

TURBOCHARGER

1988 Toyota Celica

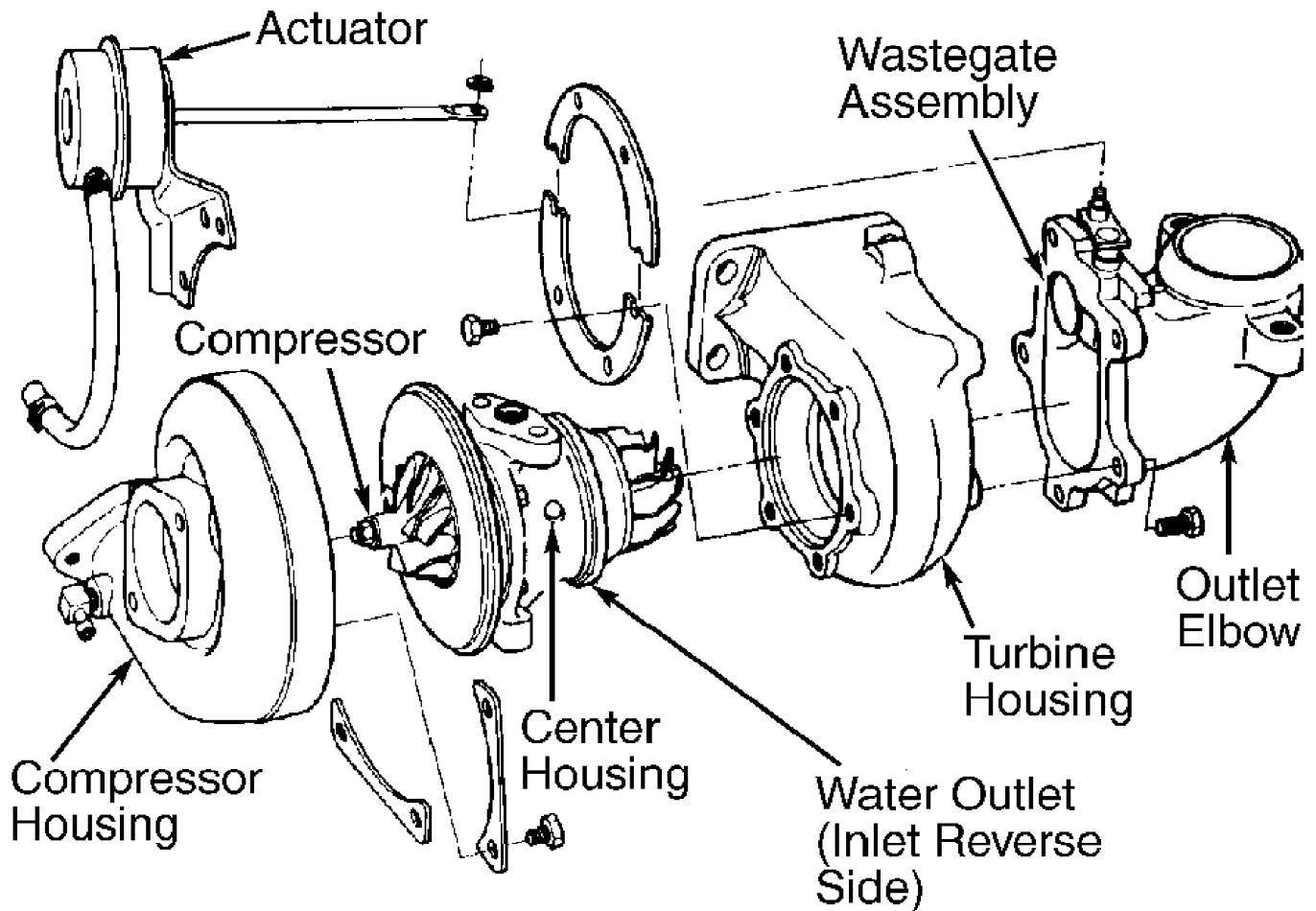
1988 TURBOCHARGING SYSTEMS
All Models

DESCRIPTION

Most models use a water-cooled turbocharger, mounted directly to the exhaust manifold with a wastegate assembly attached to rear of turbine housing. The turbocharger consists of a turbine/compressor assembly, oil supply system and wastegate. Other components include impellers, impeller shaft, bearings and impeller housings.

The safety valve of the system is a pressure actuated wastegate that prevents excessive intake boost pressure.

Turbocharger operation requires a large quantity of clean oil to prevent bearing failure. Engine oil pressure provides constant lubrication to the system.



35720

Fig. 1: Typical Turbocharger

OPERATION

At idle and light throttle, the Turbo engine operates like a

standard engine. When more power is required, exhaust gases from exhaust manifold enter the turbocharger's turbine housing and flow through the turbine blades.

