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Model: ASET™,
E-Tech™

(Also applies to Mack Trucks Australia)
(Supersedes SB214020 dated 09/22/06)

Actions Required to Avoid Repeat Turbocharger Failures

When replacing a failed turbocharger, it is extremely important that the following actions be performed to avoid a repeat failure:

- Clean any oil that has accumulated in the inlet manifold and the charge air cooler.
- Clean all turbocharger failure debris from the air cleaner and inlet air ducts.
- Clean all debris from the exhaust manifold (and EGR cooler if applicable).
- Inspect and clean the turbocharger oil supply line and oil drain tube.
- Replace the turbocharger mounting flange gasket, oil drain tube gasket(s) or O-ring (as applicable) and the turbocharger mounting studs and nuts.
- Change the engine oil and filters.
- Pre-lube the replacement turbocharger. On ASET™ AC engines, disconnect the VTG control valve connector prior to starting the engine.
- Perform the engine start and run-in procedures as described later in this bulletin.

The above action items are explained in detail in this bulletin.

A turbocharger failure can introduce a volume of oil and other debris into the charge air cooler and other components of the inlet air system. Additionally, engine oil can also become contaminated with soot and other debris due to a turbocharger failure. To avoid a repeat failure, the following procedures should be followed whenever a failed turbocharger is replaced.

Cleaning Oil from Inlet Manifold

NOTE

E-Tech™ engines manufactured approximately mid-1999 and later, ASET™ AI and AMI engines manufactured prior to 2004, and all ASET™ AC engines utilize an inlet manifold design that has the manifold floor approximately 2" below the level of the cylinder head port. In the event of a turbocharger failure, this area of the inlet manifold can become a reservoir for oil. If accumulated oil is not removed from the inlet manifold, the engine may experience "diesel engine run-away" when the engine is first started after the replacement turbocharger has been installed.

Whenever a turbocharger failure has introduced a volume of oil into the charge air cooler, the cooler must be thoroughly cleaned or replaced before the engine is started. Additionally, on engines having the one-piece inlet manifold, the manifold must be checked for the

presence of oil and cleaned as necessary. The manifold can be checked without removing it from the engine by removing the inlet hose from the manifold and using a flashlight to look inside.

NOTE

On ASET™ AC engines, it will be necessary to remove the mixer tube to view the inside of the manifold.

If it is not possible to see inside the manifold, a piece of wire or similar object could be inserted into the manifold and used to check if oil is present. Accumulated oil can be removed with a suction pump by removing the air compressor boost pressure supply line and fitting located at the rear of the manifold, then inserting a suction pump hose into the opened port. Make sure the hose extends all the way to the bottom of the manifold. Using this method ensures that oil accumulated at the rear of the manifold will be removed.

CAUTION

In most instances, the engine is mounted in the chassis tilted toward the rear. Because of this, oil will collect at the back of the inlet manifold making it possible for some oil to enter cylinder No. 6. If enough oil enters the cylinder, hydraulic lock could occur and result in severe damage when attempting to start the engine. To avoid such damage, use the barring tool to rotate the engine several revolutions before starting. Resistance felt as the engine is rotated (as cylinder No. 6 approaches TDC of the compression stroke) indicates that oil may be present in the combustion chamber. To remove this oil, remove the injection nozzle from cylinder No. 6 and rotate the engine several more revolutions to push the oil from the cylinder. Before reinstalling the nozzle, clean the oil from the nozzle hole in the cylinder head.

Cleaning Oil from the Charge Air Cooler

Oil can be removed from the charge air cooler as follows:

1. Remove the charge air cooler and flush the inside with a safety solvent to remove oil and other debris.
2. Shake the cooler from side-to-side to remove large pieces.
3. Wash the cooler with hot, soapy water (use liquid gel automatic dishwasher detergent to minimize foaming). Rinse with clean water and blow dry with compressed air in the reverse direction of flow.
4. Carefully inspect the cooler to ensure cleanliness.

⚠ CAUTION

Do not use caustic cleaners when flushing the cooler. Be extremely careful when handling the cooler so as not to damage the core.

NOTE

When flushing the charge air cooler, it is recommended that the cooler be turned upside down and a reverse flow be used to flush the inside.

NOTE

If oil and debris are still evident inside the charge air cooler after it has been thoroughly cleaned, contact the Mack Trucks, Inc. Warranty Department to authorize replacement.

