

Operation and Maintenance Manual

1103 and 1104 Industrial Engines

DC (Engine)
DD (Engine)
DJ (Engine)
DK (Engine)
RE (Engine)
RG (Engine)
RJ (Engine)
RR (Engine)
RS (Engine)
RT (Engine)
DF (Engine)
DG (Engine)

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Do not bypass the automatic shutoff circuits. Do not disable the automatic shutoff circuits. The circuits are provided in order to help prevent personal injury. The circuits are also provided in order to help prevent engine damage.

See the Service Manual for repairs and for adjustments.

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Engine Starting

WARNING

Do not use aerosol types of starting aids such as ether. Such use could result in an explosion and personal injury.

If a warning tag is attached to the engine start switch or to the controls, DO NOT start the engine or move the controls. Consult with the person that attached the warning tag before the engine is started.

All protective guards and all protective covers must be installed if the engine must be started in order to perform service procedures. To help prevent an accident that is caused by parts in rotation, work around the parts carefully.

Start the engine from the operator's compartment or from the engine start switch.

Always start the engine according to the procedure that is described in the Operation and Maintenance Manual, "Engine Starting" topic in the Operation Section. Knowing the correct procedure will help to prevent major damage to the engine components. Knowing the procedure will also help to prevent personal injury.

To ensure that the jacket water heater (if equipped) and/or the lube oil heater (if equipped) is working correctly, check the water temperature gauge and the oil temperature gauge during the heater operation.

Engine exhaust contains products of combustion which can be harmful to your health. Always start the engine and operate the engine in a well ventilated area. If the engine is started in an enclosed area, vent the engine exhaust to the outside.

Note: The engine is equipped with an automatic device for cold starting for normal conditions of operation. If the engine will be operated in very cold conditions, then an extra cold starting aid may be required. Normally, the engine will be equipped with the correct type of starting aid for your region of operation.

The engines are equipped with a glow plug starting aid in each individual cylinder that heats the intake air in order to improve starting.

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Engine Stopping

Stop the engine according to the procedure in the Operation and Maintenance Manual, "Engine Stopping (Operation Section)" in order to avoid overheating of the engine and accelerated wear of the engine components.

Use the Emergency Stop Button (if equipped) ONLY in an emergency situation. Do not use the Emergency Stop Button for normal engine stopping. After an emergency stop, DO NOT start the engine until the problem that caused the emergency stop has been corrected.

Stop the engine if an overspeed condition occurs during the initial start-up of a new engine or an engine that has been overhauled. This may be accomplished by shutting off the fuel supply to the engine and/or shutting off the air supply to the engine.

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Electrical System

Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operating. A spark can cause the combustible gases that are produced by some batteries to ignite.

To help prevent sparks from igniting combustible gases that are produced by some batteries, the negative "-" jump start cable should be connected last from the external power source to the negative "-" terminal of the starting motor. If the starting motor is not equipped with a negative "-" terminal, connect the jump start cable to the engine block.



IMPORTANT ENGINE INFORMATION					Engine Type	
Engine Family: 5PKXL04.4RH2 List: Displacement: 4.4 List: RH37881			 Refer to Manufacturer e11*97/68FA* 2001/63*0247*00	Factory setting	Reset if Applicable	
EPA Family Max Values	Advertised kw:86. Fuel Rate: **.0 mm3/stk Init. Timing:* DEG ATDC idle RPM: ****	<input type="checkbox"/> 2372/2500 <input type="checkbox"/> <input checked="" type="checkbox"/> 2372/2500 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
Settings are to be made with engine at normal operating temperature with transmission in neutral. This engine conforms to 2004 U.S. EPA non - road and California off - road Regulations for large C.I. engines and is certified to operate on commercially available diesel fuel.						
Emission Control System: **** ** ECM		Valve Lash Cold (inch): Exhaust 0.0** Inlet 0.00*	Engine Label		Use Service Tool to verify current engine settings	
Hanger No.		position (**)	Label No. 3181A081			

Illustration 17

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This typical example of a label is installed on engines that have electronic fuel injection systems and installed on engines that have electronic fuel injection pumps.



