CATERPILLAR®

SEBU7605-04

Operation and Maintenance Manual

C0.5, C0.7, C0.7, C1.1 / 3011C, C1.5 / 3013C, C1.6 and C2.2 / 3024C / 3024CT Industrial Engines and Engines for Caterpillar Built Machines

S/N 3111-UP (3011C Industrial Engine)
S/N C4M1-UP (C2.2 Industrial Engine)

Use the bookmarks for navigation inside of the manual

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Media Number -SEBU7605-04 **Publication Date -01/04/2007** **Date Updated -19/04/2007**

Foreword

Literature Information

This manual contains safety, operation instructions, lubrication and maintenance information. This manual should be stored in or near the engine area in a literature holder or literature storage area. Read, study and keep it with the literature and engine information.

English is the primary language for all Caterpillar publications. The English used facilitates translation and consistency in electronic media delivery.

Some photographs or illustrations in this manual show details or attachments that may be different from your engine. Guards and covers may have been removed for illustrative purposes. Continuing improvement and advancement of product design may have caused changes to your engine which are not included in this manual. Whenever a question arises regarding your engine, or this manual, please consult with your Caterpillar dealer for the latest available information.

Safety

This safety section lists basic safety precautions. In addition, this section identifies hazardous, warning situations. Read and understand the basic precautions listed in the safety section before operating or performing lubrication, maintenance and repair on this product.

Operation

Operating techniques outlined in this manual are basic. They assist with developing the skills and techniques required to operate the engine more efficiently and economically. Skill and techniques develop as the operator gains knowledge of the engine and its capabilities.

The operation section is a reference for operators. Photographs and illustrations guide the operator through procedures of inspecting, starting, operating and stopping the engine. This section also includes a discussion of electronic diagnostic information.

Maintenance

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Engine Oil and Filter - Change

SMCS - 1318-510; 1348-044

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact the skin.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Do not drain the oil when the engine is cold. As the oil cools, suspended waste particles settle on the bottom of the oil pan. The waste particles are not removed with the draining cold oil. Drain the crankcase with the engine stopped. Drain the crankcase with the oil warm. This draining method allows the waste particles that are suspended in the oil to be drained correctly.

Failure to follow this recommended procedure will cause the waste particles to be recirculated through the engine lubrication system with the new oil.

Drain the Engine Oil

After the engine has been run at the normal operating temperature, stop the engine. Use one of the following methods to drain the engine crankcase oil:

- If the engine is equipped with a drain valve, turn the drain valve knob counterclockwise in order to drain the oil. After the oil has drained, turn the drain valve knob clockwise in order to close the drain valve.
- If the engine is not equipped with a drain valve, remove the oil drain plug in order to allow the oil to drain. After the oil has drained, the oil drain plug should be cleaned and installed.

Replace the Oil Filter

NOTICE

Caterpillar oil filters are built to Caterpillar specifications. Use of an oil filter not recommended by Caterpillar could result in severe engine damage to the engine bearings, crankshaft, etc., as a result of the larger waste particles from unfiltered oil entering the engine lubricating system. Only use oil filters recommended by Caterpillar.

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1. Remove the oil filter with a **1U-8760** Chain Wrench .

   Note: The following actions can be carried out as part of the preventive maintenance program.

2. Cut the oil filter open with a **175-7546** Oil Filter Cutter Gp. Break apart the pleats and inspect the oil filter for metal debris. An excessive amount of metal debris in the oil filter may indicate early wear or a pending failure.

   Use a magnet to differentiate between the ferrous metals and the nonferrous metals that are found in the oil filter element. Ferrous metals may indicate wear on the steel and cast iron parts of the engine.

   Nonferrous metals may indicate wear on the aluminum parts, brass parts or bronze parts of the engine. Parts that may be affected include the following items: main bearings, rod bearings, turbocharger bearings and cylinder heads.

Due to normal wear and friction, it is not uncommon to find small amounts of debris in the oil filter. Consult your Caterpillar dealer in order to arrange for a further analysis if an excessive amount of debris is found in the oil filter.

