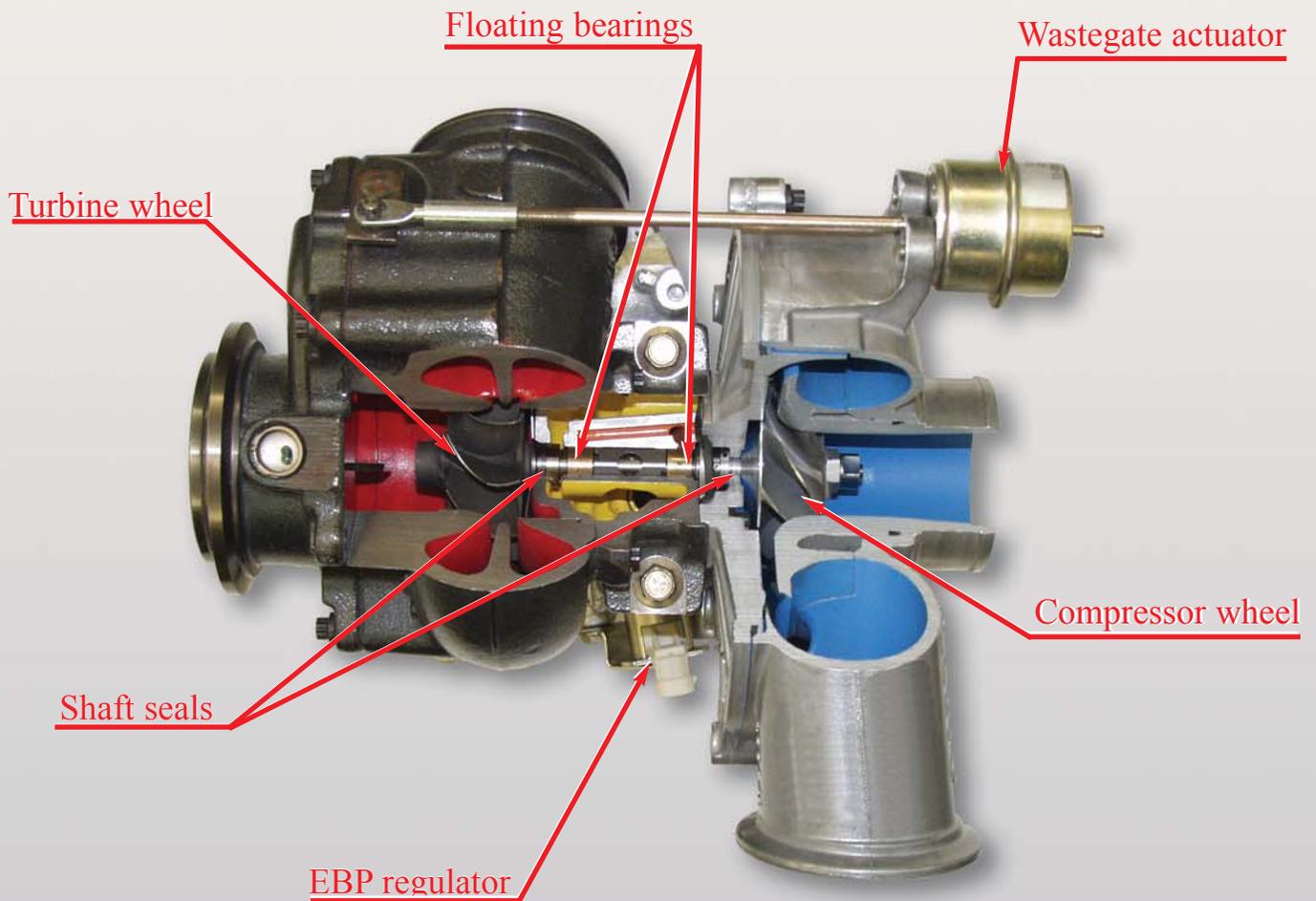


# Technician Turbocharger Guide for the Powerstroke Engine



Turbochargers are precision pieces of machinery which operate at high speed, using heat of expanding exhaust gasses to “boost” intake manifold pressure. Turbochargers increase performance and decrease exhaust smoke through improving an engine’s volumetric efficiency.

Turbochargers are often replaced by mistake for the following reasons:

- Low power
- Oil leaks
- Noise

Most turbocharger failures result from:

- Poor maintenance (air/oil)
- Modifications (increasing turbocharger speed)

Turbochargers are relatively simple devices. This simplicity also should apply to diagnosing them.