IMPORTANT ENGINE INFORMATION				
Engine Family: 5PKXL04.0AJ1 List: RE81372 Engine Type: 2160/2200 Displacement: 4.400			 Refer to Manufacturer e11*97/68CA*00*000*0089*01	
	Advertised kw:62 @ RPM: 2200 Fuel Rate at adv kw: 64.2 mm3/stk Init. Timing:* DEG BTDC idle RPM: ****			
Settings are to be made with engine at normal operating temperature with transmission in neutral. This engine conforms to 2005 U.S. EPA non - road and California off - road Regulations for large C.I. engines and is certified to operate on commercially available diesel fuel.				
Emission Control System: DDI		Valve Lash Cold (inch): Exhaust 0.0** Inlet 0.00*	Engine Label	
Hanger No.		position	Label No. 3181A081	

Illustration 18

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This typical example of a label is installed on engines that have mechanical fuel injection pumps.

Engine Operation

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Engine Operation

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Correct operation and maintenance are key factors in obtaining the maximum life and economy of the engine. If the directions in the Operation and Maintenance Manual are followed, costs can be minimized and engine service life can be maximized.

The engine can be operated at the rated rpm after the engine reaches operating temperature. The engine will reach normal operating temperature sooner during a low engine speed (rpm) and during a low power demand. This procedure is more effective than idling the engine at no load. The engine should reach operating temperature in a few minutes.

Gauge readings should be observed and the data should be recorded frequently while the engine is operating. Comparing the data over time will help to determine normal readings for each gauge. Comparing data over time will also help detect abnormal operating developments. Significant changes in the readings should be investigated.

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Engine Warm-up

1. Run the engine at low idle for three to five minutes, or run the engine at low idle until the jacket water temperature starts to rise.

More time may be necessary when the temperature is below -18°C (0°F).

2. Check all of the gauges during the warm-up period.
3. Perform a walk-around inspection. Check the engine for fluid leaks and air leaks.
4. Increase the rpm to the rated rpm. Check for fluid leaks and air leaks. The engine may be operated at full rated rpm and at full load when the temperature of the water jacket reaches 60°C (140°F).

Fuel Conservation Practices

The efficiency of the engine can affect the fuel economy. Perkins design and technology in manufacturing provides maximum fuel efficiency in all applications. Follow the recommended procedures in order to attain optimum performance for the life of the engine.

- Avoid spilling fuel.

Fuel expands when the fuel is warmed up. The fuel may overflow from the fuel tank. Inspect fuel lines for leaks. Repair the fuel lines, as needed.

- Be aware of the properties of the different fuels. Use only the recommended fuels.
- Avoid unnecessary idling.

Shut off the engine rather than idle for long periods of time.

- Observe the air cleaner service indicator frequently. Keep the air cleaner elements clean.
- Maintain the electrical systems.

One damaged battery cell will overwork the alternator. This will consume excess power and excess fuel.

- Ensure that the drive belts are correctly adjusted. The drive belts should be in good condition.
- Ensure that all of the connections of the hoses are tight. The connections should not leak.
- Ensure that the driven equipment is in good working order.
- Cold engines consume excess fuel. Utilize heat from the jacket water system and the exhaust system, when possible. Keep cooling system components clean and keep cooling system components in good repair. Never operate the engine without water temperature regulators. All of these items will help maintain operating temperatures.

Some synthetic base oils have performance characteristics that enhance the service life of the oil. Perkins does not recommend the automatic extending of the oil change intervals for any type of oil.

Re-refined base stock oil

Re-refined base stock oil are acceptable for use in Perkins engines if these oils meet the performance requirements that are specified by Perkins. Re-refined base stock oil can be used exclusively in finished oil or in a combination with new base stock oil. The US military specifications and the specifications of other heavy equipment manufacturers also allow the use of re-refined base stock oil that meet the same criteria.

