Perkins®

THE HEART OF EVERY GREAT MACHINE

August 2019

4000 Series Service Supplements

4000 Series Industrial Engines

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Engine News: - DL048

Change to the recommended oils

This engine news article only applies to all 4000 series gas

engines.

In line with Perkins continuous drive to improve product and quality, the following oils have passed Perkins criteria.

Caution: *Multigrade oils must not be used.*

Engines that operate on natural gas should be lubricated by oils that have a nominal sulphated ash content of 0.5% by weight and a TBN (Total Base Number) between 5 and 7.

Sour gas engines should be lubricated by oils that have a nominal sulphated ash level of 0.8 to 1% by weight.

The following SAE40 monograde engine oils comply with the parameters given above:

Natural Gas Oils

1. Mobil - Pegasus 705
2. Mobil - Pegasus 805
3. Mobil - Pegasus 1005
4. Mobil - Pegasus 1105
5. Addinol - Eco Gas 4000XD
6. Texaco/Caltex - Geotex LA
7. Q8 - Mahler MA
8. Castrol - Duratec L
9. BP - Energas NGL
10. Shell - Mysella S3 N40
11. Shell - Mysella S5 N40
12. Total - Nateria MH40
13. Chevron/Caltex - **(1)** HDAX (0% and 0.5% sulphated ash)
14. Chevron - HPLX low ash
15. Petro Canada - Sentron LD 5000

(1) This oil has a lower TBN value than the recommended minimum value, but the additive elements give the equivalent performance.

Sour Gas Oils

1. Mobil - Pegasus 610
2. Mobil - Pegasus 710
3. Addinol - MG40
4. Sentron - CG40
5. Q8 - Mahler HA40

Caution: *Oil change schedules for any of the above oils must be approved by Perkins Application Department, Stafford, England.*

Engine News: - DL058

Extended oil service for diesel engines

This Engine News article applies to all 4000 series diesel engines.

All engines that use specification of engine oil API CH4 can extend oil filter life to 500 hours or 12 months whichever occurs first.
Operators that want to extend the engine oil life above 500 hours must do so by analysis of the oil every 50 hours.
Caution: *When any one of the limits that are indicated below are reached, the oil must be renewed.*

Note: Oil filters must be changed at 500 hours regardless.

- The oil viscosity at 100°C must not change more than ± 15% from new
- The oil viscosity at 40°C must not change more than + 30% from new
- The water content must not be above 0.2% of max volume
- The fuel dilution must not be above 1.5% of max volume
- The soot content must not be above 2% of max volume

IP276 is a test standard to measure the conductivity in a solution.

The total base number is to be equal or greater than 50 percent of the original value as well as being greater than the total acid number numerically when measured in the approved manner (IP276).

Total solids to be less than 4 percent by volume.

The oil must be changed if the wear metals are above:

Wear metals	Parts per million
Iron	50
Chromium	25
Lead	25
Copper	30
Tin	20
Aluminium	25
Nickel	10
Antimony	5
Manganese	5
Boron	20
Sodium	75

Check for any sudden increase in wear metals over the normal trends, even if the parts per million is still below the limits given above. A sudden increase in wear metals over the normal trends may indicate excess wear.

Note: Oil consumption is not representative until after the engine has run 250 hours.

Engine News: - DL063

Preventative Maintenance Schedule

This engine news article applies to 4006, 4008, 4012 and 4016 diesel

engines.

The earlier diesel engine models are detailed in Operators Handbooks TSL 4184 and TSL 4186. Refer to the ‘Earlier Diesel Engines’ section in this article for more information.

Later diesel engines are 4006-23TAG, 4006D-E23TAG, 4008-30TAG, 4008TAG, 4012-46A, 4016TAG and 4016-61TRG engines. Refer to the ‘Later Diesel Engines’ section in this article for more information.

Earlier Diesel Engines

The information replaces the Preventative Maintenance Schedules contained in Operators Handbooks TSL 4184 and TSL 4186 and the service information contained in Operation Manuals TSL 4075 and TSL 4165.

Schedule for engines on a continuous duty cycle

Notes:

- Engines rated at 1800 rev/min or engines that operate on a stand-by duty cycle are not effected by this article
- At 15,000 hrs / 20,000 hrs service, a major overhaul is required
- The intervals at which routine overhauls are required, to keep the engine in good operating condition, will vary considerably depending on operating conditions, the quality of the lubricating oil and fuel used.

Continued

The maintenance operations must be applied at the interval (hours or months) which occurs first.

