SERVICE INFORMATION BULLETIN

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DATE: September 2010

SUBJECT: AIR COMPRESSOR AND UNLOADER VALVE

ADDITIONS, REVISIONS, OR UPDATES

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<td>DDC-SVC-MAN-0081</td>
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<td>Procedures have been developed for replacement of the air compressor unloader valve independent of the air compressor assembly.</td>
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<td>DDC-SVC-MAN-0005</td>
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NOTE: Page numbers are based on the most recent version of the individual publication and may be adjusted throughout the annual print cycle.
THE FOLLOWING INFORMATION APPLIES TO EPA07/10 DD PLATFORM ENGINES
DESCRIPTION AND OPERATION OF THE AIR COMPRESSOR AND RELATED PARTS

The function of the air compressor is to provide and maintain air under pressure to operate devices in air brake systems. Detroit Diesel offers two sizes of air compressors. The single cylinder has a displacement 360 cm³ and the two cylinder has a displacement 650 cm³. Both compressors are installed with an Energy Saving System (ESS) to save fuel.

The air compressor is mounted to the rear of the cylinder block on the left side of the engine.

The engine provides a continuous supply of oil to the compressor. Oil is routed from the oil passage in the gear case to the compressor oil inlet. The air compressor is designed to permit direct installation of the compressor onto the gear case. The compressor consists of a water-cooled cylinder head assembly and an integral air-cooled crankcase assembly. The cylinder head assembly is made up of the cylinder head, cooling plate and valve plate assembly and uses two sealing gaskets. The cylinder head contains air and water ports as well as an unloader assembly. A cooling plate is located between the cylinder head and valve plate assemblies and assists in cooling. The valve plate assembly consists of brazed steel plates which have valve openings and passages for air and engine coolant to flow into and out of the cylinder head.

![Diagram of BA-921 Single Cylinder Air Compressor and Related Parts]

1. Bolt  
2. Cover  
3. O-ring  
4. Coolant Return Line Assembly  
5. Coolant Inlet Line Assembly  
6. Single Cylinder Air Compressor  
7. O-ring  
8. Gear  
9. Nut  
10. Clamp (OEM provided)  
11. Bolt (OEM provided)  
12. Intake Line (OEM provided)  
13. Bolt

Figure 1  BA-921 Single Cylinder Air Compressor and Related Parts
The air compressor is driven by the engine and functions continuously when the engine is in operation. The function of the unloader valve allows the air compressor to operate in an “unloaded” state, where the compressor piston continues to reciprocate, but does not build additional air pressure in the vehicle’s compressed air system. Located within the cylinder head, the unloader valve assembly (in conjunction with the governor) controls whether the air compressor operates in a loaded or unloaded state.

When the vehicle air pressure system is above the minimum threshold, air pressure from the governor acts on the unloader piston, lifting it off its seat. With the unloader valve unseated, air from the cylinder flows into a small chamber in the head instead of into the vehicle’s compressed air system. Air then cycles between the cylinder and chamber in the head until the unloader valve is seated once again.

Figure 2  LK-862 Two Cylinder Air Compressor and Related Parts
NOTE:
Air in piston shuttles back and forth from the piston to the closed room during unloaded operation.

Figure 3  Piston and Closed Room

When the vehicle air pressure system is below the minimum threshold, no air pressure is sent to the unloader valve. With the unloader valve seated, the air compressor will build air pressure in the vehicle compressed air system.

Figure 4  Air Pressure Discharge to Vehicle
NOTE:
The two-cylinder compressor requires two Unloader Valve Service Kits, one for each cylinder.

Figure 5  Unloader Valve and Related Parts

REMOVAL OF THE AIR COMPRESSOR

Remove as follows:

1. Disconnect the batteries.
2. Drain the coolant.

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<td>Ensure the air pressure has been released from the air lines before removing the lines from the air compressor.</td>
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3. Relieve air pressure from tanks.
4. Disconnect the air lines to and from the compressor.
5. Disconnect and drain the coolant supply and return lines at the air compressor.
6. Remove the four bolts that secure the air compressor to the cylinder block.

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<td>Do not contact the drive gear to the engine block during removal; damage to the seal surface will cause oil leaks.</td>
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7. Slide the air compressor forward and remove from engine.
8. Discard air compressor gasket.