Exhaust flow and turbine speed increase as throttle opens and RPM increases. The impeller turns with turbine and forces air into compressor housing and intake manifold. As impeller and turbine speed increases, boost pressure also increases.

If boost pressure exceeds safe limits, engine damage may result. The wastegate opens when exhaust pressure exceeds a predetermined limit and allows exhaust gases to by-pass compressor.

OPERATING PRECAUTIONS

When Starting

After engine has started, allow it to run at idle for several minutes. If engine has been shut down for a long period, be sure to run engine at idle until engine oil has circulated throughout engine. When turbocharger is replaced, remove oil pipe by loosening top flare nut and pour fresh engine oil directly into oil filler port.

During Operation

Monitor oil pressure gauge to confirm that constant oil pressure is available. If abnormal noise is produced by rotating parts of turbocharger, or unusual vibration is noted, stop operation and check.

When Stopping

Allow engine to run at idle for several minutes before stopping engine. If engine is operated at high load, then stopped abruptly, the engine oil supply is cut off while the turbocharger is still very hot. The turbocharger bearings will be overheated and could be damaged.

TROUBLE SHOOTING

NOTE: Check the following items. If found defective, replace turbocharger assembly. If related parts are defective, repair or replace.

VIBRATION OR NOISE

1) Inspect for defective bearings or interference of rotating parts with related objects. Consider neglect of engine oil change, sustained use with contamination in oil pipe, a restricted or broken oil filter. Check for repeated abrupt starts and stops that could cause bearing failure.

2) If nothing is wrong with lubricating system, an incorrectly balanced rotating section or bent shaft may be suspected. This is due to excessive wear of bearings or contamination that have caused damage to turbine or compressor wheels.

3) If any of these conditions exist, turbocharger assembly must be replaced. Before a new turbocharger assembly is installed, carefully check for contamination or pieces of broken turbine or compressor wheels which might be left in manifold system.

LOW BOOST PRESSURE

1) Check air cleaner element for contamination or clogging and clean or replace element as necessary. If turbine or compressor wheels do not rotate smoothly and lightly when turned by hand, replace turbocharger assembly. Check wastegate valve or relief valve which might be left opened.

2) If turbocharger appears to be good, but has low boost pressure, check for the following:

- * Gas leaks in exhaust system.
- * Deformed or clogged exhaust pipe or muffler which might be causing increased exhaust resistance.
- * Air leaks from compressor discharge side.

WHITE EXHAUST SMOKE

Sustained engine operation with faulty bearings will result in failure of oil seal which could cause leakage of engine oil into exhaust and intake pipes. Leakage of engine oil from turbocharger into exhaust pipe or intake pipe will result in White colored exhaust. If this occurs, check for clogged, crushed or deformed oil return pipe. If nothing is wrong with oil return pipe, leakage is probably due to wear of piston ring (seal ring) in turbocharger.

TESTING

Pressure Check

1) For Camry, connect a 3-way union to boost compensator pressure hose and install a pressure gauge to it. While driving with engine running at 2500 RPM or more (accelerator pedal fully depressed in first gear).

2) For Pickup, connect a pressure gauge to fuel filter. While driving with engine running at 2400 RPM or more (accelerator pedal fully depressed in low range). Check the turbocharging pressure. Standard pressure is 7.7-9.7 psi (.54-.68 kg/cm²) for Camry and 5.8-7.7 psi (.41-.54 kg/cm²) for Pickup.

3) If pressure is less than specification, first check intake air and exhaust systems and relief valve for leakage. If there is no leakage, replace turbocharger assembly. If pressure is above specification, first check if the actuator hose is disconnected or cracked. If not, replace turbocharger assembly.

Intake Air System

Check for leakage or clogging between the air cleaner and turbocharger inlet and between turbocharger outlet and cylinder head. If air cleaner is clogged, clean or replace element. Repair or replace any collapsed or deformed hoses. Check and repair any leaking connections. Check and replace cracked components.

Exhaust System

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbocharger outlet and exhaust pipe. Repair or replace deformed components. Remove foreign material in passages. Repair or replace leaking and cracked components.

Actuator & Wastegate

Disconnect actuator hose. Using a pressure gauge, apply 8.2-8.7 psi (.58-.61 kg/cm²) of pressure to actuator hose and check that rod moves .0098" (.25 mm) or more. If less, replace turbocharger assembly.

CAUTION: Never apply more than 11.4 psi (.8 kg/cm²) of pressure to the actuator.

Impeller Wheel Rotation

Disconnect air cleaner hose. Grasp edge of impeller wheel and turn it. Verify that it turns smoothly. If it does not turn or if it turns with drag, replace turbocharger assembly.