## LOW POWER

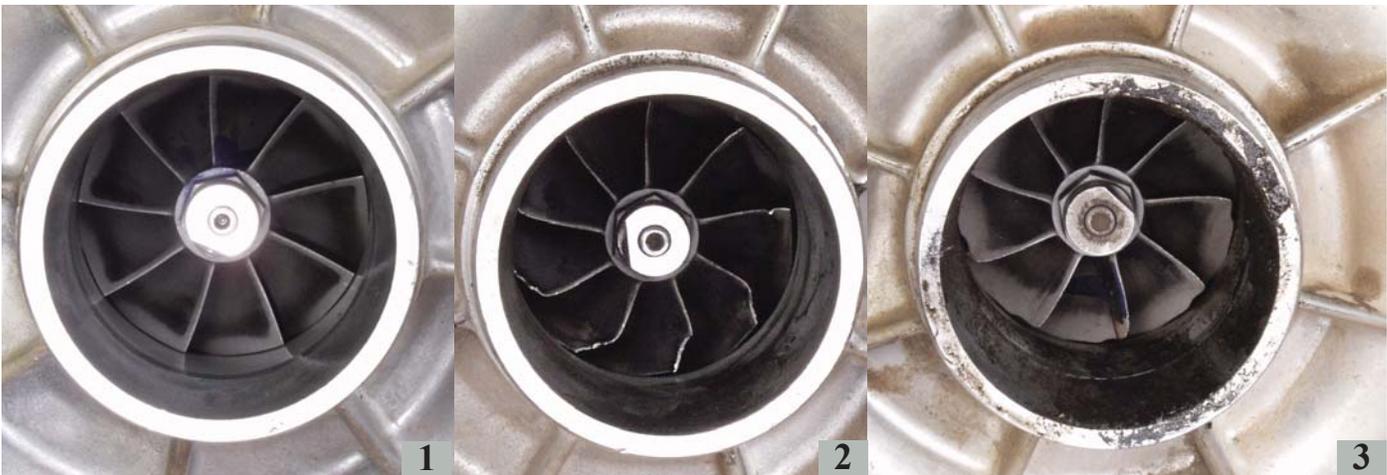
In cases where the engine performance is in question, as evidenced by a boost reading below the specification for the vehicle, the following is true:

If neither of the wheels rub, the blades are not damaged, and the shaft and wheels spin freely, there is no reason to replace the turbocharger. In cases where performance is low and no fault lies with the turbocharger, the low performance will be due to low fuel delivery, a restriction or leak in the intake or exhaust systems, or worn engine components (low compression, check crankcase pressure).

The condition of the turbocharger relative to performance can be visually identified.

**! WARNING: ALL VISUAL INSPECTIONS OF THE TURBOCHARGER MUST BE MADE WITH THE ENGINE OFF AND THE TURBOCHARGER NOT SPINNING. TURBOCHARGER COMPONENTS MAY BE EXTREMELY HOT. BOTH WHEELS ARE VERY SHARP AND MAY SPIN AT HIGH SPEED. USE CAUTION**

First, inspect the compressor wheel for damage.



### Good Turbocharger:

Compressor blades are clean and straight. There are no large gaps between the compressor housing and the compressor wheel. No visible damage to blades. This turbocharger should not be replaced.

### Foreign Object Damage:

This compressor wheel shows signs of some outside object (nuts, bolts, screws, etc.) coming in contact with the blades while they were spinning.

### Dirt Ingestion:

Also called dusting. The compressor wheel blades show signs of erosion from dirt entering the intake air system. The blades are rounded off and there is dirt accumulation in the compressor inlet.

**Note:** If damage to the compressor wheel is found, the intake air system should be cleaned and inspected for foreign objects, poor maintenance, broken components, or improper installation.

## LOW POWER Cont'd

Does any evidence of wheel to housing contact exist, such as witness marks on the housing or rolled edges on the wheel? Before testing a service part replacement, pour some clean oil into the lube oil passages.

**NOTE:** Do not perform this inspection on a dry service turbocharger. It may exhibit wheel rub until it is lubed. The shaft bearings are floating bearings, requiring lubricating oil to provide proper running clearance.

