CALIFORNIA
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

42824

To the Operator

This guide contains instructions on the safe operation and preventive maintenance of your Detroit Diesel DD15 engine used in vehicle applications. Maintenance instructions cover routine engine services such as lubricating oil and filter changes in enough detail to permit self-servicing, if desired.

The operator should become familiar with the contents of this guide before operating the engine or carrying out maintenance procedures.

Power-driven equipment is only as safe as the person operating the controls. You are urged, as the operator of this diesel engine, to keep fingers and clothing away from the revolving belts, drive shafts, pulleys, etc. on the engine installation.

Throughout this guide **CAUTIONS** and **WARNINGS** regarding personal safety and **NOTICES** regarding engine performance or service life will appear. To avoid personal injury and ensure long engine service life, always heed these instructions.

Whenever possible, it will benefit you to rely on an *authorized* Detroit Diesel service outlet for all your service needs from maintenance to major parts replacement. Authorized service outlets worldwide stock factory-original parts.

The information and specifications in this publication are based on the information in effect at the time of approval for printing. Contact an authorized Detroit Diesel service outlet for information on the latest revision. The right is reserved to make changes at any time without obligation.

The DD15 engine is built in accordance with sound technological principles and based on state-of-the-art technology.

Despite this, the engine may constitute a risk of damage to property or injury to persons if it is not used for its intended purpose.

The engine should not be modified or converted in an incorrect manner or the safety instructions included in this manual disregarded.

NOTICE:

Coolant must be inhibited with the recommended Supplemental Coolant Additives (SCA) listed in the **How To** section of this engine Operator's Guide. In addition, the engine can be equipped with a coolant filter as an installed option or as an after-sale item. **Failure to check and maintain SCA levels at required concentrations will result in severe damage (corrosion) to the engine cooling system and related components.**

WARRANTY

The applicable engine warranty is contained in the booklet “Warranty Information for DD15 Engines,” available from authorized Detroit Diesel service outlets.

Keep this Operator's Guide with the engine installation at all times. It contains important operating, maintenance, and safety instructions.

Trademark Information

DDC®, Detroit Diesel®, DDEC®, Optimized Idle®, Diagnostic Link®, *POWER Trac*®, *POWER COOL*®, and *POWER GUARD*® are registered trademarks of Detroit Diesel Corporation. All other trademarks used are the property of their respective owners.

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INTRODUCTION

This guide is intended for use by the operator of a Detroit Diesel DD15 engine used in On-Highway Vehicle applications.

Non-Genuine and Rebuilt Component Quality Alert

Electronic engine controls have been instrumental in aiding engine manufacturers in meeting the stringent emission requirements of the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) and also in meeting the ever-increasing performance demands of the customer.

Maintenance procedures must be followed in order to continue satisfactory performance and durability and to ensure coverage of the engine under the manufacturer's warranty. Many of these maintenance procedures also ensure that the engine continues to comply with applicable emissions standards. Proper maintenance procedures, using specific components engineered to comply with emissions regulations, may be performed by an authorized Detroit Diesel distributor or dealer, an independent outlet or the operator or owner. The owner is responsible for determining the suitability of components to maintain emissions compliance during the engine's useful emission life.

Detroit Diesel cautions that the indiscriminate rebuilding of precision components, without the benefit of specifications, specialized equipment, and knowledge of the electronic operating system, will jeopardize performance or lead to more serious problems, and can take the engine outside of compliance with U.S. EPA or CARB emissions standards.

There are other components in an engine, such as turbocharger, camshaft, piston, etc., which are specifically designed and manufactured to exacting standards for emissions compliance. It is important that these components, if replaced, modified or substituted, can be verified to ensure that the engine remains in compliance with emissions standards. The use of inadequately engineered, manufactured or tested components in repair or rebuild of the engine may be in violation of the federal Clean Air Act and applicable U.S. EPA or CARB regulations.

Furthermore, modern engines exhibit operating parameters which require the use of proper fluids, such as fuel, coolant and lubricating oil, to maintain long engine life. The use of fluids that do not meet Detroit Diesel specifications may result in early wear out or engine failure.

Personnel Requirements

Work on the engine should be carried out only by skilled technicians who have been instructed in the specific skills necessary for the type of work being performed.

Engine Conversions and Modifications

The function and safety of the engine could be affected if unauthorized modifications are made to it. Detroit Diesel will not accept responsibility for any resulting damage.

Tampering with the fuel injection system and engine electronics could also affect the engine's power output or exhaust emission levels. Compliance with the manufacturer's settings and with statutory environmental protection regulations cannot then be guaranteed.

CAUTION SUMMARY

The following cautions must be observed by the operator of the vehicle or equipment in which this engine is installed and/or by those performing basic engine preventive maintenance. Failure to read and heed these cautions and exercise reasonable care for personal safety and the safety of others when operating the vehicle/equipment or performing basic engine preventive maintenance may result in personal injury and engine and/or vehicle/equipment damage.

Engine Operation

Observe the following cautions when operating the engine.

WARNING:

PERSONAL INJURY

To avoid injury from loss of vehicle/vessel control, the operator of a DDEC equipped engine must not use or read any diagnostic tool while the vehicle/vessel is moving.

WARNING:

HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

CAUTION:

LOSS OF VEHICLE CONTROL

To avoid injury from the loss of vehicle control, do not use cruise control under these conditions:

- **When it is not possible to keep the vehicle at a constant speed (on winding roads, in heavy traffic, in traffic that varies in speed, etc.).**
- **On slippery roads (wet pavement, ice-or snow-covered roads, loose gravel, etc.).**

WARNING:

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

WARNING:

PERSONAL INJURY

To avoid injury from engine shutdown in an unsafe situation, ensure the operator knows how to override the stop engine condition on a DDEC-equipped unit.

CAUTION:

LOSS OF VEHICLE CONTROL

To avoid injury from loss of vehicle control, do not activate the Engine Brake system under the following conditions:

- **On wet or slippery pavement, unless the vehicle is equipped with ABS (anti-lock braking system) and you have had prior experience driving under these conditions.**
- **When driving without a trailer (bobtailing) or pulling an empty trailer.**
- **If the tractor drive wheels begin to lock or there is fishtail motion after the Engine Brake is activated, deactivate the brake system immediately if this occurs.**

WARNING:

BODILY INJURY

To avoid injury from an explosion, do not use ether or starting fluid on engines equipped with a manifold (grid) heater.

Preventive Maintenance

Observe the following cautions when performing preventative maintenance.

WARNING:

PERSONAL INJURY

To avoid injury when working near or on an operating engine, remove loose items of clothing and jewelry. Tie back or contain long hair that could be caught in any moving part causing injury.

WARNING:

PERSONAL INJURY

To avoid injury when working on or near an operating engine, wear protective clothing, eye protection, and hearing protection.

WARNING:

HOT OIL

To avoid injury from hot oil, do not operate the engine with the rocker cover(s) removed.

WARNING:

FIRE

To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

CAUTION:

USED ENGINE OIL

To avoid injury to skin from contact with the contaminants in used engine oil, wear protective gloves and apron.

WARNING:

PERSONAL INJURY

To avoid injury when using caustic cleaning agents, follow the chemical manufacturers usage, disposal, and safety instructions.

WARNING:

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

WARNING:

PERSONAL INJURY

To avoid injury, use care when working around moving belts and rotating parts on the engine.

WARNING:

FIRE

To avoid injury from combustion of heated lubricating-oil vapors, stop the engine immediately if an oil leak is detected.

WARNING:

PERSONAL INJURY

To avoid injury from contact with rotating parts when an engine is operating with the air inlet piping removed, install an air inlet screen shield over the turbocharger air inlet. The shield prevents contact with rotating parts.

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

WARNING:

FIRE

To avoid injury from fire, do not smoke or allow open flames when working on an operating engine.

WARNING:

FIRE

To avoid injury from fire from a buildup of volatile vapors, keep the engine area well ventilated during operation.

WARNING:

PERSONAL INJURY

To avoid injury from rotating belts and fans, do not remove and discard safety guards.

WARNING:

PERSONAL INJURY

To avoid injury from slipping and falling, immediately clean up any spilled liquids.

Compressed Air

Observe the following cautions when using compressed air.

WARNING:

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

Cooling System

Observe the following cautions when servicing the cooling system.

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

WARNING:

PERSONAL INJURY

To avoid injury from slipping and falling, immediately clean up any spilled liquids.

Electrical System

Observe the following cautions when jump starting an engine, charging a battery, or working with the vehicle/application electrical system.

WARNING:

ELECTRICAL SHOCK

To avoid injury from electrical shock, do not touch battery terminals, alternator terminals, or wiring cables while the engine is operating.

WARNING:

Electrical Shock Hazard

High voltage can remain inside the Electrostatic Oil Separator after removal. Wait 30 minutes after turning off the ignition before removing the separator. Never touch parts through ventilation openings or impeller opening with finger or conductive items (e.g. screwdriver or wire). High voltage can remain inside the Electrostatic Oil Separator for up to 12 hours after the ignition is turned off.

WARNING:

Battery Explosion and Acid Burn

To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid:

- □ **Flush your skin with water.**
- □ **Apply baking soda or lime to help neutralize the acid.**
- □ **Flush your eyes with water.**
- □ **Get medical attention immediately.**

WARNING:

PERSONAL INJURY

To avoid injury from accidental engine startup while servicing the engine, disconnect/disable the starting system.

Air Intake System

Observe the following cautions when working on the air intake system.

WARNING:

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

WARNING:

PERSONAL INJURY

To avoid injury from contact with rotating parts when an engine is operating with the air inlet piping removed, install an air inlet screen shield over the turbocharger air inlet. The shield prevents contact with rotating parts.

Lubricating Oil and Filters

Observe the following cautions when replacing the engine lubricating oil and filters.

WARNING:

PERSONAL INJURY

To avoid injury from slipping and falling, immediately clean up any spilled liquids.

WARNING:

FIRE

To avoid injury from combustion of heated lubricating-oil vapors, stop the engine immediately if an oil leak is detected.

WARNING:

FIRE

To avoid injury from fire, do not smoke or allow open flames when working on an operating engine.

WARNING:

FIRE

To avoid injury from fire from a buildup of volatile vapors, keep the engine area well ventilated during operation.

Fuel System

Observe the following cautions when fueling the vehicle or working with the fuel system.

WARNING:

FIRE

To avoid injury from fire, keep all potential ignition sources away from diesel fuel, including open flames, sparks, and electrical resistance heating elements. Do not smoke when refueling.

WARNING:

PERSONAL INJURY

To prevent the escape of high pressure fuel that can penetrate skin, ensure the engine has been shut down for a minimum of 10 minutes before servicing any component within the high pressure circuit. Residual high fuel pressure may be present within the circuit.

WARNING:

FIRE

To avoid increased risk of a fuel fire, do not mix gasoline and diesel fuel.

WARNING:

FIRE

To avoid injury from fire caused by heated diesel-fuel vapors:

- **Keep those people who are not directly involved in servicing away from the engine.**
- **Stop the engine immediately if a fuel leak is detected.**
- **Do not smoke or allow open flames when working on an operating engine.**
- **Wear adequate protective clothing (face shield, insulated gloves and apron, etc.).**
- **To prevent a buildup of potentially volatile vapors, keep the engine area well ventilated during operation.**

Aftertreatment System

Observe the following cautions when servicing the Aftertreatment System (ATS). Be advised that these two labels are attached to the Aftertreatment Device (ATD).