A Daily
B Every 250 hours
C Every 500 hours or 12 months
D Every 12 months
E Every 5,000 hours
F Every 7,500 hours

A	B	C	D	E	F	Operation
●						Check the coolant level
●						Check the lubricating oil level
●						Check the restriction indicators for the air filters and, when necessary, renew the filter elements
●						Drain all water/sediment from the primary fuel filter
●						Visual inspection of the engine systems
	●					Replace the lubricating oil filters
		●				Renew the lubricating oil and replace the lubricating oil filters**(1)**
		●				Renew the canister of the main fuel filter
		●				Adjust bridge pieces and check valve clearances **(2) (3)**
		●				Clean the crankcase breather filter
		●				Check that the air charge cooler and radiator matrix are clean and free from debris
		●				Check the condition and the tension of all drive belts - replace if necessary
		●				Inspect the coolant hoses and clips - replace if necessary
		●				Lubricate the govenor ball joints
			●			Drain and flush the coolant system. Refill the system with new coolant mixture
			●			Check the engine protection devices **(2) (3)**
			●			Inspect the engine mountings
			●			Check the governor actuator and ensure correct operation. **(2) (3)**
			●			Clean and reset the crankshaft speed sensor in the flywheel housing **(2) (3)**
				●		Check the fuel injectors and ensure correct operation, renew if necessary. **(2) (3)**
					●	Inspect the turbocharger **(2) (3)**
					●	Inspect the alternator **(2) (3)**
					●	Inspect the starter motor **(2) (3)**
					●	Inspect the coolant pump **(2) (3)**
					●	Inspect the fuel lift pump **(2) (3)**
					●	Inspect the engine oil pump **(2) (3)**

(1) Only if the oil used is of an equal or superior grade to API-CG4. If not, the oil must be renewed at 250 hrs.
(2) By a person who has had the correct training.
(3) For further information refer to the relevant workshop manual.

Cylinder head overhaul and major overhaul

During a cylinder head overhaul, a piston should be removed. The following components should be inspected in order to determine the major overhaul period.

- Pistons
- Piston rings
- Cylinder liners.

Cylinder head overhaul	
Hours	**Duty**
10,000	Base Load
7,500	Prime Load
1,000	Stand-by Duty

Major overhaul	
Hours	**Duty**
20,000	Base Load
15,000	Prime Load
2,000	Stand-by Duty

The following components should be inspected during a major overhaul,

- Crankshaft and bearings
- Connecting rods and bearings
- Camshaft and followers
- Pistons, piston rings and cylinder liners
- Engine oil cooler
- Engine mounted charge coolers.

The crankshaft vibration damper should be replaced during a major overhaul.

Note: For information on cylinder head overhaul and major overhaul procedures, refer to the relevant workshop manual.

Later Diesel Engines

Notes:

- The intervals at which routine overhauls are required, to keep the engine in good operating condition, will vary considerably depending on operating conditions, the quality of the lubricating oil and fuel used
- The information in this section of the article applies to all engines that are rated at 1500 and 1800 rev/min.

Continued

The maintenance operations must be applied at the interval (hours or months) which occurs first.

A Daily

B Every 500 hours or 24 months for standby

C Every 1,500 hours or 24 months for standby

D Every 12 months

E Every 7,500 hours or 5 years for standby

A	B	C	D	E	Operation
●					Check the coolant level
●					Check the lubricating oil level
●					Check the restriction indicators for the air filters and, when necessary, renew the filter elements
●					Drain all water/sediment from the primary fuel filter
●					Visual inspection of the engine systems **(3)**
	●				Renew the lubricating oil and replace the lubricating oil filters **(1)**
	●				Renew the canister of the main fuel filter
	●				Clean the crankcase breather filter
	●				Check the condition and the tension of all drive belts - replace if necessary
	●				Inspect the coolant hoses and clips - replace if necessary
	●				Lubricate the govenor ball joints
		●			Adjust bridge pieces and check valve clearances **(2) (3) (4)**
			●		Drain and flush the coolant system. Refill the system with new coolant mixture **(5)**
			●		Check the engine protection devices **(2) (3)**
			●		Inspect the engine mountings
			●		Inspect the crankshaft vibration damper **(7)**
			●		Check the governor actuator and ensure correct operation **(2) (3)**
			●		Clean and reset the crankshaft speed sensor in the flywheel housing **(2) (3)**
			●		Check that the radiator core or matrix is clean and free from debris
			●		For TWG and TRG models, check that the engine mounted charge cooler core is clean and free from debris
			●		Complete a full load performance test, specifically on standby or low hours of operation **(2) (6)**
				●	Pressure check the fuel injectors, re-calibrate and ensure correct operation, renew if necessary **(2) (3)**
				●	Remove and inspect the pistons, piston rings and cylinder liners to determine the major overhaul service interval **(2) (8)**
				●	Inspect the turbocharger **(2) (3)**
				●	Inspect the alternator **(2) (3)**
				●	Inspect the starter motor **(2) (3)**
				●	Inspect the coolant pump **(2) (3)**
				●	Inspect the fuel lift pump **(2) (3)**
				●	Inspect the engine oil pump **(2) (3)**