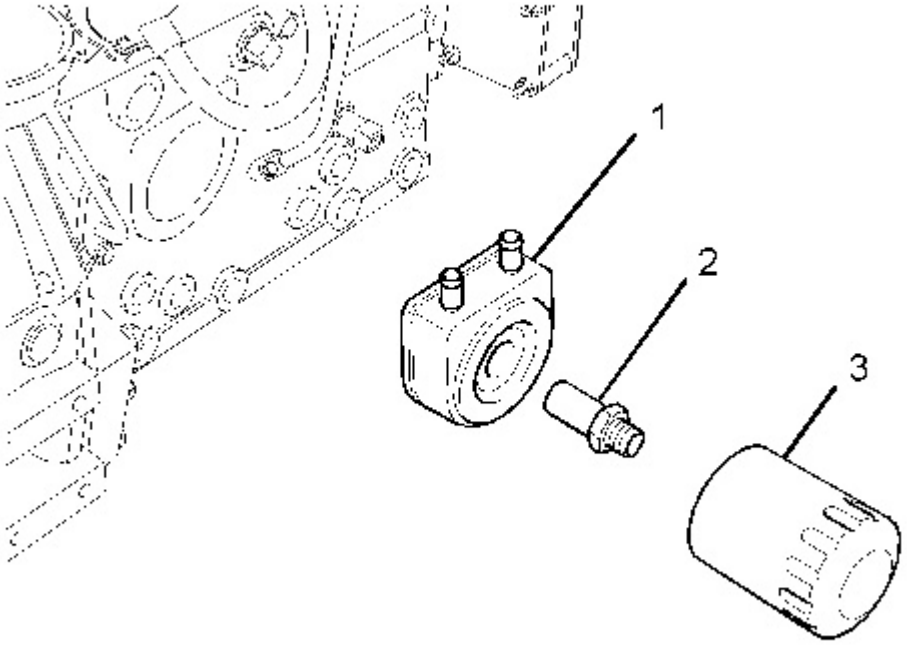

Illustration 1 g01091799

(1) Oil cooler

(2) Adapter

(3) Oil filter

Note: The oil cooler (1) and the adapter (2) are installed to the C2.2/3024CT engine only.

3. Clean the sealing surface of the cylinder block or the oil cooler (1) .
4. Apply clean engine oil to the new oil filter seal (3) .

NOTICE

Do not fill the oil filters with oil before installing them. This oil would not be filtered and could be contaminated. Contaminated oil can cause accelerated wear to engine components.

5. Install the oil filter. Tighten the oil filter until the oil filter seal contacts the cylinder block or the oil cooler. Tighten the oil filter by hand according to the instructions that are shown on the oil filter. Do not overtighten the oil filter.

Fill the Engine Crankcase

1. Remove the oil filler cap. Refer to this Operation and Maintenance Manual, "Refill Capacities and Recommendations" for more information on lubricant specifications. Fill the crankcase with the correct amount of oil. Refer to this Operation and Maintenance Manual, "Refill Capacities" for more information on refill capacities.

NOTICE

If equipped with an auxiliary oil filter system or a remote oil filter system, follow the OEM or filter manufacturer's recommendations. Under filling or overfilling the crankcase with oil can cause engine damage.

NOTICE

To prevent crankshaft bearing damage, crank the engine with the fuel OFF. This will fill the oil filters before starting the engine. Do not crank the engine for more than 30 seconds.

2. Start the engine and run the engine at "LOW IDLE" for two minutes. Perform this procedure in order to ensure that the lubrication system has oil and that the oil filters are filled. Inspect the oil filter for oil leaks.

3. Stop the engine and allow the oil to drain back to the sump for a minimum of ten minutes.

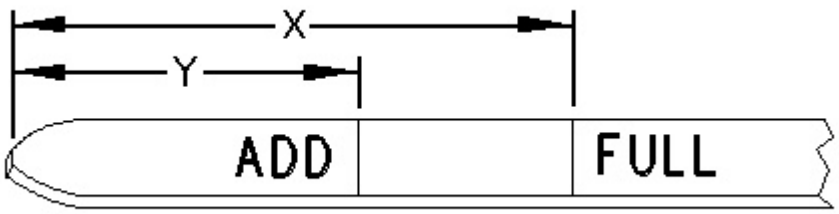

Illustration 2 g00110310

4. Remove the oil level gauge in order to check the oil level. Maintain the oil level between the "ADD" and "FULL" marks on the oil level gauge.

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Refill Capacities and Recommendations

SMCS - 1348; 1395; 7560

Engine Oil

NOTICE

These recommendations are subject to change without notice. Contact your local Caterpillar dealer for the most up-to-date recommendations.

API Oils

The Engine Oil Licensing and Certification System by the American Petroleum Institute (API) is recognized by Caterpillar. For detailed information about this system, see the latest edition of the "API publication No. 1509". Engine oils that bear the API symbol are authorized by API.