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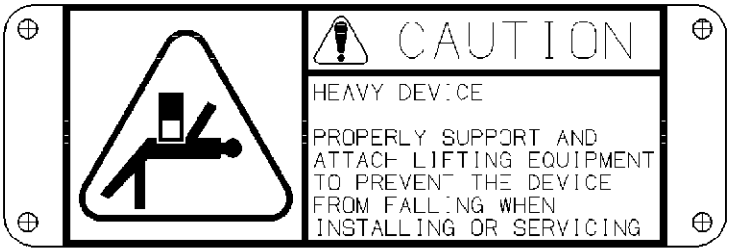

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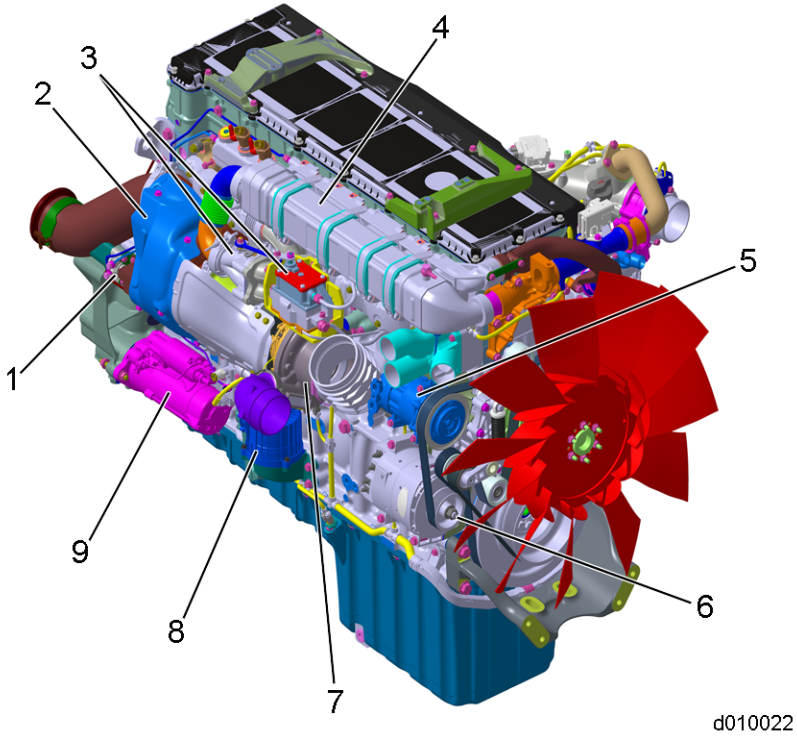
ENGINE IDENTIFICATION

The DD15 engine has a certification label, model number, and engine serial number for identification.

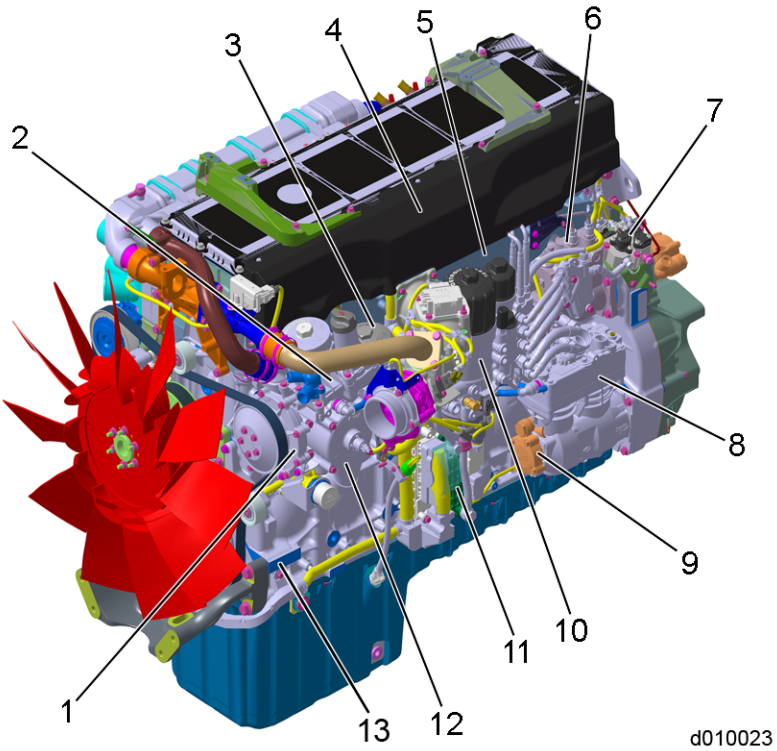
Engine Components

For a general view of the DD15 engine and major components, see Figure 1 and Figure 2.



1. Fuel Doser Valve
2. Axial Power Turbine
3. EGR Valve / Actuator
4. EGR Cooler
5. A/C Compressor
6. Alternator
7. Turbocharger
8. Crankcase Breather
9. Starter

Figure 1 Major Engine Components, Right Side



1. Water Pump
2. Oil/Coolant Module
3. Oil Filter
4. Fuel Rail
5. Air Intake Manifold
6. High Pressure Fuel Pump
7. Doser Block
8. Air Compressor
9. Power Steering Pump
10. Fuel Filter Module
11. Motor Control Module
12. Thermostat
13. Engine Serial Number

Figure 2 Major Engine Components, Left Side

Engine Model and Serial Number Designation

The fourteen-digit engine model and manufacturing number is etched on a pad located on the left front of the engine cylinder block.

The engine serial number and MCM part number is located on the MCM label.

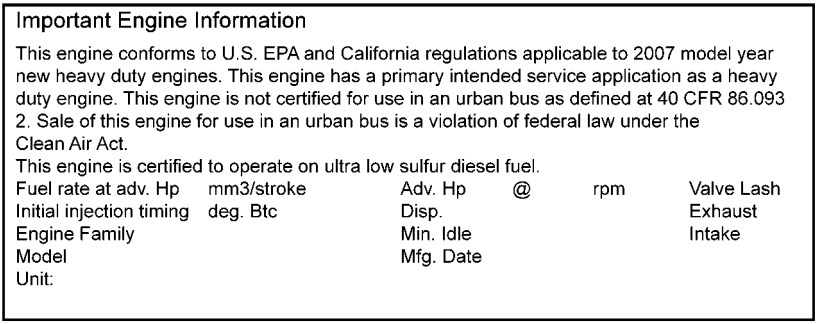
Details on the Plate

The engine type reference and the complete engine model and serial number appear above the manufacturing time and date.

The engine type reference is the production code. The engine model and serial number contains the type reference followed by a sequential manufacturing number. The last six digits of the engine model and serial number are the serial number for the engine.

Certification Labels

A certification exemption label will be attached to the valve rocker cover. This label certifies that the engine conforms to federal and certain state emissions regulations for its particular application. It also gives the operating conditions under which certification was made.


Important Engine Information

This engine conforms to U.S. EPA and California regulations applicable to 2007 model year new heavy duty engines. This engine has a primary intended service application as a heavy duty engine. This engine is not certified for use in an urban bus as defined at 40 CFR 86.093 2. Sale of this engine for use in an urban bus is a violation of federal law under the Clean Air Act.

This engine is certified to operate on ultra low sulfur diesel fuel.

Fuel rate at adv. Hp	mm3/stroke	Adv. Hp	@	rpm	Valve Lash
Initial injection timing	deg. Btc	Disp.			Exhaust
Engine Family		Min. Idle			Intake
Model		Mfg. Date			
Unit:					

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OPERATING INSTRUCTIONS FOR STARTING THE ENGINE

Following are instructions for starting the engine.

First Time Start Preparation

When preparing to start a new or newly overhauled engine which has been in storage, perform all of the operations listed below. Failure to follow these instructions may result in serious engine damage.

Be sure you are familiar with all of the instruments, gauges, and controls which are needed to operate the engine.

Note especially the location and function of the following:

- □ Oil pressure gauge
- □ Low oil pressure warning light
- □ Coolant temperature gauge
- □ High coolant temperature warning light
- □ Water in fuel warning light in the side of the fuel filter module
- □ Air restriction indicator

Watch for any signs of engine problems when starting or driving. If the engine overheats, uses excessive fuel or lubricating oil, vibrates, misfires, makes unusual noises, or shows an unusual loss of power, turn the engine off as soon as possible and determine the cause of the problem. Engine damage may be avoided by a quick response to early indications of problems.

When starting the engine in cold weather, refer to section How to Select Coolant.

System Checks

Perform the following system checks before starting for the first time.

Cooling System Checks

Check the cooling system as follows:

1. Make sure all drain cocks in the cooling system are installed (drain cocks are often removed for shipping) and are closed tightly.
2. Fill the coolant overflow surge tank with genuine Detroit Diesel *POWER COOL* antifreeze until coolant level stays between the low and full coolant marks on the tank. For more detailed recommendations, refer to section How to Select Coolant.
3. Entrapped air must be purged after filling the cooling system. To do this, allow the engine to warm up with the pressure cap removed. With the transmission in neutral, increase engine speed to 1,000 rpm and add coolant to the surge tank as required.
4. Check to make sure the front of the radiator and air-to-air charge cooler (if equipped) are unblocked and free of debris.

Lubrication System Checks

The lubricating oil film on the rotating parts and bearings of a new or newly overhauled engine, or one which has been in storage for six months or more, may be insufficient when the engine is started for the first time.

NOTICE:

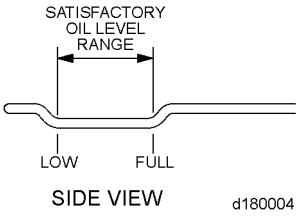
- Insufficient lubrication at startup can cause serious damage to engine components.
- Do not add oil if the oil reading is between the two bends on the dipstick. There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

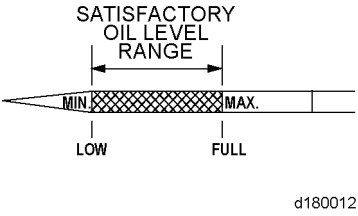
To ensure an immediate flow of oil to all bearing surfaces at initial engine startup, the engine lubrication system should be charged with a commercially available pressure prelubricator. After prelubricating, add additional oil no more than 3.8 L (4.0 qt) at a time to bring the level to the proper mark on the dipstick.

For lubricant recommendation, refer to section How to Select Lubricating Oil.

Checking the Oil Level — Check the oil level as follows:

1. Check the oil level using the oil dipstick. The oil level is measured using the two bends or the crosshatch area on the dipstick. If the oil reading is between these bends or in the crosshatch area, then the oil is at the proper level for engine operation.





NOTE:
The engine must be shut down for 60 minutes and on a level surface for an accurate oil level reading. Otherwise, the engine must be brought up to an operating temperature of 60°C (140°F), shut down, and allowed to sit for five minutes on a level surface.

Failure to allow the oil to drain back properly as just described can result in a low oil level reading.

WARNING:

PERSONAL INJURY

To avoid injury from slipping and falling, immediately clean up any spilled liquids.

NOTICE:

Do not add oil if the oil reading is between the two bends or in the crosshatch area on the dipstick. There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

2. If necessary, top off by filling engine oil no more than 4 L (4.2 qt) at a time through the oil fill cap to the satisfactory fill range on the oil dipstick. For detailed procedures, refer to section How to Change Oil and Replace the Lubricating Oil Filter. Do not overfill.

Extended Storage — An engine in storage for an extended period of time (over winter, for example) may accumulate water in the oil pan through normal condensation of

moisture (always present in the air) on the cold, internal surfaces of the engine.

NOTICE:

Failure to eliminate water-diluted lubricating oil may lead to serious engine damage at startup.

Lubrication oil diluted by water cannot provide adequate bearing protection at engine startup. For this reason, Detroit Diesel recommends replacing the engine lubricating oil and filters after extended storage.

Fuel System Checks

Fill the tanks with the recommended fuel. Keeping tanks full reduces water condensation and helps keep fuel cool, which is important to engine performance. Full tanks also reduce the chance for microbe (black slime) growth. For fuel recommendations, refer to section How to Select Diesel Fuel. **Make sure the fuel shutoff valve (if used) is open.**

NOTICE:

Prolonged use of the starting motor and engine fuel pumps to prime the fuel system can result in damage to the starter, fuel pumps, and injectors.

If the shutoff valve is even partially closed, it may cause erratic engine operation due to an inadequate supply of fuel to the fuel pump.

WARNING:

BODILY INJURY

To avoid injury from an explosion, do not use ether or starting fluid on engines equipped with a manifold (grid) heater.

NOTICE:

NEVER use ether as a starting aid to run the engine. Doing so will result in injector damage.

If an external starting aid is used, such as a starting fluid, the heat generated by the external fuel source will cause the injector tips to be damaged when the fuel cools them. The injector piston and bushing can be scored from running without lubrication.

To ensure prompt starting and even running, the fuel system *must* be primed if air has entered the fuel system. Priming is done by operating the manual hand priming pump located on the fuel filter module or connecting an external priming pump to the *priming port* on the fuel filter module.

Authorized Detroit Diesel service outlets are properly equipped.

Priming is required if the fuel system has been serviced.

Drain off any water that has accumulated. Water in fuel can seriously affect engine performance and may cause engine damage.

Adding Fuel — When adding fuel, pay attention to the following:

NOTICE:

Always use Ultra-Low Sulfur Fuel (ULSF) with 15 PPM sulfur content or less, based on ASTM Standard D 2622 test procedure. Higher sulfur levels will damage the Engine Aftertreatment System.