**! Warning: Visually assure that wheel is not turning before inserting your hand into the compressor. Do not place fingers in turbo with engine running.**



Spin the compressor wheel to make sure that it spins freely. The wheel should not contact the housing.

If the customer concern is low power (low boost) and inspecting the turbocharger reveals:

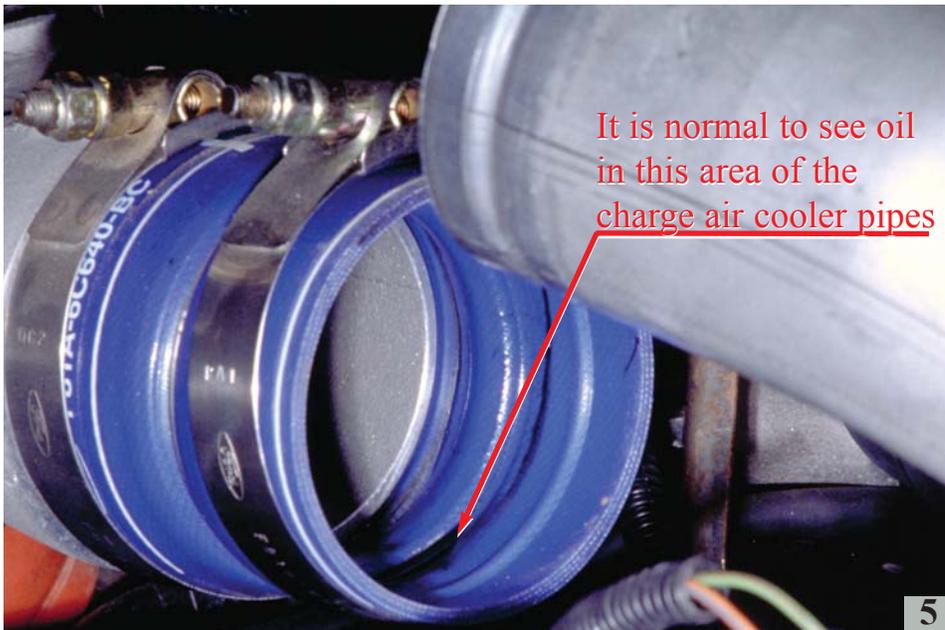
- no wheel damage
- no wheel rub
- no binding when turning the wheel

### **DO NOT REPLACE THE TURBOCHARGER**

Refer to engine performance diagnostics in the PCED.

## NORMAL OIL CARRYOVER

Another condition that often leads to replacement of the turbocharger is the presence of oil at the hose connections of the charge-air-cooling system. Oil vapors from the crankcase are vented into the turbocharger compressor from the crankcase breather on the left valve cover. This venting will over time lead to the presence of oil in the pipes between the turbocharger and the charge air cooler. A leak or seepage that is visible at the hose connections is not a sign indicating the turbocharger is defective. If excessive oil consumption is a symptom, (exceeds 1 qt per 1000 miles) the turbocharger may be at fault but it will have wheel rub because for the shaft seal to fail the shaft bearing must also be failed. The only legitimate reason for a turbocharger to be replaced for excessive oil in the intake is if the turbocharger shaft bearings have failed.



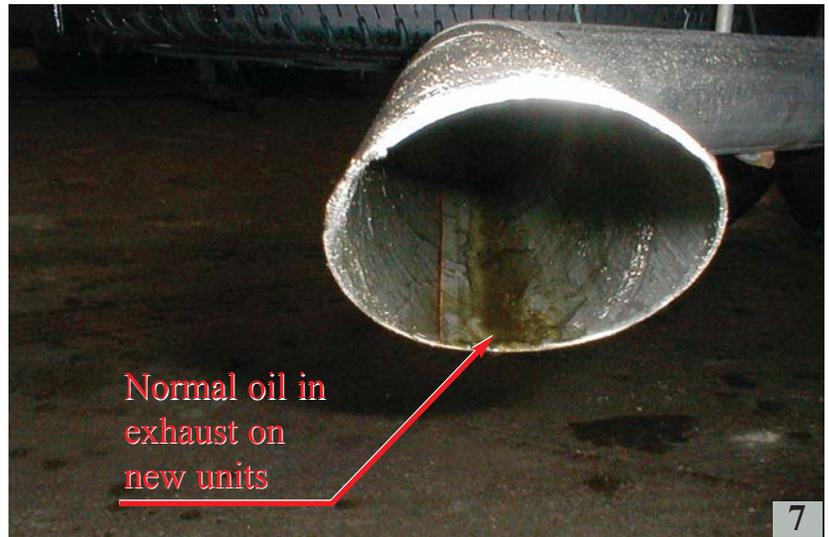
**Normal Oil Carryover:** The photo to the left shows normal oil carryover in the charge air cooler pipes. This condition can be aggravated by excessive air inlet restriction. The turbocharger should not be replaced for this condition.