(1) Only if the oil used is of an equal or superior grade to API-CH4. Refer to 4000 Series Engine News number 58, ‘Extended oil service for diesel engines’ for more information.
For standby engines, oil sampling should take place every 12 months to establish the condition of oil to determine the service interval.
For model 4006D-23TAG, the oil change service interval is 250 hours or 12 months.
For model 4006D-E23TAG, the oil change service interval is 300 hours or 12 months. Refer to Operation and Maintenance Manual, ‘Fluid Recommendations (Engine Oil Specification)’ for the correct oil specification.
(2) By a person who has had the correct training.
(3) For further information refer to the relevant workshop manual or service manual.
(4) On certain engines, new cylinder heads, cylinder head valves and valve seats have been introduced.
Refer to 4000 Series Engine News number 105, ‘New Cylinder Heads’ for more information.
For model 4006D-E23TAG, the engine valve lash - inspect/adjust service interval is every 2,000 service hours or 12 months. Refer to Operation and Maintenance Manual for more information.
For certain engines that were built before the new cylinder heads, cylinder head valves and valve seats were introduced, the engine valve lash - inspect/adjust service interval is every 500 service hours or 1 year. The cylinder head overhaul service interval is at 7,500 hours.
(5) Depends on the specification of coolant used. Refer to General Service Bulletin number 172, ‘Coolant Specification’ for more information.
(6) For information on no load or light load engine operation, refer to 4000 Series Engine News number 110, ‘No Load or Light Load Operation’.
(7) For information on the inspection of the crankshaft vibration damper, refer to 4000 Series Engine News number 106, ‘Vibration Damper - Inspect’.
(8) For 4006 and 4008 engines; one set of components, piston assembly, piston rings, cylinder liner and bearings are required.
For 4012 and 4016 engines; two set of components, piston assembly, piston rings, cylinder liner and bearings are required (1 set of components for the respective ‘banks’).

Note: For engines that are being operated in Prime Power applications, Perkins recommends that the information that is detailed in 4000 Series Engine News 116 'Prime Power Recommendations' is reviewed.

Cylinder head overhaul and major inspection

Cylinder head overhaul and major inspection	
Hours	**Duty**
20,000	Base Load **(9)**
15,000	Prime Load **(9)**
2,000	Stand-by Duty **(9)**

The following components should be inspected during a major overhaul,

- Crankshaft and bearings
- Connecting rods and bearings
- Camshaft and followers
- Pistons, piston rings and cylinder liners
- Engine oil cooler
- Engine mounted charge coolers.

The crankshaft vibration damper should be replaced during a major overhaul.

Note: For information on cylinder head overhaul and major overhaul procedures, refer to the relevant workshop manual or service manual.

(9) On certain engines, new cylinder heads, cylinder head valves and valve seats have been introduced. Refer to 4000 Series Engine News number 105, 'New Cylinder Heads' for more information.
For model 4006D-E23TAG, the engine valve lash - inspect/adjust service interval is every 2,000 service hours or 12 months. Refer to Operation and Maintenance Manual for more information.
For certain engines that were built before the new cylinder heads, cylinder head valves and valve seats were introduced, the engine valve lash - inspect/adjust service interval is every 500 service hours or 1 year. The cylinder head overhaul service interval is at 7,500 hours.

Engine News: - DL079

Gas Specification Limits

This Service Bulletin applies to all 4000 Series TRS Gas engines.

Requirements for Sour Gases for use in Perkins TRS Gas engines.

Description	Designation	Value	Remarks
Lower calorific value	LCV	>15 MJ/Nm^3	Derate may be required
Maximum variation of LCV		<±10 %	During operation
Minimum Methane content	CH_4	>35 vol-%	Derate may be required
Total Sulphur compounds expressed as H_2S	$S + H_2S + SO_2 + SO_3$	<35 mg/MJ	Sulphur compounds are those that contain sulphur. The total sulphur level must account for all sulphur in the fuel and can be expressed as the equivalent of H_2S
Total halide compounds expressed as CL	CL + FL + I +Br	<19 mg/MJ	Halide compounds are those that contain chlorine, fluorine, iodine or bromine. Total halide levels must take into account all halides and be expressed as the equivalent chlorine
Ammonia	NH_3	<2.81 mg/MJ	
Dust	3-10 μm	<1 mg/MJ	
Oil vapours	$>C_5$	<1.19 mg/MJ	No condensation in gas train and inlet manifold allowed
Silicon	Si	<0.56 mg/MJ	Lubicating oil analysis to show a metal content of <15 mg/kg of oil
Maximum humidity (relative)		< 80 %	At lowest inlet temperature, no condensation in inlet manifold and gas train allowed
Min/max. gas pressure (4006/08 TRS engines)		15-50 mbar	At inlet of zero-pressure regulator
Min/max. gas pressure (4006/08 TRS engine with Elektra) (4016 TRS engines)		50-250 mbar	At inlet to Air Fuel Ratio regulator
Maximum fluctuation in gas pressure		3 mbar	Maximum rate of change of gas pressure is 3 mbar/min, variation frequency < 5/h
Min/max. gas temperature		10-50 ºC	

Sour Gases	Landfill gas, Digester gas, Bio gas, Mine gas
Gas specification requirements to be used as guide only, Perkins require a full gas analysis to be supplied to the gas applications engineer at the time of inquiry/order.	
Engine ratings depend on the LCV of the fuel and maybe adapted to suit the specifics of the fuel.	
Total possible derate is calculated by adding individual derates for:	Charge Cooler - water inlet temperature Altitude Ambient temperature Lower Calorific Value (LCV) Methane Number Volumetric considerations

Requirements for Natural Gases for use in Perkins TRS Gas engines.