- □ Add winter or summer grade fuel according to the season of the year.
- □ Work in the cleanest conditions possible.
- □ Prevent water from entering the fuel tank.

For further information, refer to section How to Select Diesel Fuel.

Priming the Fuel System — Prime the fuel system as follows:

1. Operate the hand primer on module for three minutes or 250 strokes.
2. Crank the engine for 20 seconds.
3. Wait 60 seconds for starter cool down.
4. If engine does not start, repeat step 2 and step 3. The starting cycle can be repeated up to three times
5. If engine still fails to start, continue as follows:
   [a] Use DDDL to check for fault codes, repair as necessary.
   [b] Repeat step 2 and step 3.
6. Allow engine to reach operating temperature 60°C (140°F).
7. Increase engine speed to 1800 rpm for three minutes.
8. Reduce engine speed and check for fuel leaks. Repair if necessary.

Other Checks

Make sure the transmission is filled to the proper level with the fluid recommended by the gear manufacturer. Do not overfill.

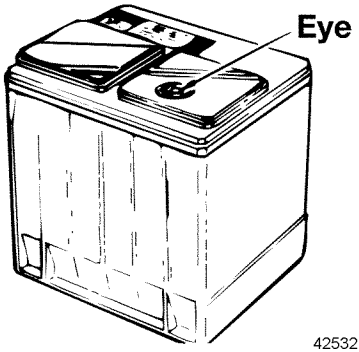
WARNING:

Battery Explosion and Acid Burn

To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid:

- □ **Flush your skin with water.**
- □ **Apply baking soda or lime to help neutralize the acid.**
- □ **Flush your eyes with water.**
- □ **Get medical attention immediately.**

Make sure cable connections to the storage batteries are clean and tight. Check the hydrometer "eye" of maintenance-free batteries for charge.



If lead-acid or low-maintenance batteries are used, make sure battery electrolyte level is normal.

Use only batteries that have been correctly filled and serviced. To provide corrosion protection, apply dielectric grease liberally to the terminal pads.

Check the turbocompound for signs of oil or exhaust leaks. Leaks should be corrected before starting the engine. Check engine mounting bolts for tightness. Bolts should be retightened, if necessary.

Starting the Engine for the First Time

Before starting the engine the first time, perform the operations listed in the System Checks section.

WARNING:

BODILY INJURY

To avoid injury from an explosion, do not use ether or starting fluid on engines equipped with a manifold (grid) heater.

The engine uses an electrical grid heater as a cold weather starting aid if the ambient temperature is below 4°C (40°F).

To start a DD15 engine, make sure the transmission is in neutral and turn the ignition key on.

WARNING:

ENGINE EXHAUST

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

WARNING:

PERSONAL INJURY

To avoid injury when working near or on an operating engine, remove loose items of clothing and jewelry. Tie back or contain long hair that could be caught in any moving part causing injury.

You will notice that both the Amber Warning Lamp (AWL), Red Stop Lamp (RSL), Malfunction Indicator Light (MIL), Diesel Particulate Filter Regen lamp, and High Exhaust System Temperature (HEST) Lampwill come on. This is the result of the Detroit Diesel Electronic Control (DDEC®) computer diagnosing the system to ensure everything is functional, including the light bulbs for the warning lights. If everything is OK, all lights will go out in approximately five seconds.

Start the engine *after* the lights go out. If starting a vehicle, start the engine with foot *off* the accelerator pedal.

NOTICE:

If the warning lights stay on, or do not come on momentarily after turning on the ignition, contact the Detroit Diesel Customer Support Center at 800-445-1980. Operating the engine under these circumstances may result in engine damage.

Electric Starter — Start an engine equipped with an electric starting motor as follows:

NOTICE:

To prevent serious starting motor damage, do not press the starter switch again after the engine has started.

1. Place the transmission in neutral, and set the parking brake.
2. With foot off the accelerator pedal, turn on the ignition switch and start the engine.
3. If the engine doesn't start after 20 seconds, stop. Try again after waiting about 60 seconds.

NOTICE:

Do not rev the engine if the oil pressure gauge indicates no oil pressure. Shut down the engine within approximately ten seconds to avoid engine damage. Check to determine the cause of the problem.

4. Monitor the oil pressure gauge immediately after starting the engine.

NOTE:

Do not place the engine under full load until it reaches operating temperature. Colder engine temperatures will cause the engine to preset idle up to 900 rpm. Even at a high idle condition, you don't have to wait for engine warm up and return to normal 600 rpm idle to drive the truck.

Running the Engine

While the engine is operating, monitor the battery charge indicator light, the oil pressure, and avoid excessive idling.

One difference you will notice with the DD15 engine is under the hood noise. The gear train was designed for quiet operation compared to competitive engines and the camless injectors minimize noise and vibration to the point of barely hearing the engine run even at wide open throttle.

Oil Pressure

Observe the oil pressure gauge immediately after starting the engine. A good indicator that all moving parts are getting lubrication is when the oil pressure gauge registers pressure 14 psi (97 kPa) at idle speed.

If no pressure is indicated within 10 to 15 seconds, stop the engine and check the lubrication system.

The pressure should not drop below 55 psi (380 kPa) at 1800 rpm, and normal operating pressure should be higher. If oil pressure does not fall within these guidelines, it should be checked with a manual gauge.

⚠ WARNING:

HOT OIL

To avoid injury from hot oil, do not operate the engine with the rocker cover(s) removed.

Warm-up

Run the engine at part throttle for about five minutes to allow it to warm up before applying a load.

Inspection

While the engine is idling, inspect the transmission, check for fluid leaks, and check the crankcase and turbocompound.

Transmission — While the engine is idling, check the automatic transmission (if equipped) for proper oil level and add oil as required.

Fluid Leaks — Look for coolant, fuel, or lubricating oil leaks. If any are found, shut down the engine immediately and have the leaks repaired after the engine has cooled.

Crankcase — If the engine oil was replaced, stop the engine after normal operating temperature has been reached. Allow the oil to drain back into the crankcase for about 60 minutes, then check the oil level. If necessary, add oil no more than 3.8 L (4.0 qt) at a time to bring the level to the proper mark on the dipstick. Use only the heavy-duty oils recommended. Refer to section How to Select Lubricating Oil.

NOTICE:

Do not add oil if the oil reading is between the two bends on the dipstick or in the crosshatch area . There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

Turbocharger — Make a visual inspection of the turbocharger for oil leaks, exhaust leaks, excessive noise, or vibration. Stop the engine immediately if a leak or unusual noise or vibration is noted. ***Do not restart the engine until the cause of the concern has been investigated and corrected.***

Axial Power Turbine — Check axial power turbine for excessive noise or vibration. Stop the engine immediately if unusual noise or vibration is noted. ***Do not restart the engine until the cause of the concern has been investigated and corrected.***

Avoid Unnecessary Idling

Whenever possible, avoid unnecessary idling.

NOTICE:

Do not allow the engine to idle overnight or unattended for several hours. Extensive idling will cause a buildup of hydrocarbons which can cause an uncontrolled regeneration resulting in damage to the ATD. If the California Engine Idle Limiting feature is enabled and the engine shuts down, the MCM will require recycling of the ignition system which cannot be completed on a dead or weak battery.

During long engine idling periods with the transmission in neutral, the engine coolant temperature may fall below the normal operating range.

The incomplete combustion of fuel in a cold engine will cause crankcase oil dilution, formation of lacquer or gummy deposits on the valves, pistons, and rings, and rapid accumulation of sludge in the engine. When prolonged idling is necessary, maintain at least 900 rpm.

Stopping the Engine

Stop an engine under normal operating conditions as follows:

1. Reduce engine speed to idle and put all shift levers in the neutral position.

NOTICE:

Do not stop a turbocharged engine immediately after a high-speed operation. Allow a sufficient cool-down period to prevent the turbo from continuing to turn without an oil supply to the bearings.

2. Allow the engine to run between idle and 1000 rpm with no load for five minutes. This allows the engine to cool and permits the turbocharger to slow down. After five minutes, shut down the engine.

NOTE:
Cool down idling can take place after pulling off the interstate and finding a parking spot or backing into a dock. Shutting the engine off immediately retains more block heat than if the engine runs at idle for five minutes.

Emergency Jump Starting

The DDEC VI system operates on 12 volts DC. If a DDEC VI engine with an electric starting motor requires emergency jump starting, *do not exceed 16 volts DC.*

WARNING:

BATTERY EXPLOSION

To avoid injury from battery explosion when jump starting the engine, do not attach the cable end to the negative terminal of the disabled battery.

NOTICE:

Jump starting with voltages greater than those indicated *or* reversing battery polarity may damage the Motor Control Module.

NOTICE:

Failure to connect jumper cables in the proper sequence can result in alternator and/or equipment damage.

Before attempting to jump start the engine, make sure the jumper cables are connected properly (positive to positive, negative to chassis or suitable ground) and in the proper sequence (negative to negative ground *last*).

WARNING:

Battery Explosion and Acid Burn

To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid:

- □ **Flush your skin with water.**
- □ **Apply baking soda or lime to help neutralize the acid.**
- □ **Flush your eyes with water.**
- □ **Get medical attention immediately.**

Routine Engine Start

Following are procedures for a routine everyday engine start.

WARNING:

ENGINE EXHAUST

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

WARNING:

PERSONAL INJURY

To avoid injury when working near or on an operating engine, remove loose items of clothing and jewelry. Tie back or contain long hair that could be caught in any moving part causing injury.

Starting-the-Engine Routine

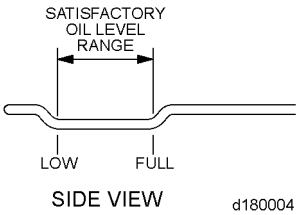
Before a routine start, refer to chapter MAINTENANCE and see the daily checks for your engine.

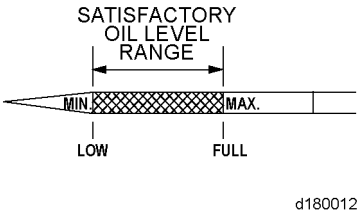
Important: Before starting the engine, carefully read all operating instructions in this manual and do all the recommended pretrip inspections and daily maintenance. Check the coolant, engine oil, and fuel levels, and drain contaminants from the coalescer (water separator).

NOTE:
If you drain water from the coalescer, you have to prime the fuel system with the built-in hand primer (up to about 50 strokes).

NOTE:
As a safety function, the electronic engine control system may be wired to start the engine only If the transmission is in neutral. This is vehicle application specific.

1. Turn on the ignition switch.
2. With the accelerator pedal in the idle position, start the engine.
3. Check the engine for leaks.
   [a] Check all hoses, hose clamps, and pipe unions on the engine for tightness. Shut down the engine and tighten them if necessary.
   [b] Check the oil feed and return lines at the turbocharger for leaks. Shut down the engine and tighten them if necessary.
4. Shut down the engine.
5. Check the oil level using the oil dipstick. The oil level is measured using the two bends or the crosshatch area on the dipstick. If the oil reading is between these bends or in the crosshatch area, then the oil is at the proper level for engine operation.





NOTE:
The engine must be shut down for 60 minutes and on a level surface for an accurate oil level reading. Otherwise, the engine must be brought up to an operating temperature of 60°C (140°F), shut down, and allowed to sit for five minutes on a level surface. Failure to allow the oil to drain back

properly as just described can result in a low oil level reading.

6. Check all the mounting fasteners on the engine for tightness.

Checking the Coolant Level (Cold Check)

Check coolant level as follows:

1. Ensure that all coolant plugs in the bottom of the radiator and on the radiator outlet pipe are secure and tight.
2. Check the coolant level. The cooling system is correctly filled when the coolant is between the full and low marks on the surge tank.

NOTE:
For more information, refer to chapter MAINTENANCE.

Checking the Coolant Level (Hot Check)

Check the coolant levels as follows:

1. Allow the engine to run for approximately five minutes at a moderate speed.

⚠ WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

2. Then, with the coolant temperature above 50°C (122°F), recheck the coolant level in the surge tank.
3. Add more coolant if necessary. Open the heater valves before adding coolant.
4. Do not close the heater valves until the engine has been run briefly and the coolant level again checked and corrected as necessary.

Monitoring Engine Operation

While the engine is operating, monitor the battery charge indicator light, the oil pressure and avoid excessive idling.

Battery Charge

The battery charge indicator light must go out once the engine starts.

If the indicator light comes on while the engine is running, do the following:

WARNING:

FIRE

To avoid injury from fire, keep all potential ignition sources away from diesel fuel, including open flames, sparks, and electrical resistance heating elements. Do not smoke when refueling.