Relief Valve

Check outside of relief valve for excessive oil oozing. If no oil oozing is found, the relief valve is okay. If oil oozing is found, replace the relief valve and check the performance. If there is no change in performance, the relief valve is okay.

Indicator Light & Warning Light Operation

1) Verify that Green indicator light and Amber warning light illuminate when ignition is turned on. If not, check 7.5A "GAUGE", "CHG" and "IGN" fuses. If fuses are blown, check for short and repair as necessary. If the fuses are okay, check to see if discharge warning light is out. If it is okay, the charging system is faulty. If the light is out, the combination meter is faulty.

2) If Green indicator and Amber warning lights illuminate when ignition is turned on, check to see if indicator and warning lights are out during engine idle. If both lights and discharge warning light are on, the charging system is faulty. If both lights stay on and discharge warning light is off, go to step 4).

3) If Green light stays on, check for open circuit in wire harness between low pressure switch and combination meter. If circuit is okay, replace faulty low pressure switch. If Amber light comes on, check for open circuit in wire harness between high pressure switch and combination meter and check for ground connection of switch. Repair either circuit as necessary.

4) If both indicator and warning lights are out during engine idle, check to see if Green indicator light comes on when 2 psi (.14 kg/cm²) pressure is applied to both pressure switches. If Green indicator does not come on, check for short circuit in wiring harness between low pressure switch and combination meter. If circuit is okay, replace faulty low pressure switch.

5) If Amber light comes on, see if Green indicator light comes on when 11.9 psi (.84 kg/cm²) pressure is applied to both switches. If not, replace faulty high pressure switch. If it does come on, combination meter is faulty.

6) If the Green indicator light does come on when the pressure in step 4) is applied, check to see if Amber indicator light comes on when 11.9 psi (.84 kg/cm²) is applied to both switches.

7) If not, check for short circuit in wire harness between high pressure switch and combination meter. If no short circuit is present, replace faulty high pressure switch. If Amber light does light when pressure is applied, turbocharger indicator and warning light operation are okay.

REMOVAL & INSTALLATION

Removal

1) Disconnect negative battery cable. Drain coolant. Disconnect oxygen sensor wire and connector. Disconnect PCV hose from cylinder head cover. Loosen clamp and disconnect air cleaner hose from turbocharger.

2) Remove 4 clips and remove air cleaner hose with air cleaner case cover. Disconnect turbocharger pressure hose to compressor elbow. Loosen clamp and disconnect air intake hose from intake manifold.

3) Remove bolt holding elbow stay to engine. Remove 2 bolts and compressor elbow with relief valve and air intake hose. Remove compressor elbow gasket. Remove turbocharger heat insulators. Remove 3 nuts from flange. Disconnect exhaust pipe from manifold and remove gasket.

4) Remove turbocharger oil pipe flange nuts. Remove 4 nuts and remove turbocharger, turbocharger gasket and flange gasket from

exhaust manifold. Remove 4 nuts, washers, turbine elbow and gasket. Remove relief valve from compressor elbow.

Inspection

1) To inspect impeller wheel rotation, grasp edge of turbine wheel and turn it. Check that impeller wheel turns smoothly. If impeller wheel does not turn or if it turns with a drag, replace turbocharger assembly.

2) To inspect axial play of shaft bearing, insert a dial gauge into intake side, hold turbine wheel edge by hand and check axial play. Standard clearance is .0051" (.13 mm). If not within specification, replace turbocharger assembly.

Installation

1) Install relief valve to compressor elbow and tighten nuts to 27 ft. lbs. (37 N.m). Install gasket and turbine elbow with 4 nuts and washers and tighten nuts to 18 ft. lbs. (25 N.m). Place a new gasket with protrusion on opposite side of cylinder head.

NOTE: After replacing a turbocharger assembly, pour 20 cc of new oil through oil inlet while turning impeller wheel to splash oil on bearing.

2) Install turbocharger, with a new oil pipe gasket, to exhaust manifold and oil pipe. Install nuts and tighten to 38 ft. lbs. (52 N.m). Install turbocharger oil pipe flange nuts and tighten to 13 ft. lbs. (18 N.m). Place a new gasket on exhaust pipe.

3) Connect exhaust pipe and install flange nuts. Tighten to 9 ft. lbs. (13 N.m). Install turbocharger heat insulators. Install compressor elbow with relief valve and air intake hose with 2 bolts and new gasket. Tighten bolts to 9 ft. lbs. (13 N.m).

4) Connect elbow stay to engine. Connect air intake hose to intake manifold with clamp. Connect turbocharger pressure hose to compressor elbow. Install air cleaner case cover and air cleaner hose with 4 clips. Connect air cleaner hose to turbocharger with clamp. Connect PCV hose to cylinder head cover.