Description	Designation	Value	Remarks
Lower calorific value	LCV	>31 MJ/Nm^3	
Maximum variation of LCV		<±5 %	During operation
Minimum Methane number		>75	Derate required below this figure
Minimum Methane content		>50 vol-%	Derate required below this figure
Hydrogen Sulphide	H_2S	<100 ppm	
Maximum humidity (relative)		<80 %	At lowest inlet temperature, no condensation in inlet manifold and gas train allowed
Min/max. gas pressure (4006/08 TRS engine)		15-50 mbar	At inlet of zero-pressure regulator
Min/max. gas pressure (4006/08 TRS engine with Elektra) (4016 TRS engine)		50-250 mbar	At inlet to Air Fuel Ratio regulator
Maximum fluctuation in gas pressure		3 mbar	Max. rate of change of gas pressure is 3 mbar/min, variation frequency < 5/h
Min/max. gas temperature		10-50 ºC	

Gas spec. requirements to be used as guide only, Perkins require a full gas analysis to be supplied to the gas applications engineer at the time of inquiry/order.	
Engine ratings depend on the Methane Number and the LCV of the fuel and may be adapted to suit the specifics of the fuel.	
Total possible derate is calculated by adding individual derates for:	Charge Cooler - water inlet temperature Altitude Ambient temperature Lower Calorific Value (LCV) Methane Number

Engine News: - DL099

Change to Overhaul Information

This engine news article applies to the 4006 TRS, 4008 TRS and the 4016 TRS engines.

Within the Operation and Maintenance Manuals (OMM) SEBU8190-00 and SEBU8604-00 for the engines listed, incorrect information has been given.
In Overhaul (Major) the manuals states:

Generally, a major overhaul is performed at 32,000 hours. This information is not correct. Generally, a major overhaul is performed at 64,000 hours. Please amend your OMM in order to show this information.

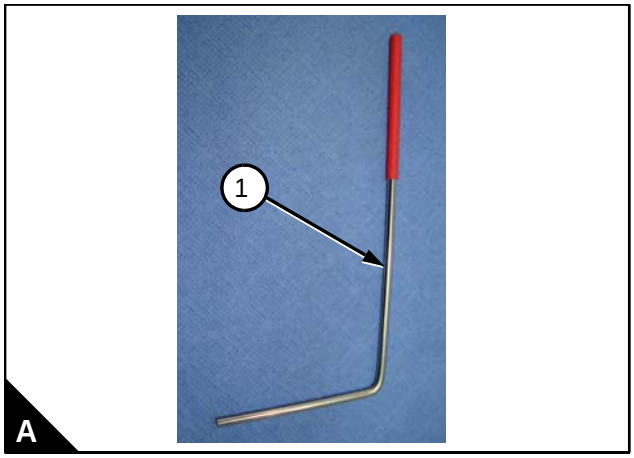
Engine News: - DL102

Fuel Injector Timing Pin

This engine news article applies to all 4000 Series diesel engines built from the following engine serial numbers.

- 4006 and 4008 engines that operate at 1500 rpm - D-------U12209A
- 4006 engines that operate at 1800 rpm - D-------U12246A
- 4012 and 4016 engines - D-------U12171A

A change in design of the fuel injector has been made. The change in design has led to the removal of the timing pin. A special tool is now required.



Instead of using a screwdriver to set the timing pin on the fuel injector, special tool (Perkins tool number T401437) (A1) should be used.

New Service Procedure

1 Set the number one piston to Top Dead Center (TDC) position on the compression stroke.

2 Set the engine valve lash. Refer to the Workshop Manual or Service Manual for the correct procedure.

3 Rotate the engine in the opposite direction of engine rotation until the spill timing mark passes the timing pointer. Then rotate the engine in the normal direction of rotation until the spill timing mark is in line with the timing pointer. This is to remove gear backlash.

4 Loosen the locking nut at the top of the fuel injector.

Note: The fuel injection timing is shown on the engine serial number plate. The timing window is located in the flywheel housing. Ensure that the correct spill timing mark is selected for the correct engine rating.

5 Use a 3 mm (0.118 inch) Allen Wrench to rotate the adjuster in a clockwise direction as far as possible.

6 Locate the hole in the side of the fuel injector where the timing pin used to be located. Insert the special tool into the hole. Refer to illustration (B).