1. Shut down the engine.
2. Charge or replace the batteries as needed.
3. If necessary, visit the nearest authorized dealer to have the alternator voltage and output checked. Do a load test on the batteries.

Oil Pressure

When the engine has reached its normal operating temperature, the engine oil pressure must not drop below the following values:

- □ 55 psi (380 kPa) at rated speed
- □ 14 psi (97 kPa) at idling speed

If oil pressure drops below these values, stop the engine and determine the cause.

Excessive Idling

Never allow the engine to idle for more than 30 minutes. Excessive idling can cause oil to leak from the turbocharger.

Changing the Idle Speed

The idle speed range of the DD15 engine is 600 to 900 rpm if the parameters in the Common Powertrain Controller (CPC) are set to the default range.

Change the idle speed as follows:

1. Turn the cruise control switch to the ON position.
2. To increase the idle speed, push the RSM/ACC Switch until the idle reaches the desired rpm.
3. To decrease the idle speed, push the SET/CST Switch until the idle reaches the desired rpm.

Shutting Down the Engine

If the engine has been running at full output or the coolant temperature has been high, allow the engine to idle for five minutes without load. Then turn off the ignition key switch.

If any of the following occur, shut down the engine immediately.

- The oil pressure swings back and forth or falls sharply.
- Engine power and rpm fall, even though the accelerator pedal remains steady.
- The exhaust pipe gives off heavy smoke.
- The coolant and/or oil temperature climb abnormally.
- Abnormal sounds suddenly occur in the engine or turbocharger.

Shutting Down After High Load Operation

After high load operation, do the following:

NOTICE:

An engine running at full output or with high coolant temperature after a high load operation should idle for five minutes without load. Shutting down without idling may cause damage to the turbocharger.

Idle for five minutes, then turn off the ignition switch and shut down the engine.

Emergency Running Mode

The engine is equipped with DDEC VI which monitors the engine as it is running.

As soon as a fault is detected, it is evaluated and one of the following measures is initiated.

NOTICE:

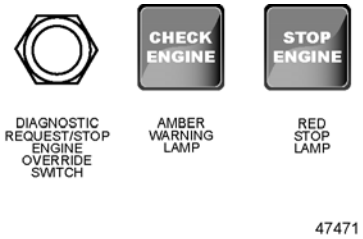
To prevent possible serious engine damage, have any faults corrected without delay by an authorized dealer.

- In conjunction with any dashboard or instrument panel display, the code for the electronic control unit reporting the fault can be read immediately on the display.
- If the fault is serious enough to impair normal operation, DDEC VI switches over to limp home mode. The limp home speed is dependent on MCM parameters and could be 1000 rpm. This allows you to move the vehicle to a service location or other safe stopping area.

Stop Engine Override Option

The Stop Engine Override Option is used for a momentary override. The Motor Control Module (MCM) will record the number of times the override is activated after a fault occurs.

Momentary Override – A Stop Engine Override (SEO) Switch is used to override the shutdown sequence. This override resets the 60–second (30–second for oil pressure) shutdown timer, restoring power to the level when the Red Stop Lamp (RSL)/Stop Engine was illuminated. The switch must be recycled after five seconds to obtain a subsequent override.



NOTE:
The operator has the responsibility to take action to avoid engine damage.

Cold Weather Operation

Special precautions must be taken during cold weather. To protect your engine, special cold weather handling is required for fuel, engine oil, coolant, and batteries.

WARNING:

BODILY INJURY

To avoid injury from an explosion, do not use ether or starting fluid on engines equipped with a manifold (grid) heater.

The engine does not require starting aids down to 10°C (50°F). A grid heater is included for temperatures between 10°C (50°F) and –20°C (–4°F). Temperatures below –20°C (–4°F), will require a grid heater, block heater, and oil pan heater.

Winter Fronts

A winter front may be used to improve cab heating while idling. At least 25% of the grill opening should remain open in sectioned stripes that run perpendicular to the charge air cooler tube flow direction. This assures even cooling across each tube and reduces header to tube stress and possible failure. Winter fronts should only be used when the ambient temperature remains below -12°C (10°F).

DDEC VI SYSTEM

The DD15 engine for 2007 is equipped with DDEC VI.

DDEC VI regulates the fuel injection quantity and timing using solenoid valves, allowing extremely low-emission operation. Besides the engine and its related sensors, the system has two control modules:

- The Motor Control Module (MCM)
- The Common Powertrain Controller (CPC) located in the vehicle cab

The two control units are connected by a proprietary datalink through which all necessary data and information can be exchanged.

The CPC broadcasts all information on the J1587 and J1939 datalinks, where it can be read by the diagnostic tool.

The MCM monitors both the engine and the datalink. When a malfunction or other problem is detected, the system selects an appropriate response; for example, the emergency running mode may be activated.

The Accelerator Pedal (AP) Assembly eliminates the need for any throttle linkage.

Motor Control Module

The MCM is located on the left-hand side of the engine.

The MCM processes the data received from the CPC, for example the position of the accelerator pedal, engine brake, etc.

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This data is evaluated together with the data from the sensors on the engine, such as coolant and fuel temperature and oil and charge pressure. The data is then compared to the characteristic maps or lines stored in the MCM.

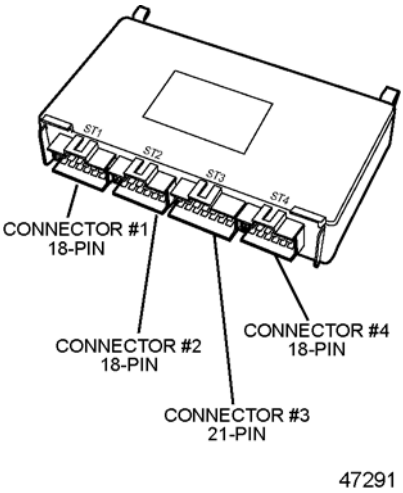
From this data, quantity and timing of injection are calculated.

NOTE:
To obtain a replacement MCM, all the information given on the MCM label is required.

The MCM data label has the 10 digit engine serial number.

Common Powertrain Controller

The CPC communicates with the MCM unit installed on the vehicle over the J1939 datalink.



Data for specific applications is stored in the CPC. These include idle speed, maximum running speed, and speed limitation.

The CPC receives data from the following sources:

- The operator (accelerator pedal position, engine brake switch, etc.)
- Other electronic control units (for example, the anti-lock brake system)
- The MCM (oil pressure, coolant temperature, etc.)

From this data, instructions are computed for controlling the engine and transmitted to the CPC via the proprietary datalink.

DDEC VI Features

DDEC VI offers a variety of features and options designed to warn the operator of an engine malfunction.

Options can range from warning panel lights to automatic reduction in engine power followed by automatic engine shutdown.

DDEC VI has the ability to perform diagnostics for self-checks and continuous monitoring of other system components.

Depending on the application, DDEC VI can monitor oil temperature, coolant temperature, oil pressure, fuel pressure, coolant level and remote sensors (if used).

DDEC VI activates to the Amber Warning Lamp (AWL)/Check Engine and the Red Stop Lamp (RSL)/Stop Engine to provide a visual warning of a system malfunction.

Cruise Control

Cruise Control is available with any DDEC engine. Cruise Control will operate in either Engine or Vehicle Speed Mode and maintain a targeted speed (MPH or RPM) by increasing or decreasing fueling. The targeted speed can be selected and adjusted with dash-mounted switches.

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Cruise Control may also be programmed to permit fast idle using the Cruise Control switches.

With the engine at normal idle, transmission in neutral and service brakes on, press the SPD CNTL Switch, and use the RSM/ACC Switch. The engine rpm should increase to a predefined speed. The engine rpm can be raised or lowered from this point using the SET/CST and RSM/ACC switches.

Cruise Control will maintain the set speed under normal road and load conditions.

⚠ CAUTION:

LOSS OF VEHICLE CONTROL

To avoid injury from the loss of vehicle control, do not use cruise control under these conditions:

- **When it is not possible to keep the vehicle at a constant speed (on winding roads, in heavy traffic, in traffic that varies in speed, etc.).**
- **On slippery roads (wet pavement, ice-or snow-covered roads, loose gravel, etc.).**

NOTICE:

When descending a hill with Cruise Control OFF, **do not** allow the engine to exceed 2300 rpm. Failure to observe this can result in over speeding and serious engine damage.

Engine speed and power are varied under Cruise Control to maintain the set vehicle speed. The vehicle speed must be above Min Cruise Set Speed and below Max Cruise Set Speed. It is recommended that Max Cruise Set Speed be set to the default to allow proper operation of other features such as Fuel Economy Incentive and PasSmart. The Vehicle Speed Limit should be used to limit vehicle throttle speed.

It cannot limit vehicle speeds on down grades if available engine braking effort is exceeded, nor can it maintain speed on upgrades if power requirements exceed engine power capability.

When the SPD CNTL is in the ON position, Cruise Control is engaged by momentarily contacting the SET/CST Switch. As a check after each engine start, DDEC VI looks for a one time activation of the clutch (if equipped) and service brake before DDEC VI allows Cruise Control to be enabled. The MCM must also recognize that the Cruise Enable Switch has changed. If the Cruise Enable Switch is off, it needs to be turned on. If the Cruise Enable Switch is on, it must be turned off then on for cruise to operate.

Holding the switch in the SET/CST position allows the vehicle to slow to a lower speed. Toggling the switch will result in a one mile-per-hour (1.6 kph) decrease in vehicle speed. If Cruise Control has been disabled, toggling the RSM/ACC Switch restores the vehicle to the previously set cruise speed.

Cruise Control can be overridden at any time with the accelerator pedal if the vehicle is operating at less than the programmed Max Road Speed. Additionally, using either the brake or the clutch will disable Cruise Control.

Data Recording Capability

DDEC VI contains the ability to extract detailed data on the engine's use and performance using DDEC Reports software. This data, known as DDEC Data, is stored in the CPC and contains information on engine performance (such as fuel economy, idle time, time in top gear) and critical incidents (such as detailed diagnostic data records and hard braking events). DDEC Data can be downloaded using DDEC Reports software to produce reports.

DDEC Reports software is part of the Detroit Diesel Diagnostic Link® 7.0 (DDDL 7.0) software package. DDDL 7.0 requirements are listed in Table 1.

Minimum Hardware	Recommended Hardware
Windows 2000 or Windows XP	Windows 2000 or Windows XP
Pentium 3 Processor, 400 MHz	Pentium 4, 1.5 GHz
256 MB RAM	512 MB RAM
10 Gigabyte Hard drive with 1 Gigabyte free	40 Gigabyte Hard Drive with 5 Gigabytes free
8 x CD ROM Drive	32 x CD/DVD ROM
Monitor and graphics card supporting 1024 x 768 resolution and 16 bit color	Monitor and graphics card supporting 1280 x 1024 resolution and 32 bit color
Parallel port, 1 free USB port	Parallel port or 3 free USB ports
Internet or Mainframe Connection to DDC Server (for updates)	Internet or Mainframe Connection to DDC Server (for updates)
Translator Boxes (Detroit Diesel Multilink, Nexiq Magic Key, Nexiq USB-Link)	Translator Box (Nexiq USB-Link)

Table 1 DDDL 7.0 System Requirements

Engine Brake

The engine brake is enabled by a dash-mounted ON/OFF Switch with a separate intensity switch to select low, medium, or high braking power.

CAUTION:

LOSS OF VEHICLE CONTROL

To avoid injury from loss of vehicle control, do not activate the Engine Brake system under the following conditions:

- **On wet or slippery pavement, unless the vehicle is equipped with ABS (anti-lock braking system) and you have had prior experience driving under these conditions.**
- **When driving without a trailer (bobtailing) or pulling an empty trailer.**
- **If the tractor drive wheels begin to lock or there is fishtail motion after the Engine Brake is activated, deactivate the brake system immediately if this occurs.**

The engine brake will only operate when the Accelerator Pedal is fully released. Disengaging the clutch will prevent the engine brake from operating.

The engine brake will supply braking power even when in Cruise Control. The MCM will control the amount of engine braking with respect to the Cruise Control set speed. The maximum amount of braking (low, medium, high) is selected with the dash switches.

Engine Protection

The DDEC VI engine protection system monitors all engine sensors and electronic components, and recognizes system malfunctions. If a critical fault is detected, the AWL (Check Engine) and RSL (Stop Engine) illuminate. The malfunction codes are logged into the MCM's memory.

The standard parameters which are monitored for engine protection are: low coolant level, high coolant temperature, low oil pressure, and high oil temperature.

