Intake & Exhaust systems

Carburetors and Throttle Body need heated intake manifolds

This keeps fuel from condensing out of air and creating uneven air fuel to each cylinder
Heated Intake Manifolds

Carburetors and Throttle Body need heated intake manifolds.

This keeps fuel from condensing out of air and creating uneven air fuel to each cylinder.
Heated Intake Manifolds

Many older intake manifolds use a HEAT RISER

The heat riser valve directs exhaust gas through a special passage to heat the intake manifold quickly

Once the engine is warm the heat riser shuts off the exhaust gas flow through the manifold

Stuck – corroded heat riser valves are common
Heat Riser Valve
Cold Intake Manifolds

Port fuel injectors use the heat of the intake valve to keep fuel evaporated.

They use COLD intake air as cold air is denser (more oxygen) to provide more power.
Variable Intake Manifolds

Show this short video

https://www.youtube.com/watch?feature=player_embedded&v=zA_19bHxEYg
Variable Intake Manifolds

PCM will control air valves inside the intake manifold plenum.

Low RPM works better with long runners

High RPM works better with shorter – more open intake system
Replacing Manifolds

Intake manifolds are very sensitive to warping.

Proper sealing depends upon following specific torque pattern and procedure.

Always look it up and follow specifications!
Turbo Chargers

Turbochargers use expanding exhaust gasses to spin a turbine wheel

This spins a compressor wheel for the intake

They operate at VERY high RPM and Temperatures
Turbo Chargers

Compressing air causes the temperature to rise.

Hot air has less oxygen
Cold air has more oxygen
(for any given volume)

Many turbochargers use an intercooler to lower the temperature and increase the density of the incoming air.
Turbocharging System with Intercooler

- Turbocharger
- Air Cleaner
- Air Flow Meter
- Compressor Wheel
- Intercooler
- Air Intake Chamber
- Turbine Wheel
- Actuator
- Wastegate Valve

Flow: 
- Exhaust Gas (black arrow)
- Intake Air (white arrow)
Turbochargers operate at very high RPM and temperatures that require special engine oil.

Frequent oil changes are #1 best bet for keeping them trouble free!
Turbochargers can feed too much air into the engine.

Too much air in the cylinder will raise compression pressure too high and the fuel will pre-ignite or explode.

This is hard on engine and drastically increases Oxides of Nitrogen or NOx.

NOx is a very harmful exhaust emission.

All turbochargers use a Wastegate to control maximum boost pressure
Wastegate Closed

- To Exhaust Pipe
- Wastegate Valve (Closed)
- Turbine Wheel
- Compressor Wheel
- Intake Air (From Air Cleaner)
- Exhaust Gas (From Combustion Chamber)
- To Combustion Chamber

Fig. 9-06
T852f333A
Most Turbocharger waste gates are computer controlled.

Pre-ignition can be monitored with a knock sensor

The knock sensor sends a signal that gets stronger as pre-ignition gets stronger

Premium or high octane fuel resists pre-ignition and can run at higher pressures and temperatures

Using a knock sensor will allow the computer to “figure out” when premium or regular fuel is being used.
Turbo Chargers Service

Advise customers to get frequent oil changes

Encourage them to allow the turbo to cool off (idle the engine) before turning off the engine.

Turning off a HOT turbocharger will allow the oil to bake forming hard carbon deposits.

Carbon deposits will wear out seals and cause oil leaks and oil burning through the intake.
Replacing Turbo Chargers

Oil passages in the engine leading to and from the turbocharger can get plugged with carbon

Be sure to clean out all passages

All Turbochargers should be pre-lubricated

Follow all procedures.

Most call for cranking the engine to get oil pressure into the turbo BEFORE starting the engine
Exhaust Systems

Gasoline is Hydrocarbon or HC

Air is Oxygen and Nitrogen

Burning fuel creates lots of CO2 and lots of H2O

Water causes rust and corrosion!
Exhaust System Service

Most exhaust bolts are corroded and will require penetrant oil

Spray all bolts early and give time for the penetrant to work into the corrosion

Heat will help remove stuck – rusted bolts

MUCH easier to take your time and not have to repair broken bolts and studs
Catalytic Converters

Gasoline is Hydrocarbon or HC

Air is Oxygen and Nitrogen

\[ H + C + O + N = \]
\[ H_2O \text{ water} \]
\[ CO_2 \text{ Carbon Dioxide} \]
\[ CO \text{ Carbon Monoxide (deadly poison)} \]
\[ NO_x \text{ Oxides of Nitrogen} \]

Some gasoline or HC escapes unburned
Catalytic Converters

Catalytic Converter System

Wall Thickness

HC  CO  NOx  O2

H2O  CO2  N2

Fig. 8-1
TL8741801
Catalytic Converters

Modern catalytic converters are 3-way

They burn up extra HC and turn it into H2O and CO2

They combine an extra oxygen to turn CO into CO2

The reduce NOx by splitting Nitrogen from Oxygen

A functioning converter will reduce exhaust emissions by over 90% !
Catalytic Converters

Oxygen sensors are used to “Monitor” the efficiency of the converter
Catalytic Converters

Too much HC will overheat a converter

HC comes from unburned fuel

Any misfire creates excessive HC

Misfire is “Monitored” to alert the driver that catalyst damage is possible
Catalytic Converters

Too much HC will overheat a converter

Overheated converters will melt inside and plug up.

Partially plugged converter (or exhaust) will rob the engine of power.

Fully plugged converter may keep engine from starting or allow it to start but quickly kill the engine as backpressure builds.
Plugged Exhaust

Engines with plugged exhaust will show lower engine vacuum as RPM of engine increases.

Pressure gauges can be installed into the exhaust to measure back pressure and find the restriction.

Pressure in exhaust should stay under 2.5 psi.