7 Rotate the adjuster counterclockwise until the special tool has become trapped. Apply light sideways pressure on the special tool. Rotate the adjuster in a clockwise direction until the special tool starts to move. Remove the special tool.

8 Install a Dial Test Indicator (DTI) to rocker box of the cylinder. Position the plunger of DTI on the top face of the adjuster. Ensure the dial of the DTI is set to zero.

Note: Ensure the plunger of the DTI has sufficient travel. Sufficient travel is more than 3 mm (0.118 inch).

9 Use the 3 mm (0.118 inch) Allen Wrench to rotate the adjuster clockwise until the dial on DTI indicates 3 mm (0.118 inch) of downward travel.

10 Tighten the locking nut at the top of the fuel injector.

11 Remove the tooling.

12 Repeat the procedure until the fuel injection timing has been set for all fuel injectors.

Engine News: - DL106

Vibration Damper - Inspect

This engine news article applies to 4000 Series engines.

The crankshaft vibration damper (viscous damper) limits the torsional vibration of the crankshaft. Crankshaft vibration damper is mounted at the front of the engine. Damage or failure to the crankshaft vibration damper can increase torsional vibrations. This can result in damage to the crankshaft and to other engine components.

A deteriorating damper can cause excessive torsional vibration and can cause excessive gear train noise. A damper that is hot may be the result of the excessive torsional vibration, worn bearings or damage to the damper. Use an infrared thermometer to monitor the temperature of the damper during the operation. Follow the instructions that are included with the infrared thermometer. If the temperature reaches 100 degrees Celsius, consult your Perkins Dealer Solution Network (DSN).

Viscous Damper

The viscous damper has a weight that is located inside a fluid filled case. Inspect the damper for evidence of fluid leaks. If a fluid leak is found, determine the type of fluid. The fluid in the damper is silicone. Silicone has the following characteristics: transparent, viscous, and smooth.

Inspect and replace the damper for any of the following reasons:

- The damper is dented, cracked, or leaking
- The paint on the damper is discoloured from heat
- The engine has had a major issue
- Analysis of the oil shows wear metals and particles. Investigation revealed that the front main bearing is badly worn
- There is a large amount of gear train wear that is not caused by a lack of oil
- The temperature of the damper fluid is 100 degrees Celsius and above
- Exceeded the service life of the damper.

Table 1:Damper Service Life (hrs)

	Diesel		Gas
Engine Type	**Prime**	**Baseload**	
4006	15000	20000	32000
4008	15000	20000	32000
4012	15000	20000	32000
4016	15000	20000	32000

Note: For 4016TRG engines built in the UK from engine serial number D-------U11862B and for engines built in India from serial number D-------S11669B, refer to Table 1 for the damper service life. For 4016TRG engines built in the UK before engine serial number D-------U11861B and engines built in India before serial number D-------S11669B, refer to 4000 Series Engine News 98, issue 1 for the damper service life.

Refer to the relevant Service Manual for information about the replacement of the vibration damper.

Engine News: - DL107

Rocker Box Cap Head Screws

This engine news article applies to all 4000 Series diesel engines from engine serial number DGDF6002U13348A.

New rocker box cap head screws have been introduced. The new rocker box cap Allen head screws have replaced the existing head screws that have a slotted design in the head of the screw.

New rocker box cap head screw (Perkins part number 314079) replaces rocker box cap head screw (Perkins part number 315056).

Tighten the new rocker box cap head screws to a torque of 9 Nm (80 lbf/in) 0.9 kgf m.

Note: Over tightening of the new rocker box cap head screws can cause damage to the rocker box cover.

Engine News: - DL108

Alternator Belt - Inspect/Adjust/Replace

This engine news article applies to 4000 Series diesel and gas engines.

In the Operation and Maintenance Manual, the force of 15.6 N (3.5 lb) that is applied to the mid point and the total deflection of 1.5 mm (0.06 inch) of the alternator belt is not correct. Disregard these values.

The incorrect values are in the following Operation and Maintenance Manuals:

- 4006-23 and 4008-30 Diesel Industrial Engines (SEBU9077-01), Belts - Inspect/Adjust/Replace (Alternator Belt)
- 4006-23 and 4008-30 TRS Gas Industrial Engines (SEBU8190-00), Alternator and Fan Belts - Replace
- 4012-46A Diesel Industrial Engine (SEBU8191-01), Belts - Inspect/Adjust/Replace (Alternator Belt)
- 4016-61 TRG Diesel Industrial Engine (SEBU8604-00), Belts - Inspect/Adjust/Replace (Alternator Belt)
- 4016-61 TRS Gas Industrial Engines (SEBU8430-00), Belts - Inspect/Adjust/Replace (Alternator Belt)

The correct force that should be applied to the mid point of the alternator belt is 4.3-8.7 N (0.97-1.96 lb). The correct total deflection should not exceed 2.75 mm (0.11 inch).