**INSPECTION OF THE AIR COMPRESSOR**

Advanced troubleshooting information for the Bendix® air compressor can be found on the Bendix web site at http:\www.bendix.com or call the Bendix Technical Assistance Center at 1-800-AIR-BRAKE, (1-800-247-2725).

Inspect the compressor as follows:

1. Inspect the intake hose adapters for physical damage; make certain to check the adapters at both ends of the intake hose or tubing.
2. Inspect the intake hose clamps and tighten them if needed.
3. Inspect the intake hose or line for signs of drying, cracking, chafing and ruptures; replace if necessary.
4. Ensure all metal tubes are tight to the mating fitting.
5. Inspect the metal tubes for any cracks or breaks; replace as necessary.
6. Check the exterior of the compressor for signs of oil seepage. Refer to the troubleshooting for appropriate tests and corrective action. Check for cylinder head gasket air leakage. Refer to the Bendix web site for procedure and repair components.

Inspect the Compressor Unloader Valve as follows:

1. Check for leaks at the unloader port. Replace leaking or worn O-rings.
2. Make certain that the unloader system lines are connected properly.
3. Cycle the compressor through the loaded and unloaded cycle several times. Make certain that the governor cuts-in (compressor resumes compressing air) at a minimum of 105 psi (cut-out should be approximately 15-20 psi greater than cut-in pressure. Adjust or replace the governor as required.
4. Note that the compressor cycles to the loaded and unloaded conditions promptly. If prompt action is not noted, repair or replace the governor and/or repair the compressor unloader.
INSTALLATION OF THE AIR COMPRESSOR

Install as follows:

1. Clean all foreign material from the mating surfaces of the air compressor and the cylinder block.

2. Install a new O-ring on the air compressor hub and a new O-ring on the oil supply, and then install the air compressor on the cylinder block. Torque the four bolts to 60 N·m (44 lb·ft).

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<td>Ensure the correct bolt length is used when the air compressor is installed. If an incorrect bolt length (too long) is used, the cup plugs installed in the cylinder block can be pushed out into the gear train causing severe damage to the gear train. The correct bolt length is 35 mm (1.37 in.).</td>
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<td>Ensure when the air compressor coolant lines are installed that there is an O-ring and an O-ring retainer installed on both ends of the coolant lines. Ensure that the air compressor retainer is installed on the coolant line and is pushed down to lock the lines onto the inlet and outlet ports to the cylinder block, fuel filter module and air compressor. A leak will occur if the lines are incorrectly installed and the coolant line retainer is not engaged in the locked position. If the O-ring or the coolant line retainers are missing, or removed, replace the coolant line.</td>
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3. Install the coolant supply and return lines to the air compressor.

4. Install the air lines to and from the air compressor. Refer to OEM specifications.

5. Fill the cooling system. Refer to OEM specifications.

6. Start the engine and check for leaks.
REMOVAL OF THE AIR COMPRESSOR UNLOADER VALVE

Remove as follows:

1. Clean the area surrounding the unloader valve assembly.

2. Hold the unloader cap (1) in place to restrain the spring pressure and remove the two unloader cap screws. Remove and discard the unloader cap (1) and gasket (2).

NOTE:
For LK-862 two cylinder compressors, retain the original caps for re-assembly. For BA-921 single-cylinder compressors, discard cap, but retain the splash shield.

3. Remove and discard the balance piston (3) and spring (4) from the cylinder head. Then remove and discard the unloader piston (7) along with its three O-rings (6, 8, 9).

4. Inspect the cylinder head bore for any scoring or damage. If damage is found, replace the compressor.
INSTALLATION OF THE AIR COMPRESSOR UNLOADER VALVE

Install as follows:

1. Clean the unloader piston bore in the cylinder head.
2. Using the lubricant provided, thoroughly lubricate and install the O-rings on the unloader piston and lubricate the unloader piston bore in the cylinder head. It is recommended to utilize the entire grease cartridge for each unloader valve assembly being installed.

NOTE:
Install the largest and smallest O-rings to the outside of the piston.

3. Insert the spring into the unloader piston.
4. Lubricate the balance piston and insert the piston (smaller diameter first) into the spring previously installed in the unloader piston.