The process that is used to make re-refined base stock oil should adequately remove all wear metals that are in the used oil and all the additives that are in the used oil. The process that is used to make re-refined base stock oil generally involves the process of vacuum distillation and hydrotreating the used oil. Filtering is adequate for the production of high quality, re-refined base stock oil.

Lubricants for Cold Weather

When an engine is started and an engine is operated in ambient temperatures below -20°C (-4°F), use multigrade oils that are capable of flowing in low temperatures.

These oils have lubricant viscosity grades of SAE 0W or SAE 5W.

When an engine is started and operated in ambient temperatures below -30°C (-22°F), use a synthetic base stock multigrade oil with an 0W viscosity grade or with a 5W viscosity grade. Use an oil with a pour point that is lower than -50°C (-58°F).

The number of acceptable lubricants is limited in cold weather conditions. Perkins recommends the following lubricants for use in cold weather conditions:

First Choice – Use oil with an EMA DHD-1 Recommended Guideline. Use a CH-4 oil that has an API license. The oil should be either SAE 0W20, SAE 0W30, SAE 0W40, SAE 5W30, or SAE 5W40 lubricant viscosity grade.

Second Choice – Use an oil that has a CH-4 additive package. Although the oil has not been tested for the requirements of the API license, the oil must be either SAE 0W20, SAE 0W30, SAE 0W40, SAE 5W30, or SAE 5W40.

NOTICE

Shortened engine service life could result if second choice oils are used.

Aftermarket Oil Additives

Perkins does not recommend the use of aftermarket additives in oil. It is not necessary to use aftermarket additives in order to achieve the engine's maximum service life or rated performance. Fully formulated, finished oils consist of base oils and of commercial additive packages. These additive packages are blended into the base oils at precise percentages in order to help provide finished oils with performance characteristics that meet industry standards.

There are no industry standard tests that evaluate the performance or the compatibility of aftermarket additives in finished oil. Aftermarket additives may not be compatible with the finished oil's additive package, which could lower the performance of the finished oil. The aftermarket additive could fail to mix with the finished oil. This could produce sludge in the crankcase. Perkins discourages the use of aftermarket additives in finished oils.

To achieve the best performance from a Perkins engine, conform to the following guidelines:

- Select the correct oil, or a commercial oil that meets the "EMA Recommended Guideline on Diesel Engine Oil" or the recommended API classification.
- See the appropriate "Lubricant Viscosities" table in order to find the correct oil viscosity grade for your engine.
- At the specified interval, service the engine. Use new oil and install a new oil filter.
- Perform maintenance at the intervals that are specified in the Operation and Maintenance Manual, "Maintenance Interval Schedule".

S·O·S Oil analysis

Some engines may be equipped with an oil sampling valve. If S·O·S oil analysis is required the oil sampling valve is used to obtain samples of the engine oil. The S·O·S oil analysis will complement the preventive maintenance program.

The S·O·S oil analysis is a diagnostic tool that is used to determine oil performance and component wear rates. Contamination can be identified and measured through the use of the S·O·S oil analysis. The S·O·S oil analysis includes the following tests:

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Maintenance Interval Schedule

When Required

Battery - Replace	54
Battery or Battery Cable - Disconnect	55
Engine - Clean	60
Engine Air Cleaner Element (Dual Element) - Clean/Replace	61
Engine Air Cleaner Element (Single Element) - Inspect/Replace	63
Engine Oil Sample - Obtain	64
Fuel Injector - Test/Change	68
Fuel System - Prime	69
Severe Service Application - Check	75

Daily

Alternator and Fan Belts - Inspect/Adjust/ Replace	53
Cooling System Coolant Level - Check	59
Driven Equipment - Check	60
Engine Air Cleaner Service Indicator - Inspect	63
Engine Oil Level - Check	64
Fuel System Primary Filter/Water Separator - Drain	70
Walk-Around Inspection	77

Every 50 Service Hours or Weekly

Fuel Tank Water and Sediment - Drain	73
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Every 500 Service Hours or 1 Year