This system features a 30–second, stepped-power shutdown sequence or an immediate speed reduction without shutdown in the event a major engine malfunction occurs, such as low oil pressure, high oil or coolant temperature, or low coolant level.

WARNING:

PERSONAL INJURY

To avoid injury from engine shutdown in an unsafe situation, ensure the operator knows how to override the stop engine condition on a DDEC-equipped unit.

NOTICE:

Engines equipped with the powerdown/shutdown option have a system override button or switch to allow engine operation for a short period of time. Using the override button so the engine does not shut down in 30 seconds but operates for an extended period may result in engine damage.

California Engine Idle Limiting

In order to meet the California Engine Idle Limiting Standard, an engine idle shutdown feature has been built into the DDEC VI Engine Control Strategy. When the California Engine Idle Limiting feature is enabled, the engine will generally shut down after five minutes of continuous idling when the transmission is in neutral or park and the parking brake is set or after fifteen minutes when the transmission is in neutral or park and the parking brake is not set.

Activating or momentarily changing the position of the service brake pedal, the clutch pedal, Stop Engine Override, the accelerator pedal, or park brake status during the final 30 seconds before a shutdown would otherwise occur will prevent the engine from shutting down and will reset the shutdown timer. After an automatic shutdown, the engine may be restarted and operated normally.

The automatic shutdown feature is generally disabled on engines certified by the US EPA for use outside California but is required to be enabled for all California certified engines with the exception of engines used in specific vehicle types which the state of California has determined to be exempt from the idle shutdown requirement. These include buses, school buses, recreational vehicles, medium duty vehicles, military tactical vehicles, and authorized emergency vehicles as they are defined by the state of California. Owners of these vehicle types that wish to have the shutdown feature disabled should consult with California authorities to determine if their vehicles qualify for the exemption.

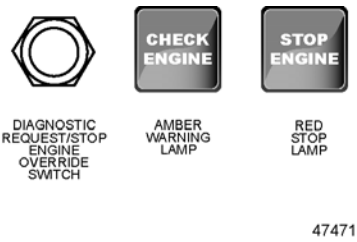
Idle Shutdown Timer

This feature is an optional 1 – 100 minute idle shutdown system. Its purpose is to conserve fuel by eliminating excessive idling and allowing a turbocharger cool-down period. To activate the shutdown, the transmission must be in neutral with the vehicle parking brakes set and the engine in idle or fast-idle mode.

DDEC VI Operation

NOTE:
This engine is equipped with DDEC VI software. This software generally assures optimal engine performance. The installation of software upgrades may cause minor changes in features and engine performance.

Since the DDEC VI system is electronic, a battery is required to operate the computer. The system operates at 12 volts. However, in the event of a power supply malfunction, the system will continue to operate at reduced voltage. When this occurs, the AWL (Check Engine) will come on.



The engine will only operate at reduced rpm until the battery voltage reaches a point where the MCM will no longer function and the engine shuts down.

Should the AWL (Check Engine) come on for any reason, the vehicle can still be operated and the driver can proceed to the required destination. *This condition should be reported to an authorized Detroit Diesel distributor or dealer.*

NOTICE:

When the RSL (Stop Engine) comes on, the computer has detected a major malfunction in the engine that requires immediate attention. **It is the operator's responsibility to shut down the engine to avoid serious damage.**

The engine can be configured to give a warning only, to ramp down (reduce power) or to shut down. Ramp down will reduce engine rpm to a predetermined speed, but will not shut down the engine. With the 30–second shutdown option, the engine will begin a 30–second, stepped powerdown sequence until it shuts down completely.

The "Stop Engine Override" feature can be activated in the case where the vehicle is operating in a critical location.

Stop Engine Override Switch

This feature allows the operator to override the automatic stop engine sequence.

This is done by pressing the Stop Engine Override Switch every 15 to 20 seconds to prevent engine shutdown from occurring.

NOTE:
The Stop Engine Override Switch and the Diagnostic Request Switch are the same.

NOTE:
Holding down the Stop Engine Override Switch will not prevent the engine shutdown sequence. You must continue to reset the automatic shutdown system by pressing the Stop Engine Override Switch at intervals of approximately 15 to 20 seconds.

It takes 30 seconds from the time the automatic shutdown sequence begins until engine shutdown. Therefore, the operator *must* press the override switch just prior to engine shutdown and continue to do so until the vehicle can be brought to a stop in a safe location.

Immediate Speed Reduction

The immediate speed reduction option will bring engine rpm back to a predetermined speed, but will not shut down the engine.

The engine should not be restarted after it has been shut down by the engine protection system, unless the problem has been located and corrected.

Red Stop Lamp

The conditions that will cause the RSL (Stop Engine) to come on are:

- □ High coolant temperature
- □ Loss of coolant
- □ High oil temperature
- □ Low oil pressure
- □ Auxiliary shutdown

Whenever the AWL (Check Engine) or the RSL (Stop Engine) come on, the DDEC computer will determine where the problem is and will then store this information in its memory.

If the malfunction is intermittent, the lights will come on and go off as the computer senses the changing engine condition.

Diagnostic Tool

The diagnostic tool for DDEC VI is DDDL 7.0. DDDL 7.0 requirements are listed in Table 1.

Once the malfunction has been corrected, the DDEC VI system will return the engine to normal operation.

The temperature of air in the intake system is increased with the addition of an EGR. DDEC VI is programmed to reduce fueling (power) for a short time to reduce air and coolant temperatures when necessary.

DDEC VI will store an information code that this event occurred, but no corrective action is required as this action is designed to maintain operation without a noticeable affect on vehicle performance.

Flashing Malfunction Codes —

All malfunction codes are four digits. The malfunction code recorded in the computer memory will remain until it is erased by a technician.

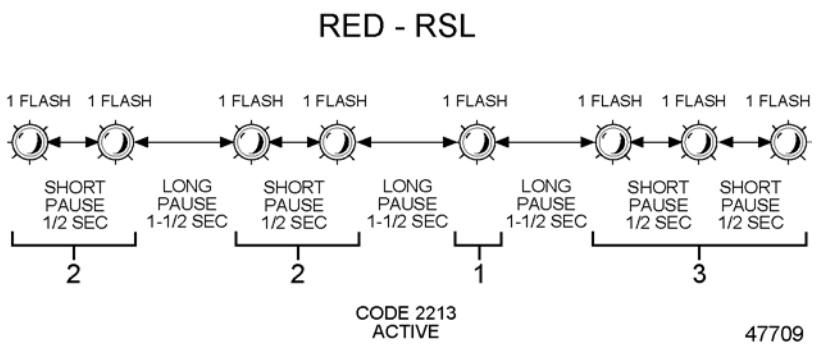
The flashing malfunction code can also be obtained by the operator. To support flashing codes, a Stop Engine Override/Diagnostic Request Switch must be configured and the AWL (Check Engine) and RSL (Stop Engine) must be hard-wired. The CPC cannot flash these lamps if they are not hard-wired.

The flashing code feature may be activated by satisfying one of the following conditions:

- Engine speed is <100 rpm and the SEO Switch is put in the ON position.
- Idle Governor is active and the SEO Switch is put in the ON position.
- Vehicle speed is <3 mph and Parking Brake is activated and the SEO Switch is put in the ON position.

The flashing code feature is deactivated once the SEO Switch is returned to the OFF position or the listed conditions are no longer satisfied.

Only one light will be flashing codes at any time. All codes will be flashed twice. The interdigit pause is 1.5 seconds. The pause between codes is 3.5 seconds. The same 3.5–second pause occurs as the switch is made from RSL (Stop Engine) to AWL (Check Engine).



When code flashing is initiated, the active codes will be flashed on the RSL (Stop Engine). Then the inactive codes will be flashed on the AWL (Check Engine). When all the inactive codes have been flashed, the process of flashing all the active codes followed by all the inactive codes will repeat until the conditions for code flashing are no longer satisfied.

If there are no active or inactive faults, the number 3 is flashed once followed by an intercode gap of 3 seconds.

To Read Codes: Press and hold the SEO/Diagnostic Request Switch. Active codes will be flashed on the RSL (Stop Engine) first, followed by inactive codes being flashed on the AWL (Check Engine).

The codes will continue to flash and repeat as long as the Diagnostic Request Switch is held in the ON position. Both CPC and MCM faults are included.

Active Codes — The active codes will be flashed on the RSL (Stop Engine) in the order of most recent to least recent occurrence based on engine hours.

Inactive Codes — The inactive codes will be flashed on the AWL (Check Engine) in the order of most recent to least recent occurrence based on engine hours.

DDEC VI ENGINE DRIVING TIPS

Driving with an electronically controlled engine is very user friendly.

Accelerating the Vehicle

The Accelerator Pedal (AP) was designed to communicate "percentage" accelerator pedal travel to the engine's Motor Control Module (MCM). The engine will respond accordingly to the driver's demand.

A throttle or governor characteristic you may need time to get used to is the DDEC Limiting Speed Governor. This allows the driver to command total engine response between idle and rated speed, such as accelerating at half throttle – an advantage when driving under slippery conditions.

If you require wide-open throttle engine response, either accelerating or just plain pulling hard, the throttle AP will have to be held to the floor. To obtain 100% fueling at any speed, the AP will have to be maintained at the fully pressed position.

Cruise Control

For added driver convenience and comfort, DDEC VI also features a Cruise Control option that works just like the system in your car. It can be operated in any gear above 1100 rpm or road speed faster than 20 mph (32 kph), up to the rated engine speed. It also can be programmed to hold your road speed at or below the maximum vehicle speed. The switch to energize Cruise Control is usually mounted on the instrument panel.

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Turn the switch ON to energize the system. Remember as a check after each engine start, DDEC VI looks for a one time activation of the clutch (if equipped) and service brake before DDEC VI allows Cruise Control to be enabled.

DDEC VI must also see or recognize that the Cruise Enable Switch has changed. If the Cruise Enable Switch is OFF it needs to be turned ON. If the Cruise Enable Switch is left in the ON position at key OFF, the switch must be cycled OFF then ON for DDEC VI to see a status change to allow Cruise Control activation. The status of DDEC VI inputs to activate Cruise Control at key ON is listed in Table 2.

Once Cruise Control is enabled and you reach your road speed, press the SET Switch to activate Cruise Control. The cruise light will come on. To increase road speed in one mile-per-hour (1.6 kilometer-per-hour) increments, press the RSM/ACC Switch. To reduce road speed, press and hold the SET/CST Switch until the lower speed is reached.

Cruise Control is deactivated by slightly pressing the service brakes, clutch pedal, or trailer brake. The ON/OFF Switch will also deactivate Cruise Control.

Cruise Control will maintain vehicle speed even on up grades, unless power requirements demand a downshift. If the Cruise Control/Engine Brake function is turned ON, the Cruise Control will limit your speed on down grades. Most likely, Cruise Control will feel stronger than driving with the accelerator pedal because of the instantaneous and wide-open throttle response. That's why Cruise Control use is not suggested during slippery driving conditions.

Input	Status of Input at Key ON	Status of Input Before Cruise Control Activates
Service Brake Switch	ON	OFF
Clutch Release Switch (Manual Trans only)	ON	OFF
Cruise Control Enable Switch	OFF	ON

Table 2 Input Status to Activate Cruise Control

Use Cruise Control after down shifting on a hill to pull the hill. Hitting the RSM/ACC Switch (not the SET Switch) will keep the truck accelerating in the lower gears up to the rated engine speed.

Cruise Control will disengage below 1000 rpm or 20 mph (32 kph) road speed. When using Cruise Control, if you want to pull the engine below 1000 rpm, remember to hold the accelerator pedal to the floor to keep the engine pulling at wide-open throttle. The engine will pull to about 1050 rpm.

Remember: The electronic data programmed into the DDEC VI system will not allow you to hurt or overfuel the engine at low or "lug" engine speeds. There is enough oil pressure to withstand hard pulls at low engine speeds.

Engine Brake and Cruise Control

If your engine is equipped with both Cruise Control and an engine brake, the engine brake can operate automatically while you are in Cruise Control. If the Cruise Control/Engine Brake function is turned ON in the DDEC VI system programming, the engine brake will come on "low" when your set road speed increases a few miles-per-hour (kilometers per hour) above your cruise set speed. If your speed continues to increase, the DDEC VI system will increase the engine brake's braking power progressively. When the vehicle returns to the set cruise speed, the engine brake will turn off until you need them.