Note: The alternator belt should be replaced if the alternator belt shows signs of wear, damage or missing teeth, or if the alternator belt is broken.

No Load or Light Load Operation

This engine news article applies to all 4000 Series 1500 rpm and 1800 rpm diesel

engines.

Do not operate the engine excessively at no load or light load. If the engine is not in use, shut the engine down. Refer to the relevant User's Handbook or Operation and Maintenance Manual for the correct procedure.

Excessive no load or light load operation of the engine will result in only partly burnt fuel. This will cause high carbon build up on the injector nozzles, cylinder head valves, pistons and rings. In addition, unburnt fuel will remove the lubricating oil from the cylinder bores and dilute the oil in the sump. This can cause loss of lubrication of the bearings and result in an engine seizure.

Light load operation can cause carbon build up on the top of the piston. When the power is increased, the piston could seize on the carbon.

No load operation and or multiple start/stop events in colder ambient conditions can cause the emission of white smoke from the exhaust. This is a result of partly unburnt fuel due to the low cylinder temperatures. No load operation should be avoided and multiple start/stop events kept to a minimum.

Perkins does not recommend that an engine is operated on loads of less than the values that are listed in Table 1.

Table 1

Engine Sales Model	Minimum Load (kWe)
4006-23	250
4008TAG/4008-30	340
4012-46A	500
4016TAG/4016-61 TRG	680

If an engine is operated on loads less than those identified in Table 1, certain engine symptoms will be observed which may give cause for concern. The usual results of this operation is higher than normal lubrication oil consumption, oil leaks from the inlet manifolds and the exhaust manifolds. The condition is particularly evident on stand-by generator set applications, where exercising of no load is common practice. These concerns are due to the fact that:

1 Turbocharger oil seals are not fully effective on light load, which results in oil being delivered together with the air into the engine air manifolds.
2 The cylinder temperatures are too low to ensure the complete combustion of all the fuel delivered.

This can result in an oil leak from the exhaust manifold junction seals. A further result is that of abnormal carbon build-up on the cylinder head valves, piston crowns and exhaust ports and thus the normal service interval between overhauls may have to be reduced. Fuel dilution of the lubricating oil will also occur.

Perkins recommends that the following precautions are observed:

1 The operation of the engine at no load or light load should be avoided or reduced to a minimum period. If weekly or monthly exercising at no load or light load is carried out, the operating period should be kept down to minutes, or until the battery charging rate returns to normal.

2 After failed start/stop events, the exhaust system should be inspected for unburnt fuel and drained accordingly. The engine should be operated on full load.

3 Every year the engine or generator set should be operated at full load for a minimum of four hours, to burn off the build up of carbon in the engine and exhaust system. This may require the use of ‘test’ load. The load should be built up gradually from zero over the first hour and the balance completed at full rated load for the engine.

4 On engines with light load profiles, Perkins recommends a regular oil sample analysis is completed and the oil changed accordingly.

Note: If prolonged periods of no loads or light loads are repeated it may not be possible to reverse the effects by full load operation. This is due to the damage that may have been caused to the piston rings and liners, resulting in polished cylinder bores.

Engine Starting and Priming the Lubrication System

This engine news article applies to all 4000 Series engines.

Perkins engines would like to reiterate the following engine starting statement.

If the engine has not been started for more than 3 months, or the engine is new, or after an oil and filter change, it is recommended that the oil system is primed.

For diesel engines, refer to the relevant Operation and Maintenance Manual or User's Handbook for the correct procedure.

For gas engines, use the following procedure:

1 Close the fuel supply valve. Refer to the Original Equipment Manufacturer (OEM) for more information.

2 Turn the keyswitch to the START position. Hold the keyswitch in this position until the oil pressure gauge indicates 100 kPa (14.5 psi). Continue to hold the keyswitch in the START position for an additional 10 seconds.

Only crank the engine for 30 seconds when building engine oil pressure. After 30 seconds, stop cranking and allow 2 minutes for the starter to cool.

Note: The keyswitch is part of the OEM supplied panel. The exact procedure for starting may vary. Refer to OEM supplied instructions for the correct starting procedure.

3 Turn the keyswitch to the STOP position.

4 Open the fuel supply valve. Refer to the OEM for more information.

The engine is now ready to run.

Prime Power Recommendations

This engine news article applies to all 4000 Series diesel

engines.

In addition to the engine maintenance interval schedule, Perkins recommends that oil and fuel sample analysis is undertaken on a regular basis. This also applies to the coolant in both primary and secondary cooling circuits.

Fluid recommendations are located in the relevant User's Handbook or Operations and Maintenance Manual.

Oil sample analysis enables the operator to monitor the condition of the engine based on the actual operating conditions. Regular oil sample analysis is preferred as this is necessary to ensure that a trend is established, determining oil change intervals and major inspection criteria.