**Normal Oil Seepage:** The photo to the right shows normal oil seepage on the charge air cooler connections. This condition can be aggravated by excessive air inlet restriction or an overfilled crankcase oil level (refer to SSM 11982). The turbocharger should not be replaced for this condition.



## NORMAL NEW ENGINE EXHAUST APPEARANCE

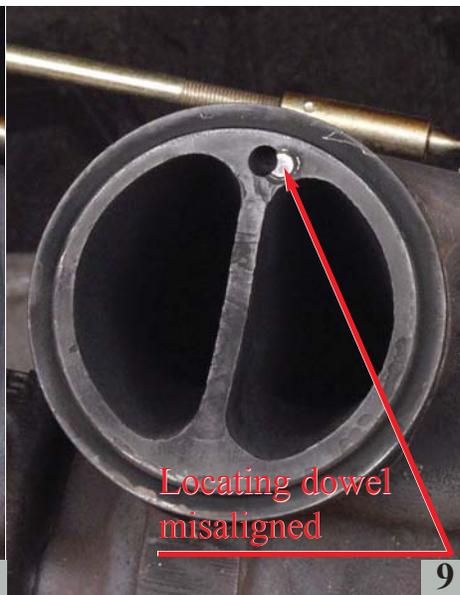
On very low mileage trucks, (typically less than 1000 miles) some turbochargers have been replaced because of an "oily residue" exiting the exhaust pipe. Be aware that during the manufacture of exhaust pipes, lubricants are used in the bending process and to prevent rust. Do not consider replacing the turbocharger just because oil is coming out of the tailpipe. The initial oil in the engine has had dye added, so inspect with a blacklight first. If it is thought that the oil is from the engine, loosen the exhaust pipe from the turbocharger outlet and look for signs of engine oil exiting the turbocharger. If the turbocharger is leaking oil into the exhaust, expect to find the bearings in the unit to be worn and for wheel rub to be present.



## NOISE

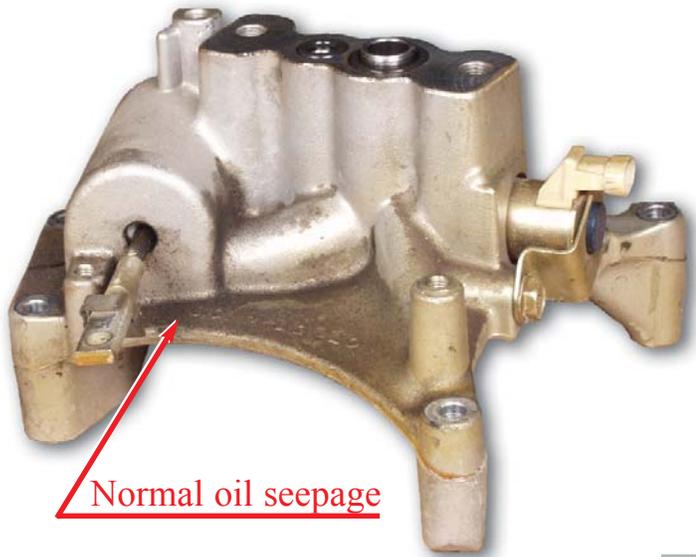
Turbochargers have been replaced for noise concerns when the concern is exhaust mis-alignment at the connections. Carefully inspect the exhaust connection at the inlet to the turbine housing, and the turbine exhaust outlet to exhaust pipe connection. Mis-alignment at these connections will often produce noise complaints. Re-aligning and tightening the V-band clamp can often repair the noise concern. If the turbocharger itself is responsible for excessive noise, expect to find wheel to housing rub, and bearing failure, as illustrated in photo 4.

**NOTE:** The exhaust backpressure device during its normal function will change the sound of the engine, in cold ambient conditions. Some vehicle operators may not understand the function of the device. Refer to cold weather operation in the Owner's Guide Supplement to the Owner's Manual. Refer to SSM 16697.