For safety reasons, don't use Cruise Control when it is not possible to keep the vehicle at constant speed due to:

- Winding roads
- Heavy traffic
- Slippery pavement
- Descending grades calling for engine brake assistance

For an explanation of the engine brake system and recommendations for proper operation, refer to chapter ENGINE BRAKE SYSTEM.

Shifting

Depending on your transmission model, the gear split may vary from 400 to 500 rpm. The electronic governor provides almost no overrun capability; and, if the transmission is downshifted too early, you will experience a temporary loss of pulling power until the engine speed falls below rated speed.

In general, when using a 7- or 9-speed transmission, you should always downshift between 1000 and 1100 rpm. This is true even on steep grades with heavy loads. When using an 18-, 15-, or 13-speed transmission, you will need to downshift at an rpm that allows "less than rated" rpm before throttle application in the next gear down. You may want to limit engine speed to 1900 rpm in all gears. The DD15 engine provides horsepower through 2100 rpm, but fuel economy is not as efficient above 1800 rpm.

If you decide to drive at lower rpm's for improved fuel economy, don't let different engine noises throw you off guard. The DD15 engine sounds quiet at 1400 rpm, almost as if it had quit pulling. If you had a boost gauge to look at while driving, you would notice the turbocharger maintaining steady intake manifold pressure, even as rpm falls. Depending on the air intake arrangement, you may also experience a "chuffing" sound as the engine starts to pull hard at lower rpm's. This is normal and caused by the velocity changes of the air flow within the air intake plumbing. Electronic engines can actually deliver more fuel at lower engine speeds than at rated speed.

The DD15 engine has been designed for a very quiet operation, but the air flow may be noticeable to the tuned attentive ear. The turbocharger operates at higher boost pressure forcing EGR gas flow through the EGR plumbing. In some situations the driver may believe he/she has experienced a charge air cooler system leak. Even connecting trailer light and air hoses, the driver may hear a different tone (exhaust and under hood with the engine idling.) If equipped with a turbo boost gauge, the driver may occasionally note intake manifold pressure exceeds 35 psi (6.89 kPa).

Idling

The common belief that idling a diesel engine causes no engine damage is wrong. Idling produces sulfuric acid, which is absorbed by the lubricating oil and eats into bearings, rings, valve stems and engine surfaces. If you must idle the engine for cab heat or cooling, the *high idle* function of the Cruise Control switches should be used. An idle speed of 900 rpm should be enough to provide cab heat in above 0°C (32°F) ambients.

ENGINE BRAKE SYSTEM

The DD15 engine is equipped with an engine brake. Before operating the vehicle, you *must* familiarize yourself with the engine brake system to obtain optimum benefit from it. Engine brake control systems may vary slightly, depending on the engine brake configuration and cab design. However, basic operator controls are similar for all models.

Driver Control Switches

Vehicles with manual transmissions allow the driver to turn the engine brake on and off and select a low, medium or high level of braking.

Low/Med/High Switch

The “Low” setting on this switch activates two (2) brake cylinders, yielding about one-third engine braking horsepower. The “Medium” activates four (4) cylinders, supplying about two-thirds engine braking horsepower. The “High” setting activates all six (6) cylinders, providing full engine braking horsepower.

Clutch Pedal and Throttle Position Controls

The engine brake has two additional controls, one activated by the position of the clutch pedal and the other activated by the position of the accelerator pedal. These controls permit fully automatic operation of the engine braking system.

Engine Brake Operation

The engine brake system depends on a full-pressure flow of warm engine lubricating oil for proper lubrication of moving parts and optimum performance.

NOTICE:

Always allow the engine to reach full normal operating temperature before activating the engine brake system to ensure positive engine brake engagement.

⚠ CAUTION:

LOSS OF VEHICLE CONTROL

To avoid injury from loss of vehicle control, do not activate the Engine Brake system under the following conditions:

- **On wet or slippery pavement, unless the vehicle is equipped with ABS (anti-lock braking system) and you have had prior experience driving under these conditions.**
- **When driving without a trailer (bobtailing) or pulling an empty trailer.**
- **If the tractor drive wheels begin to lock or there is fishtail motion after the Engine Brake is activated, deactivate the brake system immediately if this occurs.**

Under normal driving conditions the engine brake system is left in the ON position. However, this should change if roads become wet or slippery.

After it is switched on, the engine brake system is automatically activated each time you remove your feet completely from the clutch pedal and accelerator pedal. The engine brake automatically deactivates itself when you press the clutch pedal while shifting gears.

NOTICE:

Do not attempt to “double clutch” the transmission while the engine brake system is turned on. Shifting gears without pressing the clutch or using the engine brake to reduce engine rpm may result in serious powertrain damage.

NOTE:
Some systems may be programmed to activate themselves only when the brake pedal is pressed, so read your vehicle owner's manual thoroughly to find out if you have this option.

Anti-Lock Braking Systems

Vehicles equipped with Anti-lock Braking Systems (ABS) have the ability to turn the engine brake OFF if a wheel-slip condition is detected. The engine brake will automatically turn itself ON once the wheel slip is no longer detected.

The DDEC VI system will deactivate the engine brake system when the engine speed falls below 1000 rpm or when the vehicle slows down to a preset speed, depending on DDEC programming. This prevents stalling the engine. The engine brake can also be used with vehicle Cruise Control turned ON.

Driving on Flat, Dry Pavement

Use the following guidelines when driving on flat, dry pavement:

1. If driving on flat, dry, open stretches with a light load and greater slowing power is not required, place the progressive braking switch in the LOW position.
2. If you find you are still using the service brakes, move the switch to a higher position until you do not need to use the service brakes to slow the vehicle down.
3. If you are carrying a heavier load and road traction is good, move the progressive braking switch to the HIGH position.
4. Check your progressive braking switch often for proper position, since road conditions can change quickly. *Never skip a step when operating the progressive braking switch.* Always go from OFF to LOW, and then to a higher position.

Descending a Long, Steep Grade

An explanation of "control speed" may be helpful in understanding how to use the engine brake system while descending a grade. *Control Speed* is the constant speed at which the forces pushing the vehicle forward on a grade are equal to the forces holding it back, without using the vehicle service brakes. In other words, *this is the speed the vehicle will maintain without using the service brakes or fueling.*

Use the following guidelines when descending a long, steep grade:

1. Before beginning the descent, determine if your engine brake system is operating properly by lifting your foot briefly off the accelerator pedal. You should feel the system activate.

⚠ CAUTION:

BRAKE FADE

To avoid injury, do not over apply the vehicle service brakes when descending a long, steep grade. Excessive use of the vehicle brakes will cause them to heat up, reducing their stopping ability. This condition, referred to as "brake fade", may result in loss of braking, which could lead to personal injury or vehicle/property damage or both.

2. Ensure the progressive braking switch is in the appropriate power position.

⚠ WARNING:

PERSONAL INJURY

Failure to keep the vehicle within safe control speed limits while descending a grade may result in loss of vehicle control, which could cause personal injury.

NOTICE:

Failure to keep the vehicle within safe control speed limits while descending a grade may result in vehicle or property damage or both.

3. Do not exceed the *safe control speed* of your vehicle. Example: You could descend a 6% grade, under control only at 10 mph (16 kph) without an engine brake, but at 25 mph (40 kph) with an engine brake. You could not descend that same hill at 50 mph (80 kph) and still expect to remain under control. Get to know how much slowing power your engine brake can provide. So get to know your engine brake system *before* climbing hills and do not exceed a safe control speed.
4. Check your progressive braking switch often for proper position, since road conditions can change quickly. *Never skip a step when operating the progressive braking switch.* Always go from OFF to LOW and then to a higher position when on slippery roads.

Driving on Wet or Slippery Pavement

Do not attempt to use the engine brake system on wet or slippery roads until you have some experience with it on dry pavement.

CAUTION:

LOSS OF VEHICLE CONTROL

To avoid injury from loss of vehicle control, do not activate the Engine Brake system under the following conditions:

- **On wet or slippery pavement, unless the vehicle is equipped with ABS (anti-lock braking system) and you have had prior experience driving under these conditions.**
- **When driving without a trailer (bobtailing) or pulling an empty trailer.**
- **If the tractor drive wheels begin to lock or there is fishtail motion after the Engine Brake is activated, deactivate the brake system immediately if this occurs.**

NOTE:
On single trailers or combinations, a light air application of the trailer brakes may be desirable to help keep the trailer stretched out. Follow the manufacturer's recommended operating procedure when using your trailer brakes.

On wet or slippery pavement, start with the master switch in the OFF position and use the gear you would normally use under these conditions.

If the vehicle is maintaining traction, place the selective braking switch in the LOW position and turn ON the engine brake system. If the drive wheels are maintaining traction and you desire greater slowing power, move the braking switch to the next highest position.

However, if the tractor drive wheels begin to lock or there is a fishtail motion, *turn the engine brake system OFF immediately and do not activate it until road conditions improve.*

Check your progressive braking switch often for proper position, since road conditions can change quickly. Never skip a step when operating the progressive braking system. Always go from OFF to LOW and then to a higher position.

ENGINE SYSTEMS

The engine systems are the following:

Fuel System

The fuel system consists of DDEC VI control system, common rail, fuel injectors, low and high pressure pump, fuel filter module, prefilter, coalescer (water separator), final filter, a cooling plate for the Motor Control Module (MCM), and the necessary connecting fuel lines. The DD15 engine uses the benefits of a common rail system along with injectors that provide amplification for better fuel atomization.

Lubrication System

The lubrication system consists of an oil pump, oil cooler, cartridge style oil filter, pressure regulator valve at the oil pump, and oil pressure sensor located on the side of the engine block. Clean pressurized oil is fed to all the vital components by passages located in the engine block and cylinder head.

Air System

The outside air drawn into the engine passes through the air filter and is pulled into the turbocharger and compressed. It then moves to the air-to-air charge cooler (heat exchanger) and is cooled. Next it flows to the intake manifold and into the cylinders, where it mixes with atomized fuel from the injectors.

For optimum protection of the engine from dust and other airborne contaminants, service the dry type air cleaners used *when the maximum allowable air restriction has been reached.*

Cooling System

A radiator/thermo-modulated fan cooling system is used on the DD15 engine. This system has a centrifugal type coolant pump to circulate coolant within the engine. One full-blocking type thermostat located in a module attached to the left side of the cylinder block controls the flow of coolant. The coolant module incorporates the oil cooler, oil filter, coolant filter, and coolant pump.

Electrical System

The electrical system consists of a starting motor, starting switch, battery-charging alternator, storage batteries, and the necessary wiring.

Exhaust System

Hot exhaust gas flowing from the exhaust manifold into the exhaust stream is used to drive the turbocharger. The still hot exhaust gas exiting the turbocharger travels to the Axial Power Turbine (APT) which in turn drives a gear set. This gear set ultimately drives a gear that is located within the gear case driving the crankshaft. The turbocharger and APT together make up the turbocompound. The turbocompound turns wasted hot exhaust heat into useful energy to drive the crankshaft.

Exhaust Gas Recirculation System

The purpose of the Exhaust Gas Recirculation (EGR) System is to reduce engine exhaust gas emissions in accordance with EPA regulations.

AFTERTREATMENT SYSTEM

In order to meet current emissions regulations, the traditional muffler has been replaced by a new Aftertreatment Device (ATS). This device consists of a Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF). Together these two components burn off collected particulate matter in a process called "regeneration." The key to successful regeneration is high exhaust temperature for an extended period of time. Without adequate temperatures for regeneration, the filter will continue to trap particulates and eventually plug. In order to avoid plugging, Detroit Diesel has designed an actively regenerated Aftertreatment System (ATS). See Figure 3.