NOTE:
For the LK-862 two cylinder compressor, install the original unloader caps and discard the caps supplied with the service kit. For the BA-921 single cylinder compressor, install the cap supplied in the kit, and re-use the splash shield.

5. Position the unloader cap gasket on the cylinder head. Position the unloader cap (and splash shield for the BA-921 single cylinder compressor) on top of the balance piston, making certain the cap is oriented properly.
6. Using manual pressure, gently push the balance piston into the unloader piston until the unloader cap rests against the cylinder head.
7. Install and torque the unloader cap screws to 7-8 N·m (62-71 lb·in.).
THE FOLLOWING INFORMATION APPLIES TO EPA07 SERIES 60 ENGINES
AIR COMPRESSOR UNLOADER VALVE

The air compressor is driven by the engine and functions continuously when the engine is in operation. The function of the unloader valve allows the air compressor to operate in an “unloaded” state, where the compressor piston continues to reciprocate, but does not build additional air pressure in the vehicle’s compressed air system. Located within the cylinder head, the unloader valve assembly (in conjunction with the governor) controls whether the air compressor operates in a loaded or unloaded state.

When the vehicle air pressure system is above the minimum threshold, air pressure from the governor acts on the unloader piston, lifting it off its seat. With the unloader valve unseated, air from the cylinder flows into a small chamber in the head instead of into the vehicle’s compressed air system. Air then cycles between the cylinder and chamber in the head until the unloader valve is seated once again. When the vehicle air pressure system is below the minimum threshold, no air pressure is sent to the unloader valve. With the unloader valve seated, the air compressor will build air pressure in the vehicle compressed air system.

NOTE:
Two-cylinder compressor requires two Unloader Valve Service Kits, one for each cylinder.

1. Unloader Cap
2. Gasket
3. Balance Piston
4. Spring
5. Splash Shield
6. O-ring
7. Unloader Piston
8. O-ring
9. O-ring
NOTE:
Air in piston shuttles back and forth from the piston to the closed room during unloaded operation.

When the vehicle air pressure system is below the minimum threshold, no air pressure is sent to the unloader valve. With the unloader valve seated, the air compressor will build air pressure in the vehicle compressed air system.
REMOVAL OF THE AIR COMPRESSOR UNLOADER VALVE

Remove as follows:

1. Clean the area surrounding the unloader valve assembly.
2. Hold the unloader cap (1) in place to restrain the spring pressure and remove the two unloader cap screws. Remove and discard the unloader cap (1) and gasket (2).

NOTE:
For LK-862 two cylinder compressors, retain the original caps for re-assembly. For BA-921 single cylinder compressors, discard cap, but retain the splash shield.

3. Remove and discard the balance piston (3) and spring (4) from the cylinder head. Then remove and discard the unloader piston (7) along with its three O-rings (6, 8, 9).
4. Inspect the cylinder head bore for any scoring or damage. If damage is found, replace the compressor.

INSTALLATION OF THE AIR COMPRESSOR UNLOADER VALVE

Install as follows:

1. Clean the unloader piston bore in the cylinder head and inspect for any scoring or damage.
2. Using the lubricant provided, thoroughly lubricate and install the O-rings on the unloader piston and lubricate the unloader piston bore in the cylinder head. It is recommended to utilize the entire grease cartridge for each unloader valve assembly being installed.

NOTE:
Install the largest and smallest O-rings to the outside of the piston.

3. Insert the spring into the unloader piston.
4. Lubricate the balance piston and insert the piston (smaller diameter first) into the spring previously installed in the unloader piston.
NOTE:
For the LK-862 two cylinder compressor, install the original unloader caps and discard the caps supplied with the service kit. For the BA-921 single cylinder compressor, install the cap supplied in the kit, and re-use the splash shield.

5. Position the unloader cap gasket on the cylinder head. Position the unloader cap (and splash shield for the BA-921 single cylinder compressor) on top of the balance piston, making certain the cap is oriented properly.

6. Using manual pressure, gently push the balance piston into the unloader piston until the unloader cap rests against the cylinder head.

7. Install and torque the unloader cap screws to 7-8 N·m (62-71 lb·in.).
ADDITIONAL SERVICE INFORMATION

Additional service information is available in *Power Service Literature.*