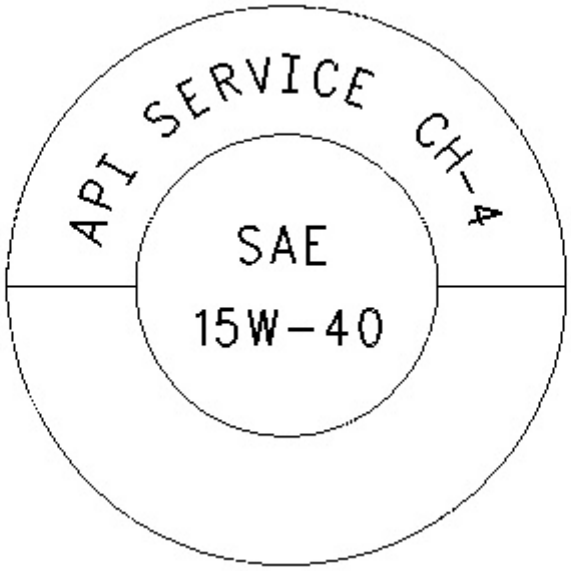

Illustration 1 g00546535

Typical API symbol

Diesel engine oils CC, CD, CD-2, and CE have not been API authorized classifications since 1January 1996. Table 1 summarizes the status of the classifications.

Table 1

API Classifications	
Current	**Obsolete**
CI-4 (1). CH-4 (1). CG-4 (2). CF-4 (3)	CE
CF (4)	CC, CD
CF-2 (5)	CD-2 (5)

(1) **API CH-4 and CI-4 oils are acceptable if the requirements of Caterpillar's ECF-1 (Engine Crankcase Fluid specification-1) are met. CH-4 and CI-4 oils that have not met the requirements of Caterpillar's ECF -1 Specification may cause reduced engine life.**

(2) API CG-4 oils are acceptable for all Caterpillar diesel engines. When the API CG-4 oils are used, the oil drain interval should not exceed the standard oil drain interval for your engine.

(3) API CF-4 oils are not recommended for this series of Caterpillar diesel engines. For all other commercial diesel engines, the oil drain interval should not exceed 50 percent of the standard oil drain interval for your engine with a maximum of 125 hours.

(4) API CF oils are not recommended for this series of Caterpillar engines and smaller Direct Injection (DI) diesel engines.

(5) API CF-2 and CD-2 oils are classifications for two-cycle diesel engines. Caterpillar does not sell engines that utilize the CD-2 and the API CF-2 oils.

Note: When oil meets more than one API classification, the applicable footnote is determined by the highest API classification that is met.

Example - An oil meets both the API CH-4 and the API CF oil classifications. In this case, the API CH-4 applies.

Cat DEO (Diesel Engine Oil)

Caterpillar Oils have been developed and tested in order to provide the full performance and service life that has been designed and built into Caterpillar Engines. Caterpillar Oils are currently used to fill diesel engines at the factory. These oils are offered by Caterpillar dealers for continued use when the engine oil is changed. Consult your Caterpillar dealer for more information on these oils.

Due to significant variations in the quality and in the performance of commercially available oils, Caterpillar makes the following recommendations:

- **Cat DEO (Diesel Engine Oil) (10W-30)**
- **Cat DEO (Diesel Engine Oil) (15W-40)**

Caterpillar multigrade DEO is formulated with the correct amounts of detergents, dispersants, and alkalinity in order to provide superior performance in Caterpillar Diesel Engines.

Caterpillar multigrade DEO is available in various viscosity grades that include SAE 10W-30 and SAE 15W-40. To choose the correct viscosity grade for the ambient temperature, see Table 2. Multigrade oils provide the correct viscosity for a broad range of operating temperatures.

Multigrade oils are effective in maintaining low oil consumption and low levels of piston deposits.

Caterpillar multigrade DEO can be used in other diesel engines and in gasoline engines. See the engine manufacturers guide for the recommended specifications. Compare the specifications to the specifications of Caterpillar multigrade DEO. The current industry standards for Caterpillar DEO are listed on the product label and on the data sheets for the product.

Consult your Caterpillar dealer for part numbers and for available sizes of containers.