Cleaning the Intake Air System

When a turbocharger fails, debris from the compressor wheel and surrounding area has very high inertia and can travel throughout the intake air piping and into the air cleaner. Additionally, small metal pieces resulting from the failure are extremely hot and will melt into and stick to the insides of the plastic hoses and tubing. All these pieces must be removed from the intake air system. Because the turbocharger wheels spin at such high speeds, even a small piece of debris can throw the wheels out of balance, resulting in eventual failure of the replacement turbocharger.

The intake air ducts should be disassembled and the insides of the ducts, elbows, hoses, etc., carefully checked for debris and cleaned as necessary. The air filter element should also be removed, inspected (be sure to check the inside of the filter) and replaced as necessary. Thoroughly clean the inside of the air cleaner canister of any debris.

⚠ CAUTION

To check the intake air ducts and air cleaner canister, carefully wipe the inside surfaces with a rag held by gloved hand. The rag will snag on pieces that may be imbedded in the inner surfaces of the ducts and canister. The glove and rag will protect the hand from being scratched or cut on any imbedded objects.

Cleaning the Exhaust Manifold

When a turbocharger failure has occurred due to metal debris which resulted from a catastrophic engine failure (such as a dropped valve, etc.), the exhaust manifold must be inspected for debris. Any debris that is lodged in the exhaust manifold must be removed to prevent a repeat failure. Inspect and clean the exhaust manifold as follows:

1. Remove the exhaust manifold from the engine.
2. Remove the EGR valve (if applicable).
3. Separate the exhaust manifold sections and inspect inside each of the sections. If the manifold sections cannot be separated easily, use an inspection mirror to thoroughly inspect inside the manifold through each of the six exhaust ports, as well as through the turbocharger (and EGR valve if applicable) mounting ports. Remove any debris that may be present.
4. With the exhaust manifold removed from the engine, inspect the cylinder head exhaust ports for damage and debris. Remove any debris found and thoroughly clean the affected areas.

NOTE

It would be unusual for debris to be lodged in the manifold or cylinder heads that could not be removed. Even if the debris is stuck or jammed, it should still be possible to remove the material. The exhaust manifold should only be replaced if there is debris that cannot be removed.

5. For ASET™ AC engines, check the EGR valve for debris by sliding the valve actuator through a full range of travel. This can be accomplished by removing the EGR valve from the engine, holding the valve upside down and then using a pliers to grasp and move the actuator rod. The EGR cooler should also be inspected for debris which may be lodged on top of the hot gas inlet side fins. This can be done with a small inspection mirror and a flashlight. Additionally, the EGR hot tube should be inspected for debris and cleaned as required.

Replace the EGR valve if the valve actuator sticks or binds. Additionally, replace the EGR cooler if any debris is seen, and clean any debris seen inside the hot side tube.

Installing the Replacement Turbocharger

CAUTION

A turbocharger failure can result in debris contaminating the turbocharger oil supply line. It is EXTREMELY IMPORTANT to remove, flush and thoroughly clean the line prior to installing the replacement turbocharger. Failure to do so can result in debris from the oil line entering the replacement turbocharger, causing damage to the bearings and eventual failure of the replacement turbocharger.

1. Drain the engine oil.
2. Remove the turbocharger oil supply line and inspect for kinks or other types of damage. Replace the line as required. If the oil line is undamaged, it can be reused.

⚠ CAUTION

Stainless steel braided lines can be crimped shut if not handled or installed correctly. If the steel braid has been kinked, it pinches the inner tube, and even if the steel braid is straightened, the inner tube will remain pinched. Caution must be used not to bend or twist the steel braided line to the point where it becomes kinked. If the line has been kinked, it must be replaced to eliminate turbocharger damage resulting from restricted oil flow.

If the oil line is being reused, it must be flushed with a clean, suitable, non-flammable solvent. Allow solvent to run through the line to flush any debris from the inside, and then blow the line dry with clean shop air.