Fuel sample analysis on a regular basis can potentially reduce damage to fuel system components by early detection of poor quality fuel. It is recommended that an analysis is carried out within the shortest possible time to address potential bad batches of fuel and prevent the bad batches of fuel being used. In turn this can have a direct impact to the oil change intervals. Based on the amount fuel consumed; for example prime power sites may require each fuel delivery to be sampled. Stand-by engines can be more prone to bacterial growth for example, and should also be analysed on a frequent basis.

Perkins recommends that the diesel fuel be stored no longer than stated in the fluid recommendations section in the relevant User's Handbook or Operations and Maintenance Manual to prevent degradation. Perkins recommends that the diesel fuel is protected from water ingress and water separators are installed in the fuel supply lines to the engine and drained on a daily basis.

Traces of chlorine and bacteria indicates that the fuel supply requires changing to help to avoid wear on fuel system components and clogging of the fuel filters.

Perkins recommends that a record of the fuel and oil consumed versus load and time is kept.

In addition to regular oil and fuel sample analysis, the condition of the engine and the need for an inspection or overhaul can be determined by several factors:

- An increase of oil consumption
- An increase of crankcase blow-by
- A decrease and variation of cylinder compression
- A decrease or increase of the rate of valve clearance from the set value
- Environmental factors, quality of the air, temperature, altitude and humidity
- A rise in exhaust gas temperature for a given load (after checking the air inlet and exhaust systems for blockages and restrictions).

Monitoring of the above factors on a regular basis will help ascertain whether there is engine or component wear taking place. These are in addition to the routine temperatures and pressures that should be monitored by the operator during the routine operating logs. The parameters, recordings and checks are listed on the next page.

Key performance parameters:

- Turbine inlet temperature at each turbocharger
- Air temperature into the air cleaner
- Boost temperature and pressure
- Ambient air temperature
- Crankcase pressure
- Engine load
- Oil pressure
- Coolant temperature
- Inlet manifold temperature

Daily/Hourly recordings (typically recorded from the control panel of the Original Equipment Manufacturer (OEM))

- Ambient air temperature
- Engine load
- Oil pressure
- Coolant temperature
- Date/time

Other factors should also be considered for determining an overhaul:

The service hours of the engine.

The wear metal analysis of the lubricating oil:

- An increase of wear metals in the lubricating oil indicates that the bearings and the surfaces that wear may require a service
- An increase in the levels of noise and vibration indicates that rotating parts require a service
- An increase in the rate of valve recession.

Note: It is possible for oil analysis to indicate a decrease of wear metals in the lubricating oil. The cylinder liners may be worn so that polishing of the bore occurs. Also, the increased use of lubricating oil will dilute the wear metals.

The condition of the engine lubricating oil should be checked at regular intervals as part of the preventive maintenance program.

Initiating an Oil Analysis Program

The First 500 Hours

Oil analysis in the first 500 hours will show higher levels of iron and copper than acceptable parameters. As the engine continues to operate the levels will drop within the specified parameters.

Every 250 Hours

An oil sample should be obtained at 250 hour intervals. A trend can be established by analysing the results of the oil sampling. Each individual operator can develop a service program for the engine.

Engine News: - DL117

Bearings in Sour Gas Applications

This engine news article applies to all 4000 Series engines that operate on sour

gas.

There have been isolated instances of issues with bearings in sour gas applications where the bearing material has been attacked by acids in the gas/oil. To prevent this type of issue, it is critical to maintain the oil and gas in the engine to the recommended standards.

Perkins recommends that the gas is monitored to ensure it is continuously complies with the recommendations as detailed in 4000 Series Engine News number 79, ‘Gas Specification Limits’.

Perkins recommends that regular oil sampling and analysis should be used by the operator to ensure that the Total Base Number / Total Acid Number (TBN / TAN) do not cross or the TBN does not fall below 60 percent of the original value from the manufacturer. For a list of approved oils, refer to the ‘Sour Gas Oils’ section of 4000 Series Engine News number 48, ‘Change to the recommended oils’.

It is important the right oil is used for the relevant application. Using an oil with a high Total Base Number (TBN) will give better protection against acid attacks. Regular sampling will record these values to ensure the TBN and Total Acid Number (TAN) do not cross. If this happens, Perkins recommends that the oil is changed immediately.

Perkins recommends:

- Oil sampling is carried out every 100 hours monitoring, the values are listed in Table 1
- Sampling rate is to be shortened to every 50 hours if adverse trends occur and reported to Perkins Application Department, Stafford, England
- Once a safe trend can be established, a service schedule can be introduced, but must be approved by Perkins Application Department, Stafford, England
- If the TAN increases by 2 or more compared to when the oil was changed then change the oil immediately
- If there is any sign of Strong Acid Number (SAN), change the oil immediately.

