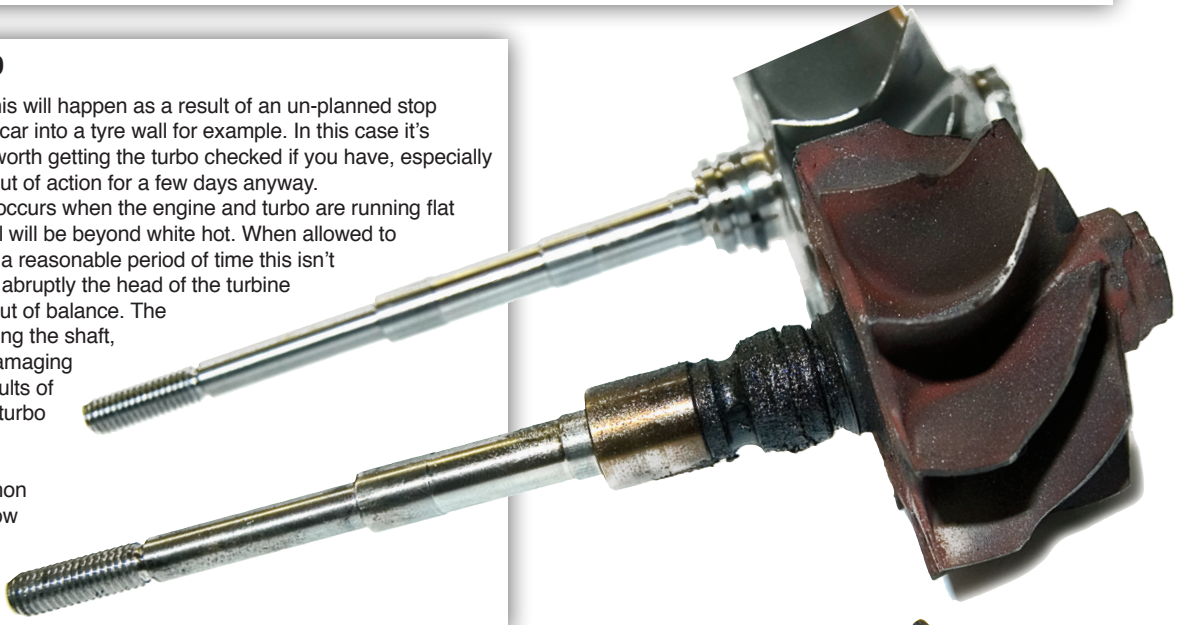
**HOW TO PREVENT...** Use a good quality oil, but more importantly change it more often than recommended. Watch the oil pressure and if possible get a reading right at the oil feed union to the turbo. And as always ensure all filters and gauzes are spotlessly clean.

## 9 HOT STOP

Sometimes this will happen as a result of an un-planned stop – stuffing the car into a tyre wall for example. In this case it's unavoidable, but it's still worth getting the turbo checked if you have, especially as the car is likely to be out of action for a few days anyway.

The 'hot stop' situation occurs when the engine and turbo are running flat out, as the exhaust wheel will be beyond white hot. When allowed to slow down and cool over a reasonable period of time this isn't a problem, but if stopped abruptly the head of the turbine wheel can droop, going out of balance. The heat can also transfer along the shaft, carbonising the oil and damaging the bearings too. The results of re-starting a hot stopped turbo can be catastrophic.

**HOW TO PREVENT...** Common sense really – always allow several minutes for the turbo to cool down after driving hard.



## 10 CARBON BUILD UP

Lack of servicing and poor quality oils will result in a gradual build up of sludge. Not just in the sump, but in all the oil galleries of the engine too. Inside the turbo are some of the narrowest oil ways, some as small as 1mm in diameter, and when they become blocked failure is imminent.

A few years ago when it was the fashion to import Japanese 4x4s and people carriers CR Turbos saw huge numbers of 'sludged' turbos. The reason of course being that the Japanese have no intention of keeping their vehicles beyond three years, so none of them have an oil change. We get them here just in time for all the problems.

Current disaster areas include the Ford/Peugeot 1.6 HDi. These are renowned for carbon sludging problems, and even with regular dealer servicing CR Turbos are seeing repeated turbo failures on vehicles with as few as 30k miles.

**HOW TO PREVENT...** Well clearly if you have a vehicle with inherent design flaws you're going to struggle, but as with most things an application of common sense will help. Service the car regularly, use good quality oil and fuel, and be nosey and have a good look at what comes out. Looking at the oil and filter removed can be a good insight into what lurks inside the engine.