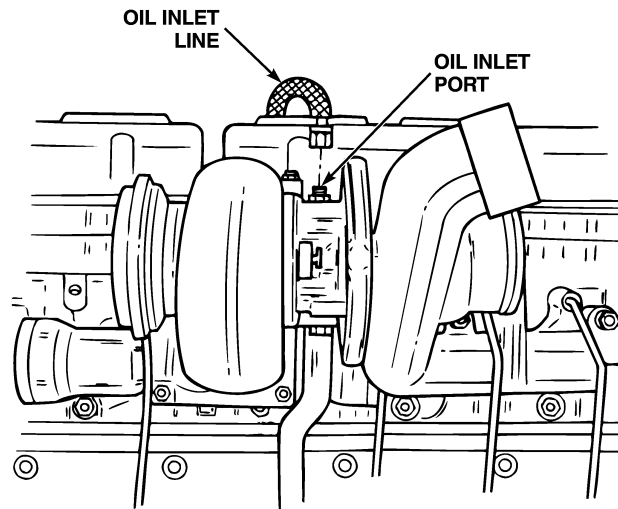
3. Using a new turbocharger mounting flange gasket, mounting studs and nuts, install the turbocharger on the exhaust manifold, and using new gasket(s) and O-ring, as applicable, install the oil drain tube and connect the exhaust pipe. Do not connect the oil supply line or the inlet air duct to the turbocharger.

NOTE

It is recommended that all four turbocharger mounting studs and nuts be replaced whenever the turbocharger has been removed. When installing a VTG turbocharger, the current mounting studs (part No. 616GC279AM) are required. These mounting studs are 60 mm long. Additionally, when installing a 631GC5176(B)(C)(D)M VTG turbocharger, the revised oil drain tube (part No. 681GC544) is required if it has not already been replaced (refer to service bulletin SB214036).

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4. Pour clean engine oil into the oil inlet port at the top of the turbocharger until overflowing. Take care not to spill oil on the turbocharger or exhaust manifold, and be sure to clean any oil that may have spilled.



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Figure 1 — Turbocharger Oil Inlet Port

5. Spin the compressor wheel by hand several revolutions and wiggle the shaft back and forth. This will ensure that oil is distributed over all bearing surfaces.
6. Install the inlet air duct to the turbocharger, but do not connect the oil supply line at this time.
7. Change the spin-on oil filters and the centrifugal oil filter as outlined in the *Maintenance and Lubrication Manual*, TS494. Be sure to prefill each new spin-on filter with two quarts of new engine oil.
8. Fill the engine crankcase with the proper specification and grade of engine oil (refer to the *Maintenance and Lubrication Manual*, TS494, for current engine oil specifications).
9. Again, pour clean engine oil into the turbocharger oil inlet port until overflowing, and then install the oil supply line.
10. Start the engine and let it run at an idle. Typically, it should take approximately eight seconds or less for sufficient oil pressure to build. Allow the engine to idle for approximately five minutes before increasing engine speed or driving the vehicle.

⚠ CAUTION

For ASET™ AC engines, disconnect the connector from the VTG control valve prior to starting the engine. This will prevent the turbocharger from reaching excessive speeds when the engine is first started. Run the engine for five minutes, and then shut the engine off. Reconnect the VTG control valve connector and use the V-MAC® service tool to clear the fault code.

Pre-Lubricating a Turbocharger After Sitting Idle for an Extended Period of Time

Turbochargers operate at very high speeds, temperatures and pressures, making lubrication of the turbocharger bearings extremely important, particularly for a turbocharger that has just been installed, and also for a turbocharger that has not been operated for a period of time.

When the engine is first started after a new turbocharger has been installed, or after the engine has been sitting without being started for a period of time (approximately 30 days or more), the bearings are basically dry, and damage to the bearings due to lack of lubrication can occur during the first couple minutes of operation. The turbocharger can continue to operate for several thousand miles, but may eventually fail due to the damage caused at the initial start-up.

Before starting the engine on a vehicle that has been sitting for an extended period of time (approximately 30 days), pre-lubricate the turbocharger as follows:

1. Disconnect the oil supply line and the inlet air duct from the turbocharger.
2. Pour clean engine oil into the oil inlet port located at the top of the turbocharger until overflowing. Take care not to spill any oil on the turbocharger or exhaust manifold, and be sure to clean any oil that may have spilled.
3. Spin the compressor wheel by hand several revolutions and wiggle the shaft back and forth. This will ensure that oil is distributed over all bearing surfaces.
4. Reconnect the air inlet duct to the turbocharger.
5. Again, pour clean engine oil into the turbocharger oil inlet port until overflowing.
6. Reconnect the oil supply line and start the engine. Allow the engine to idle approximately five minutes before increasing engine speed or driving the vehicle.

CAUTION

For ASET™ AC engines, disconnect the connector from the VTG control valve prior to starting the engine. This will prevent the turbocharger from reaching excessive speeds when the engine is first started. Run the engine for five minutes, and then shut the engine off. Reconnect the VTG control valve connector and use the V-MAC® service tool to clear the fault code.