## OIL LEAKS

Another observation that has caused turbochargers to be replaced is oil leakage at the turbocharger. In many cases the turbocharger is not at fault but rather the o-ring seals between the turbocharger and the pedestal or the o-ring seal between the pedestal and the crankcase would be the cause. These o-rings are available as service parts. If a leak is experienced at the EBP actuator, do not replace the turbocharger assembly. Replace the EBP actuator rod seal per TSB 03-19-02.

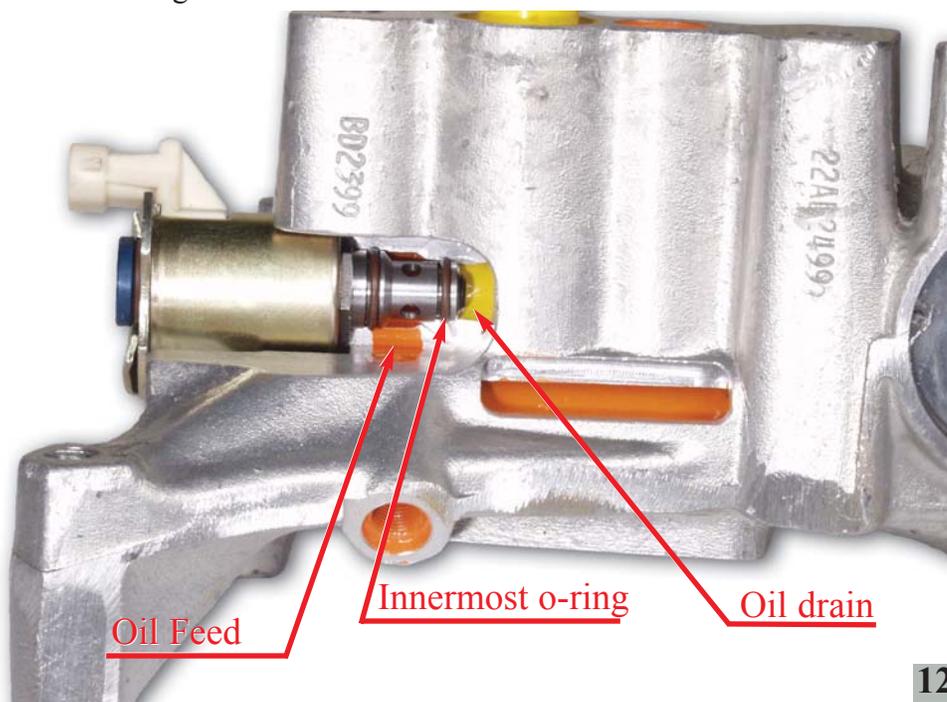


**Normal Oil Seepage:** It is normal to see some oil seepage past the seal on the EBP actuator rod. The photo to the left shows this normal seepage.

11

## PERFORMANCE

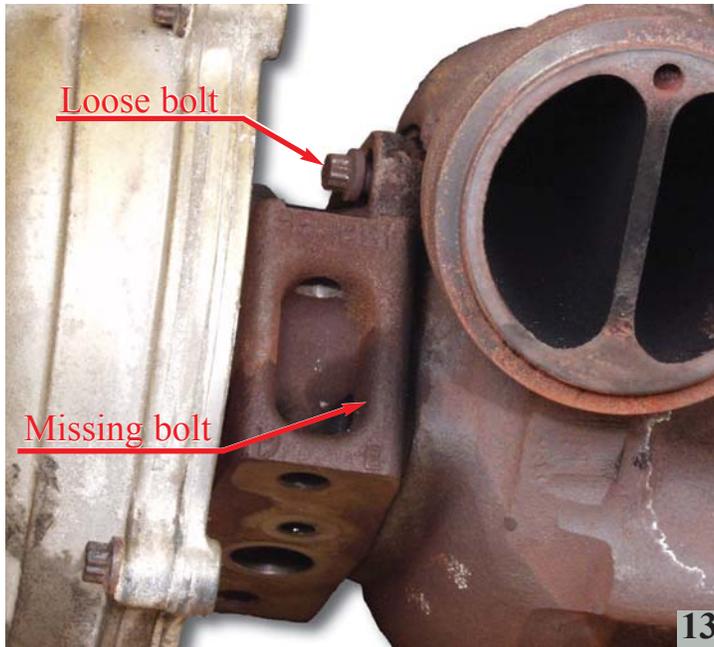
Turbochargers have been replaced when the exhaust backpressure system (EBP) malfunctions. If performance is low, disconnect the EBP actuator rod from the bell crank, and tie the valve open. If this resolves the performance concern, make sure the valve in the exhaust rotates freely. If it does, then suspect the regulator to be at fault. The exhaust backpressure regulator and the regulator o-rings can be serviced separately from the turbocharger.