Note: Caterpillar SAE 15W-40 multigrade DEO exceeds the performance requirements for the following API classifications: CI-4, CH-4, CG-4, CF-4 and CF. The Caterpillar multigrade DEO exceeds the requirements of the Caterpillar specification that is ECF-1 (Engine Crankcase Fluid-1). The Caterpillar SAE 15W-40 multigrade DEO passes the following proprietary tests: sticking of the piston ring, oil control tests, wear tests and soot tests. Proprietary tests help ensure that Caterpillar multigrade oil provides superior performance in Caterpillar Diesel Engines. In addition, Caterpillar multigrade oil exceeds many of the performance requirements of other manufacturers of diesel engines. Therefore, this oil is an excellent choice for many mixed fleets. **True high performance oil is produced with a combination of the following factors: industry standard tests, proprietary tests, field tests and prior experience with similar formulations. The design and the development of Caterpillar lubricants that are both high performance and high quality are based on these factors.**

Note: Non-Caterpillar commercial oils are second choice oils.

Commercial Oils

Note: If Caterpillar Multigrade DEO is not used, use only commercial oils that meet the following classifications.

- API CH-4 multigrade oils and API CI-4 multigrade oils are acceptable if the requirements of Caterpillar's ECF-1 (Engine Crankcase Fluid specification-1) are met. CH-4 oils and CI-4 oils that have not met the requirements of Caterpillar's ECF-1 Specification may cause reduced engine life.
- API CG-4 multigrade oils are acceptable for all Caterpillar diesel engines. When the API CG-4 oils are used, the oil drain interval should not exceed the standard oil drain interval for your engine.
- API CF-4 multigrade oils are not recommended for this series of diesel engines. For all other smaller commercial diesel engines, the oil drain interval should not exceed 50 percent of the standard oil drain interval for your engine.

NOTICE

In selecting oil for any engine application, both the oil viscosity and oil performance classification/specification as specified by the engine manufacturer must be defined and satisfied. Using only one of these parameters will not sufficiently define oil for an engine application.

In order to make the proper choice of a commercial oil, refer to the following explanations:

API CI-4 - API CI-4 oils were developed in order to meet the requirements of high performance diesel engines that use cooled Exhaust Gas Recirculation (EGR). API CI-4 oils are acceptable if the requirements of Caterpillar's ECF-1 (Engine Crankcase Fluid specification-1) are met.

API CH-4 - API CH-4 oils were developed in order to protect low emissions diesel engines that use a 0.05 percent level of fuel sulfur. However, API CH-4 oils may be used with higher sulfur fuels. API CH-4 oils are acceptable if the requirements of Caterpillar's ECF-1 (Engine Crankcase Fluid specification-1) are met.

Note: CH-4 oils and CI-4 oils that have not met the requirements of Caterpillar's ECF-1 Specification may cause reduced engine life.

NOTICE

Failure to follow these oil recommendations can cause shortened engine service life due to deposits and/or excessive wear.

Note: Refer to Special Publication, SEBU6251, "Caterpillar Commercial Diesel Engine Fluids Recommendations" for additional information that relates to lubrication for your engine.

Lubricant Viscosity Recommendations

The proper SAE viscosity grade of oil is determined by the minimum ambient temperature during cold engine start-up, and the maximum ambient temperature during engine operation.

Refer to Table 2 (minimum temperature) in order to determine the required oil viscosity for starting a cold engine.

Refer to Table 2 (maximum temperature) in order to select the oil viscosity for engine operation at the highest ambient temperature that is anticipated.

Note: Generally, use the highest oil viscosity that is available to meet the requirement for the temperature at start-up.

If ambient temperature conditions at engine start-up require the use of multigrade SAE 0W oil, SAE 0W-40 viscosity grade is preferred over SAE 0W-20 or SAE 0W-30.

Table 2

Engine Oil Viscosities for Ambient Temperatures		
	Ambient Temperature	
Viscosity Grade	Minimum	Maximum
SAE 0W-20	-40 °C (-40 °F)	10 °C (50 °F)
SAE 0W-30	-40 °C (-40 °F)	30 °C (86 °F)
SAE 0W-40	-40 °C (-40 °F)	40 °C (104 °F)
SAE 5W-30	-30 °C (-22 °F)	30 °C (86 °F)
SAE 5W-40	-30 °C (-22 °F)	50 °C (122 °F)
SAE 10W-30	-18 °C (0 °F)	40 °C (104 °F)
SAE 10W-40	-18 °C (0 °F)	50 °C (122 °F)
SAE 15W-40	-9.5 °C (15 °F)	50 °C (122 °F)

Note: Supplemental heat is recommended below the minimum recommended ambient temperature.

S·O·S Oil Analysis

Caterpillar has developed a tool for maintenance management that evaluates oil degradation and the tool also detects the early signs of wear on internal components. The Caterpillar tool for oil analysis is called S·O·S Oil Analysis and the tool is part of the S·O·S Services program. S·O·S Oil Analysis divides oil analysis into three categories:

- Wear Analysis