Battery Electrolyte Level - Check	54
Engine Air Cleaner Element (Dual Element) - Clean/Replace	61
Engine Air Cleaner Element (Single Element) - Inspect/Replace	63
Engine Ground - Inspect/Clean	64
Engine Oil and Filter - Change	65
Fuel System Primary Filter (Water Separator) Element - Replace	70
Fuel System Secondary Filter - Replace	71
Hoses and Clamps - Inspect/Replace	74
Radiator - Clean	75

Every 1000 Service Hours

Engine Valve Lash - Inspect/Adjust	67
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Every 2000 Service Hours

Aftercooler Core - Inspect	52
Alternator - Inspect	53
Engine Mounts - Inspect	64
Starting Motor - Inspect	76
Turbocharger - Inspect	76
Water Pump - Inspect	78

Every 2 Years

Cooling System Coolant - Change	58
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Every 3000 Service Hours

Fuel Injector - Test/Change	68
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Every 3000 Service Hours or 2 Years

Cooling System Coolant (Commercial Heavy-Duty) - Change	55
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Every 4000 Service Hours

Aftercooler Core - Clean/Test	52
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Every 6000 Service Hours or 3 Years

Cooling System Coolant Extender (ELC) - Add	59
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Every 12 000 Service Hours or 6 Years

Cooling System Coolant (ELC) - Change	57
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Engine Air Cleaner Element (Dual Element) - Clean/Replace

NOTICE

Never run the engine without an air cleaner element installed. Never run the engine with a damaged air cleaner element. Do not use air cleaner elements with damaged pleats, gaskets or seals. Dirt entering the engine causes premature wear and damage to engine components. Air cleaner elements help to prevent air-borne debris from entering the air inlet.

NOTICE

Never service the air cleaner element with the engine running since this will allow dirt to enter the engine.

Servicing the Air Cleaner Elements

Note: The air filter system may not have been provided by Perkins. The procedure that follows is for a typical air filter system. Refer to the OEM information for the correct procedure.

If the air cleaner element becomes plugged, the air can split the material of the air cleaner element. Unfiltered air will drastically accelerate internal engine wear. Refer to the OEM information for the correct air cleaner elements for your application.

- Check the precleaner (if equipped) and the dust bowl daily for accumulation of dirt and debris. Remove any dirt and debris, as needed.
- Operating conditions (dust, dirt and debris) may require more frequent service of the air cleaner element.
- The air cleaner element should be replaced at least one time per year. This replacement should be performed regardless of the number of cleanings.

Replace the dirty air cleaner elements with clean air cleaner elements. Before installation, the air cleaner elements should be thoroughly checked for tears and/or holes in the filter material. Inspect the gasket or the seal of the air cleaner element for damage. Maintain a supply of suitable air cleaner elements for replacement purposes.

Dual Element Air Cleaners

The dual element air cleaner contains a primary air cleaner element and a secondary air cleaner element. The primary air cleaner element can be used up to six times if the element is properly cleaned and properly inspected. The primary air cleaner element should be replaced at least one time per year. This replacement should be performed regardless of the number of cleanings.

The secondary air cleaner element is not serviceable or washable. Refer to the OEM information for instructions in order to replace the secondary air cleaner element. When the engine is operating in environments that are dusty or dirty, air cleaner elements may require more frequent replacement.

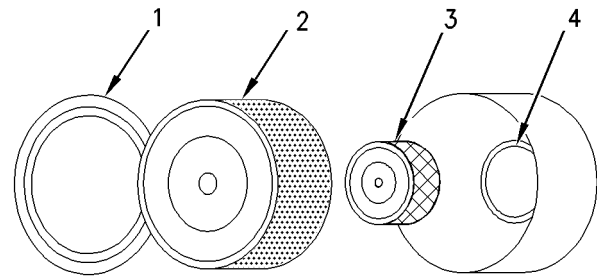


Illustration 33

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- (1) Cover
- (2) Primary air cleaner element
- (3) Secondary air cleaner element
- (4) Air inlet

1. Remove the cover. Remove the primary air cleaner element.
2. The secondary air cleaner element should be removed and discarded for every three cleanings of the primary air cleaner element.