Operating Requirements

Oxidation of the particulate matter is the key to filter performance. This requires that the catalyzing agent (platinum coated passages) are providing optimum enhancement to the oxidation process. The following requirements must be met, otherwise the ATS warranty may be compromised:

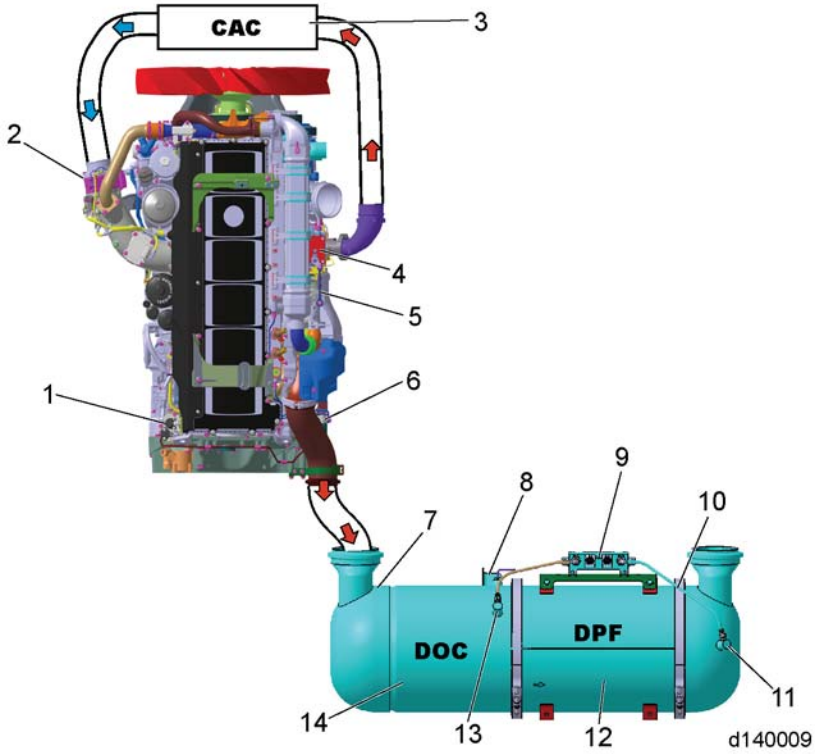
NOTICE:

Do not use kerosene or fuel blended with used lubricating oil.

- □ Use Ultra-Low Sulfur Fuel (ULSF) with 15 PPM sulfur content or less, based on ASTM Standard D 2622 test procedure.
- □ Lubrication oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil.

NOTICE:

Not following the operating requirements may result in damage to the ATS or accelerated ash plugging of the diesel particulate filter.



1. Doser Block Assembly
2. Intake Throttle Valve
3. Charge Air Cooler
4. EGR Actuator
5. EGR Valve (Plates)
6. Fuel Doser Valve
7. DOC Inlet Temperature Sensor
8. DOC Outlet Temperature Sensor
9. Sensor Junction Box
10. DPF Outlet Temperature Sensor
11. DPF Outlet Pressure Sensor
12. Diesel Particulate Filter
13. DPF Inlet Pressure Sensor
14. Diesel Oxidation Catalyst

Figure 3 Aftertreatment System

Maintenance

A high amount of black smoke emitting from the vehicle or illumination of the Amber Warning Lamp or Red Stop Lamp are indications of a system problem. Should this occur, refer to the *Aftertreatment System Technician's Guide* (DDC-SVC-MAN-0036) or contact the Detroit Diesel Customer Support Center at 800-445-1980.

Illumination of the Diesel Particulate Filter (DPF) Regen Lamp indicates that a DPF regeneration is required.

There is a need to periodically remove accumulated ash, derived from engine lubricating oil, from the filter. This ash does not oxidize in the filter during the regeneration process and must be removed through a cleaning procedure. All Detroit Diesel ATS-equipped engines will illuminate a dashboard warning lamp indicating the need for ash cleaning. For information on this cleaning procedure, refer to the *Aftertreatment System Technician's Guide* (DDC-SVC-MAN-0036) or contact the Detroit Diesel Customer Support Center at 800-445-1980.

Regeneration

Regeneration of the ATS is fundamental for the oxidation of soot. This process happens during the normal operation cycle of the vehicle; it can occur both passively and actively. Regardless of this, the operator will see no difference in vehicle performance or vehicle control. If the ATS is not capable of completing an over-the-road regeneration due to duty cycle constraints or other restrictions, a parked regeneration may need to occur.

The driver will be notified of the need for a DPF regeneration by illumination of the DPF Regen Lamp. Refer to chapter INSTRUMENT PANEL LAMPS.

The sequence of indicator lamp(s) is as follows:

1. The DPF Regen Lamp will be illuminated prior to any engine protection measures being taken. Once this lamp is lit, the operator should regenerate the ATS by either bringing the vehicle to highway speeds for an over-the-road regeneration or initiating a parked regeneration.
2. If no regeneration occurs after the initial DPF Regen Lamp illumination, the lamp will begin blinking and a regeneration should be initiated as soon as possible. If the flashing DPF Regen Lamp is still ignored, the AWL (Check Engine) will illuminate. Refer to chapter INSTRUMENT PANEL LAMPS.

This will be accompanied by a 25% engine torque reduction.

3. If a regeneration is still not initiated, a standard 120–second engine shutdown sequence will occur. All of the following dashboard lamps will be present, blinking DPF Regen Lamp, solid AWL (Check Engine), and solid Red Stop Lamp (RSL)/Stop Engine. Refer to chapter INSTRUMENT PANEL LAMPS. Once this engine shutdown sequence is completed, a parked regeneration must occur to continue vehicle operation.

If the driver continues to operate the vehicle without a regeneration, additional measures will be taken to protect the engine and ATS from damage, up to and including engine shutdown. Described below are the activities that occur during the parked regeneration process.

NOTE:
If the DDEC VI electronics have not requested the initiation of a parked regeneration (the DPF Regen Lamp is not illuminated), the Regen request switch is disabled.

WARNING:

HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

NOTE:
The driver MUST stay with the vehicle throughout the regeneration process.

NOTE:
Not all vehicles may be equipped with a Regen request switch due to application or user specification.

NOTE:
The procedure will take 20 to 40 minutes (depends on engine type and the amount of soot accumulated in the filter).

To initiate a parked regeneration, perform the following:

1. Locate Regen request switch on dash board. This is a momentary style switch.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2. If no Regen request switch is present, connect DDDL 7.X for initiation using the Service Routine menu. Select “DPF Regen Request Start”.
3. Cycle the parking brake OFF to ON – once an ignition cycle.

NOTE:
Air tank pressure must be high enough for the parking brake switch to hold in the OFF position.

4. Cycle the clutch pedal (if configured) – once an ignition cycle.
5. Ensure the following conditions are present:
   - □ Parking Brake must be ON and the clutch must be released.
   - □ Engine should be on the idle governor (can not be in Fast Idle or PTO Mode).
   - □ The engine should be fully warmed up and operating on thermostat temperature (>60°C [140°F]).
   - □ For J1939 transmissions, the transmission must be in neutral (confirmed by the J1939 datalink – current gear and selected gear is 0).
   - □ Vehicle speed must be 0 mph.
6. Hold the Regen Switch to the ON position for five seconds and release.

When the request is accepted, the DPF Regen Lamp will turn on for one second and then go off for the rest of the parked regeneration. The engine speed will increase to 1600 rpm.

With completion of regeneration, the following should occur:

- □ The High Exhaust System Temperature (HEST) Lamp will remain illuminated until the exhaust outlet temperature is below 525°C (977°F) or the vehicle speed exceeds 5 mph.
- □ The DPF Regen Lamp will turn off, along with all other associated warning lamps.

If any of the above requirements are removed, the engine will return to idle.

To cancel the parked regeneration, toggle the Regen Switch to ON for five seconds. The DPF Regen Lamp will turn on for one second to show acceptance of the cancellation request and then return to the appropriate state as defined by the current level of soot in the DPF.

Hazardous Applications

The MCM should be configured to not allow automatically triggered over-the-road regenerations (DPF Manual Regen Only Enable = Enabled).

NOTE:
This is for hazardous applications only.

There are two CPC options:

- DPF Stationary Regen Only = 0-Disabled
- DPF Stationary Regen Only = 1-Enabled

DPF Stationary Regen Only = 0-Disabled — This option allows the DPF Regen Switch to request a parked regeneration if the parked regeneration entry conditions are met. This option also allows MCM-initiated over-the-road regenerations to occur.

DPF Stationary Regen Only = 1-Enabled — This option **only** allows a parked regeneration to occur by using the DPF Regeneration Switch. The MCM will be unable to initiate an active over-the-road regeneration when this option is enabled.

Service Record

It is mandatory that customers or distributors maintain a proper record of the particulate filter servicing and cleaning. This record is an agent to warranty considerations. The record must include information such as:

- Date of cleaning or replacement
- Vehicle mileage at the time of cleaning or replacement
- Particulate filter part number and serial number

INSTRUMENT PANEL LAMPS

Lamp	Lamp Name	Description	Results
	Amber Warning Lamp (AWL)	Indicates a fault with the engine controls.	Vehicle can be driven to end of shift. Call for service.
	Red Stop Lamp (RSL)	Indicates a major engine fault that may result in engine damage. Engine derate and/or shutdown sequence will be initiated.	Move the vehicle to the nearest safe location and shut down the engine. Call for service.
	DPF Regen Lamp	Solid yellow indicates a regeneration is required. Blinking yellow, derate and/or shutdown are possible as soot load continues to increase. Lamp will shut off during parked regeneration.	Lamp Solid - regeneration is required Lamp Flashing - regeneration is required immediately.
	High Exhaust System Temperature Lamp (HEST)	Lamp is yellow. Indicates exhaust temperature is above a preset limit and unit is operating at low vehicle speed (below 5 mph [8 kph]). When the engine speed is elevated for a parked regeneration, lamp will flash once every 10 seconds.	Vehicle can be driven. Lamp Solid for Extended Period (Longer than 40 Minutes) - call for service.
	Malfunction Indicator Lamp (MIL)	Yellow lamp Indicates a failure of an Emission Control device. May illuminate at the same time as the Amber Warning Lamp.	Vehicle can be driven to end of the shift. Call for service.

Table 3 Instrument Panel Lamps

Lamp	Lamp Solid	Lamp Flashing
	□ At the start of every ignition cycle (a bulb check) □ When an electronic system fault occurs (Problem should be diagnosed as soon as possible.)	□ Diagnostic Request Switch is used to activate the AWL to flash inactive codes. □ Flashes last 90 seconds before idle shutdown if programmed for override. □ Flashes when idle shutdown or the Optimized Idle shutdown occurs.
	□ At the start of every ignition cycle, it performs a bulb check. □ A potential engine damaging fault is detected.	□ Flashes when Engine Protection Shutdown occurs. □ Diagnostic Request Switch is used to activate the RSL to flash active codes.
	□ At the start of every ignition cycle, it performs a bulb check. □ Regeneration is required.	When a regeneration is required immediately (if the lamp flashing is ignored), a derate and/or shutdown could occur.
	□ At the start of every ignition cycle, it performs a bulb check. □ Vehicle speed is less than 5 mph and the DPF outlet temperature is greater than 525°C (977°F).	Flashes every 10 seconds the DPF outlet reaches a temperature greater than 525°C (977°F).
	□ At the start of every ignition cycle (a bulb check) □ For any emission related fault (light out when the fault is inactive)	Never flashes

Table 4 Lamp Activation Conditions

MAINTENANCE

The following is intended as a guide for establishing preventive maintenance intervals. The recommendations given should be followed as closely as possible to obtain long life and optimum performance from your engine. When performed on a regular basis, changing the engine oil, coolant, and filters is the least costly way of obtaining safe and reliable vehicle operation. Added benefits and savings occur when you check that the valves, fuel injectors, oil and cooling circuits are in good working order during oil changes.

The intervals shown apply only to the maintenance functions described. These functions should be coordinated with other regularly scheduled maintenance.

Scheduled Intervals

Refer to section Preventive Maintenance Intervals for a description of the maintenance to be performed for related items.

Maintenance Schedule Applications

There are three types of maintenance schedules:

- □ Severe Service
- □ Short Haul
- □ Long Haul

NOTE:
Load factor and idle time value must be based on DDEC reports representative of the current service application.

Severe Service — Severe service applies to vehicles that annually travel up to 30,000 annual miles (48,000 kilometers) and average less than 5 miles per gallon or that operate under severe conditions. Examples of Severe Service usage include: **idle time over 35%, load factor over 55%,** operation on extremely poor roads or where there is heavy dust accumulation; constant exposure to extremely hot, cold, salt-air, or other extreme climates; frequent short-distance travel; construction-site operation; city operation (fire truck, garbage truck), or farm operation. **Only one of these conditions needs to be met to categorize an application as Severe Service.**

Short Haul — Short Haul service applies to vehicles that annually travel up to 30,000-60,000 miles (40,000-96,000 kilometers) and average between 5 and 6 miles per gallon or with a **load factor over 45%** and operate under normal conditions. Examples of Short-Haul usage are: operation primarily in cities and densely populated areas; local transport with infrequent freeway travel; or high percentage of stop-and-go travel.