12

## TURBINE HOUSING BOLTS

Some turbochargers have experienced turbine housing mounting bolt back out. This does not require turbocharger replacement unless the turbine wheel has contacted the housing and been damaged. Replacement bolts with an interference thread for improved retention are available for service. TSB 03-14-09 advises that the part number for the bolt kit is 1C3Z-9G486-AA. Do not try to "chase" the threads on these bolts.



When loose or missing bolts are found, replace the bolts with part number 1C3Z-9G486-AA per TSB 03-14-09.

## TURBOCHARGER SERVICE REPLACEMENT PARTS

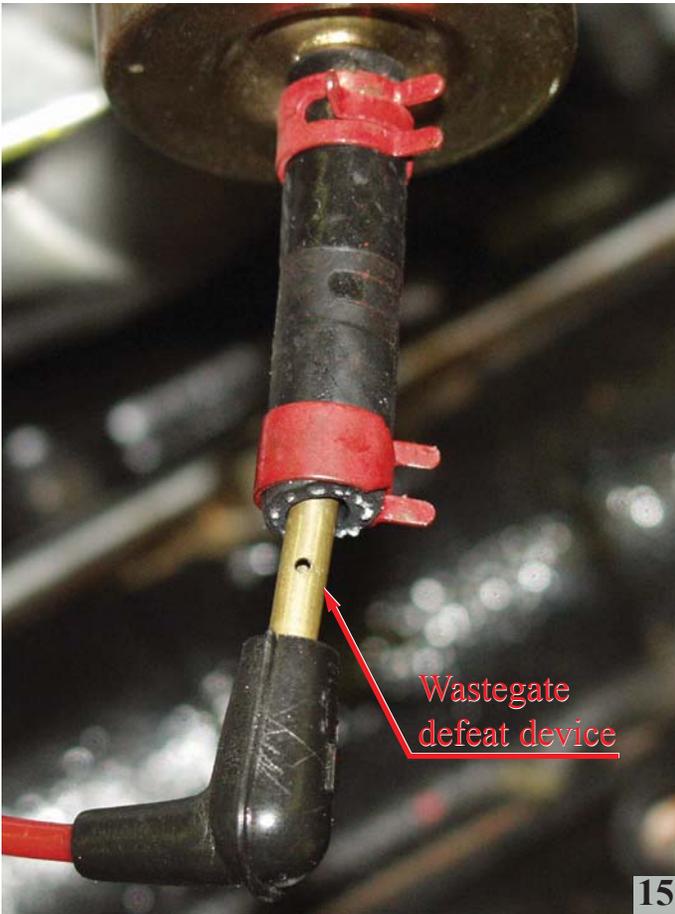
The following parts are available to repair concerns associated with the turbocharger.

	Base Part Number
Pedestal to rotating assembly o-rings	6N653
Pedestal to crankcase o-rings	6N653
Exhaust backpressure regulator	6C673
Pedestal	6N639
Wastegate actuator	6F089
Exhaust backpressure valve	6N089
Turbine housing bolts	9G486
EBP actuator rod seal kit	9P466

Refer to parts information for specific part number.

## PERFORMANCE MODIFICATIONS

Aftermarket performance enhancing PCM programs, wastegate actuator defeat devices, propane injection packages and modification to the exhaust system, may negatively affect the life of the turbocharger, particularly in high altitudes where the "thin air" offers less resistance for the wheels to turn. The higher wheel speeds created by the "thin air" and the performance enhancers typically result in a fractured turbine wheel blade. Wheels with blades missing on "modified " engines will cause low power, vibration and ultimately turbocharger failure. Over-speeding the turbocharger may also cause turbocharger thrust bearing failure, increasing the axial endplay of the turbocharger shaft, and wheel to housing contact.



15

**Aftermarket Performance Enhancers:** Above left is a wastegate actuator defeat device which will not allow the wastegate to operate correctly.



16

**Structural Failure:** Above right is a turbine wheel that has failed due to overspeed as a result of performance modifications.