Table 1: Oil Specifications

Viscosity at 100°C	16.5 cST maximum
Insolubles	1.5% wt maximum
Total Acid Number (TAN)	Less than 2 above the specification of the oil supplier for new oil
Total Base Number (TBN)	60% less than new oil value
Strong Acid Number (SAN)	0.1 mg KOH/g maximum
Nitration	30 abs/cm maximum
Oxidation	30 abs/cm maximum
Water	0.2% maximum
Iron	Less than 20 PPM
Copper	Less than 40 PPM
Chromium	Less than 25 PPM
Lead	Less than 25 PPM

Table 1: Oil Specifications	
Tin	Less than 20 PPM
Aluminium	Less than 25 PPM
Nickel	Less than 10 PPM
Antimony	Less than 5 PPM
Manganese	Less than 5 PPM
Boron	Less than 20 PPM
Sodium	Less than 75 PPM

Engine News: - DL119

Fan and Jockey Pulley Bearings

This engine news article applies to 4000 Series

ElectropaKs.

There have been isolated instances of issues with fan and jockey pulley bearings that have found to be the result of false brinelling. False brinelling may occur in bearings which are subjected to small oscillations or vibrations, whilst under load from the belts and not rotating to spread the lubricant. The small oscillations or vibrations can occur during the transportation of the completed generator set from the Original Equipment Manufacturer (OEM) to the customer site.

Perkins require all OEMs to remove the tension from the fan belts prior to transportation of the completed generator set.

During the on-site installation or commissioning process, the fan belts would need to have the correct tension applied. Refer to Operation and Maintenance Manual, 'Belts - Inspect/Adjust/Replace' for the correct procedure. In this case, the fan belts are considered new.

Engine News: - DL120

Aids for Engines in Low Temperature Climates

This engine news article applies to all 4000 Series diesel

engines.

Perkins does not recommend the 4000 Series diesel engines are installed in an application where the ambient temperature is below 0 °C (32 °F), unless the engines are installed in a heated environment.

Follow the recommendations that are detailed in this article. Following the recommendations will improve cold starting and reduce white smoke emissions.

1. Startability will be improved at temperatures below 10 °C (50 °F) from the use of a jacket water heater
2. The use of space heaters
3. Re-circulating louvres for the cooling fan. This will prevent the evacuation of hot air from the space heaters (if a Perkins supplied radiator is installed, the duct allowance should not be exceeded during louver transition)
4. For the recommendations for parasitic loads or residual loads, refer to 4000 Series Engine News 110, ‘No Load or Light Load Operation’
5. Air filters to pull in air from inside the canopy, not outside the canopy
6. Fully charged batteries of the correct capacity. Electrical cables that meet the recommended specification
7. For extreme conditions, application specific installation recommendations should be considered. These include:

- A divided air to air charge cooler to split the banks
- A charge cooler bypass.

Notes:

- The above is particularly relevant for TAG engines
- For TWG and TRG engines, consider remote thermostatically controlled cooling packs to control the charge air inlet temperature.

Engine News: - M0104181

Engine Valve Lash and Bridge Maintenance Interval Schedule Information

Within the Operation and Maintenance Manual, SE-BU8430-01, incorrect information regarding the serv-ice interval for adjusting the engine valve lash and bridge has been given.

In the Operation and Maintenance Manual, Mainte-nance Interval Schedule and the service procedure Operation and Maintenance Manual, Engine Valve Lash and Bridge - Adjust states:

Every 1000 service hours adjust the valve lash. This information is not correct. The correct service interval is to adjust the engine valve lash and bridge at every 2000 service hours.

Engine News: - M0104191

Primary Fuel Filter/Water Separator- Drain

There have been isolated incidences of fuel leaks from the drain of the primary fuel filter/water separa-tor after completing maintenance checks.

A new process has been produced that requires a recommended torque for the drain plug.

WARNING

Do not operate or work on this product unless you have read and understood the instruction and warnings in the relevant Operation and Main-tenance Manuals and relevant service literature. Failure to follow the instructions or heed the warnings could result in injury or death. Proper care is your responsibility.

The procedure is as follows:

1. Place a suitable container under the primary fuel filter/water separator to catch any fuel that might spill.

Note: Clean up any spilled fuel immediately.

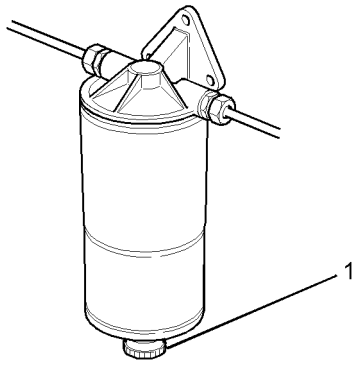


Illustration 1 g01237449

Typical example

2. Loosen the drain plug (1). Allow the fluid to drain into the container until fuel that is free of water is being drained.

3. Tighten the drain plug to a torque of 1.5 N·m to 2 N·m (13.3 lb in to17.7 lb in). Dispose of the drained fluid in accordance with local regula-tions and mandates.