Note: Refer to "Cleaning the Primary Air Cleaner Elements".

3. Cover the air inlet with tape in order to keep dirt out.
4. Clean the inside of the air cleaner cover and body with a clean, dry cloth.
5. Remove the tape for the air inlet. Install the secondary air cleaner element. Install a primary air cleaner element that is new or cleaned.
6. Install the air cleaner cover.
7. Reset the air cleaner service indicator.

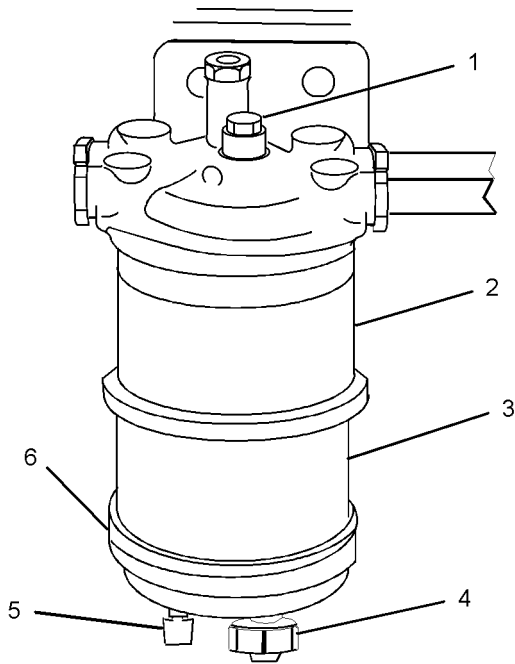


Illustration 46

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- (1) Screw
- (2) Element
- (3) Glass bowl
- (4) Sensor connection
- (5) Drain
- (6) Bottom cover

1. Place a suitable container below the water separator.
2. Open the drain (5). Allow the fluid to drain into the container.
3. When clean fuel drains from the water separator close the drain (5). Tighten the drain by hand pressure only. Dispose of the drained fluid correctly.

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Fuel System Secondary Filter - Replace

WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. To help prevent possible injury, turn the start switch off when changing fuel filters or water separator elements. Clean up fuel spills immediately.

NOTICE

Do not allow dirt to enter the fuel system. Thoroughly clean the area around a fuel system component that will be disconnected. Fit a suitable cover over disconnected fuel system component.

Element filter

Turn the valves for the fuel lines (if equipped) to the OFF position before performing this maintenance. Place a tray under the fuel filter in order to catch any fuel that might spill. Clean up any spilled fuel immediately.

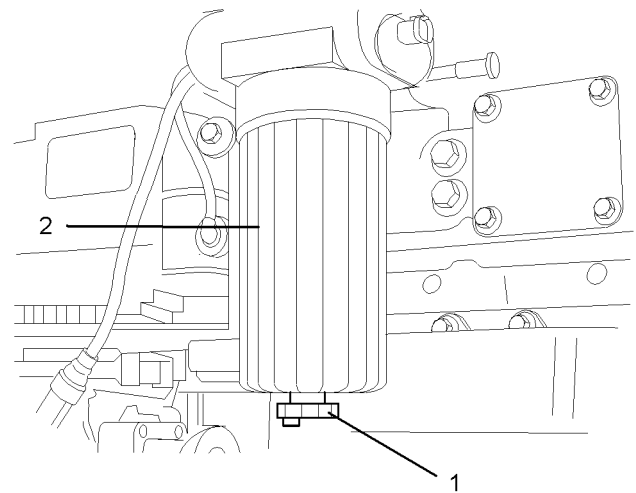


Illustration 47

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- (1) Drain
- (2) Filter bowl

1. Close the valves for the fuel lines (if equipped).
2. Clean the outside of the fuel filter assembly. Open the fuel drain (1) and drain the fuel into a suitable container.

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