Long Haul — Long Haul service (over-the-road transport) applies to vehicles that annually travel more than 60,000 miles (96,000 kilometers) and average greater than 6 miles per gallon with minimal city stop-and-go operation. Examples of Long Haul service are: Regional delivery that is mostly freeway mileage, interstate transport, and any road operation with high annual mileage.

NOTE:
Load factor and idle time values must be based on DDEC reports that accurately represent the current service application.

Maintenance Intervals

The three maintenance interval tables show which maintenance operation must be performed at the actual distances (in miles or kilometers) for each maintenance operation.

Refer to section Maintenance Tables for the three maintenance interval tables for DD15 Engine On-Highway Vehicle. The three types of service are:

NOTICE:

Failure to check and maintain Supplemental Coolant Additive (SCA) levels at required concentrations will result in severe damage (corrosion) to the engine cooling system and related components.
Coolant must be inhibited with the recommended SCAs listed in this guide. Refer to section How to Select Coolant.

- The Severe Service maintenance intervals are listed in Table 5.
- The Short Haul maintenance intervals are listed in Table 6.
- The Long Haul maintenance intervals are listed in Table 7.

Schedule Use

Before placing your new vehicle in service, determine the correct maintenance intervals that apply to your intended use of the vehicle. Refer to section Maintenance Tables to determine the distance interval at which each maintenance operation must be performed to comply with your vehicle's schedule.

When the vehicle reaches the actual distance given for an interval, refer to section Maintenance Tables.

The intervals are based on a collaboration of field and fleet data. For a more accurate analyst of when fluids should be changed, such as engine oil, refer to publication *Engine Requirements – Lubricating Oil, Fuel and Filters*, (DDC-SVC-BRO-0001) and publication *Coolant Selections for Detroit Diesel Engines*, (DDC-SVC-BRO-0002), available from authorized Detroit Diesel distributors.

Complete each maintenance operation at the required interval.

Maintenance Tables

Miles X 1000/ Km X 1000/ Hours*	25/ 40/ 640	50/ 80/ 1280	75/ 120/ 1925	100/ 160/ 2565	125/ 200/ 3205	150/ 240/ 3850	175/ 280/ 4490	200/ 320/ 5130
Item	Procedure							
1. Lubricating Oil	R	R	R	R	R	R	R	R
2. Lubricating Oil Filter	R	R	R	R	R	R	R	R
3. Coolant	Intervals for the required coolant are listed in Table 13 in the “How to Select Coolant” section of this guide.							
4. Cooling System Filter				R				
5. Fuel Filters								
Prefilter	R	R	R	R	R	R	R	R
Coalescer (Water Separator)	R	R	R	R	R	R	R	R
Final Filter	R	R	R	R	R	R	R	R
6. Initial Valve Lash Adjustment	Adjust at 60,000 mi (100,000 km), at 180,000 mi (300,000 km), and then at every 180,000 mi (300,000 km) or nearest maintenance interval.							
7. Belts	I	I	I	I	I	I	I	R
8. Air System	I	I	I	I	I	I	I	I
9. Air Cleaner	I	I	I	I	I	I	I	I
10. Exhaust System	I	I	I	I	I	I	I	I
11. Aftertreatment Device	Inspect external hardware and connections at every oil change. Remove ash at 300,000 miles (480,000 km) or 9,000 hours.*							
12. Air Compressor	I	I	I	I	I	I	I	I

* Whichever comes first.

All items are described in Preventive Maintenance Intervals.

R – Replace.

I – Inspect, service, correct, or replace as necessary.

Table 5 Severe Service Maintenance Intervals

Miles X 1000/ Km X 1000/ Hours*	35/ 55/ 895	70/ 110/ 1795	105/ 165/ 2690	140/ 220/ 3590	175/ 275/ 4485	210/ 330 5380	245/ 385/ 6280	280/ 440/ 7180
Item	Procedure							
1. Lubricating Oil	R	R	R	R	R	R	R	R
2. Lubricating Oil Filter	R	R	R	R	R	R	R	R
3. Coolant	Intervals for the required coolant are listed in Table 13 in the “How to Select Coolant” section of this guide.							
4. Cooling System Filter			R					
5. Fuel Filters								
Prefilter	R	R	R	R	R	R	R	R
Coalescer (Water Separator)	R	R	R	R	R	R	R	R
Final Filter	R	R	R	R	R	R	R	R
6. Initial Valve Lash Adjustment	Adjust at 60,000 mi (100,000 km), at 180,000 mi (300,000 km), and then at every 180,000 mi (300,000 km) or nearest maintenance interval.							
7. Belts	I	I	I	I	I	I	I	R
8. Air System	I	I	I	I	I	I	I	I
9. Air Cleaner	I	I	I	I	I	I	I	I
10. Exhaust System	I	I	I	I	I	I	I	I
11. Aftertreatment Device	Inspect external hardware and connections at every oil change. Remove ash at 300,000 miles (480,000 km) or 9,000 hours.*							
12. Air Compressor	I	I	I	I	I	I	I	I

* Whichever comes first.

All items are described in Preventive Maintenance Intervals.

R – Replace.

I – Inspect, service, correct, or replace as necessary.

Table 6 Short Haul Maintenance Intervals

Miles X 1000/ Km X 1000/ Hours*	50/ 80/ 1280	100/ 160/ 2565	150/ 240/ 3845	200/ 320/ 5125	250/ 400/ 6410	300/ 480/ 7690
Item	Procedure					
1. Lubricating Oil	R	R	R	R	R	R
2. Lubricating Oil Filter	R	R	R	R	R	R
3. Coolant	Intervals for the required coolant are listed in Table 13 in the “How to Select Coolant” section of this guide.					
4. Cooling System Filter		R				
5. Fuel Filters						
Prefilter	R	R	R	R	R	R
Coalescer (Water Separator)	R	R	R	R	R	R
Final Filter	R	R	R	R	R	R
6. Initial Valve Lash Adjustment	Adjust at 60,000 mi (100,000 km), at 180,000 mi (300,000 km), and then at every 180,000 mi (300,000 km) or nearest maintenance interval.					
7. Belts	I	I	I	I	I	R
8. Air System	I	I	I	I	I	I
9. Air Cleaner	I	I	I	I	I	I
10. Exhaust System	I	I	I	I	I	I
11. Aftertreatment Device	Inspect external hardware and connections at every oil change. Remove ash at 300,000 miles (480,000 km) or 9,000 hours.*					
12. Air Compressor	I	I	I	I	I	I

* Whichever comes first.

All items are described in Preventive Maintenance Intervals.

R – Replace.

I – Inspect, service, correct, or replace as necessary.

Table 7 Long Haul Maintenance Intervals

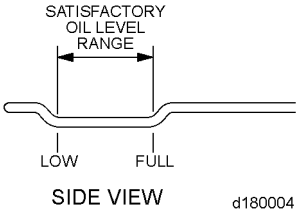
Preventive Maintenance Intervals

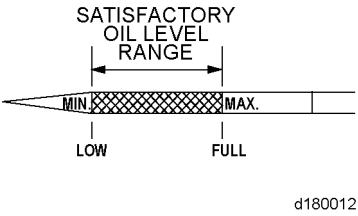
This section describes the items listed in the maintenance interval tables.

The "Daily" instructions apply to routine or daily starting of the engine. They do not apply to a new engine or one that has been operated for a considerable period of time.

Item 1 – Lubricating Oil

Check the oil level daily with the engine stopped using the oil dipstick.





The oil level is measured using the two bends or the crosshatch area on the dipstick. If the oil reading is between these bends or in the crosshatch area, then the oil is at the proper level for engine operation.

NOTE:
The engine must be shut down for 60 minutes and on a level surface for an accurate oil level reading. Otherwise, the engine must be brought up to an operating temperature of 60°C (140°F), shut down, and allowed to sit for five minutes on a level surface. Failure to allow the oil to drain back properly as just described can result in a low oil level reading.

NOTICE:

Do not add oil if the oil reading is between the two bends or in the crosshatch area on the dipstick. There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

Add the proper grade of oil to maintain the satisfactory range on the dipstick. All diesel engines are designed to use some oil, so the periodic addition of oil is normal.

NOTICE:

If the oil level is constantly above normal and excess oil has not been added to the crankcase, consult with an authorized Detroit Diesel service outlet for the cause. Fuel or coolant dilution of lubricating oil can result in serious engine damage.

Before adding lubricating oil, refer to section How to Select Lubricating Oil.

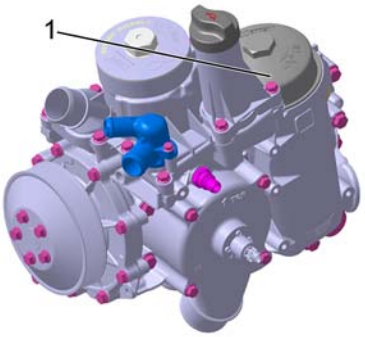
Item 2 – Lubricating Oil Filter

The DD15 engine is equipped with a single cartridge style oil filter (1) that is part of the oil/coolant module. Incorporated into the housing is a drain back port which allows residual oil to be returned to the oil pan when the filter is removed. This design, including the cartridge style element, allows for a more environmental safe oil change.

WARNING:

PERSONAL INJURY

To avoid injury from slipping and falling, immediately clean up any spilled liquids.



For maintenance intervals, please replace the oil filter using the schedule listed in Table 5, Table 6, or Table 7.

Make a visual check of all lubricating oil lines for wear and/or chafing. If any indication of wear is evident, replace the oil lines and correct the cause.

Check for oil leaks after starting the engine.

Item 3 – Cooling System

The cooling system must be *full* for proper operation of the engine.

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

Check the coolant level daily and maintain it between the full and low marks on the surge tank. Add coolant as required, but do not overfill. Before adding coolant, refer to section How to Select Coolant.

Coolant Level — Make a daily visual check for cooling system leaks. Look for an accumulation of coolant when the engine is running and when it is stopped. Coolant leaks may be more apparent on a engine when it is cold.

Coolant Inhibitors — The inhibitors in antifreeze solutions *must* be replenished with an approved corrosion inhibitor supplement when indicated by testing the coolant. Refer to section How to Select Coolant for required test intervals, inhibitor levels, and approved inhibitors.

NOTICE:

Coolant *must* be inhibited with the recommended SCAs listed in this guide. **Failure to check and maintain SCA levels at required concentrations will result in severe damage (corrosion) to the engine cooling system and related components.**

The cooling system is protected by an SCA element. In addition, the engine can be equipped with a coolant filter/inhibitor system as an installed option or as an after-sale item.

Coolant Drain Interval — A coolant system properly maintained and protected with supplemental coolant inhibitors can be operated up to the intervals listed. At these intervals the coolant *must* be drained and disposed of in an environmentally responsible manner according to state and/or federal (EPA) recommendations.

Radiator — The exterior of the radiator core should be inspected every 30,000 miles (50,000 km) or 12 months and cleaned, if necessary.

WARNING:

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

Use a quality grease solvent, such as mineral spirits, and dry with compressed air. **Fuel oil, kerosene or gasoline should not be used.**

It may be necessary to clean the radiator more frequently if the engine is being operated in extremely dusty or dirty areas.

If the low coolant level sensor is installed in the top tank of the radiator, it should be tested for proper operation every 100,000 miles (160,000 km) or 12 months, whichever comes first. Authorized Detroit Diesel distributors are properly equipped to perform this service.

Item 4 – Cooling System Filter

Install a new cooling system filter at a **maximum** of 90,000 miles (150,000 km).

Item 5 – Fuel Filters

The DD15 engine is equipped with a prefilter that filters down to 100 micron, a coalescer that separates water, and a final filter which filters material from 3 to 5 microns. The final filter is 98% effective at filtering material at 5 microns. When servicing these elements, all three filters should be changed at the same time. All three elements are located within the fuel filter module located on the left side of the engine.

Located at the base of the fuel filter module is a water level sensor. When water level reaches a predetermined height, the LED indicators on the front of the sensor change from green to red. At this time, remove the water from the module by opening the water drain valve at the bottom of the module.

For maintenance intervals, please replace the fuel filters using the schedule listed in Table 5, Table 6, or Table 7.

NOTE:
Filter change intervals may be shortened to conform with established preventive maintenance schedules, but should never be extended.

Item 6 – Valve Lash Adjustment

Valve lash adjustment should be performed at the maintenance interval listed in Table 5, Table 6, or Table 7. Proper valve lash clearance allows the engine to produce the best possible performance with the lowest emissions. Valve lash adjustments should be performed by an authorized Detroit Diesel maintenance or repair facility.

Item 7 – Belts

The DD15 engine is equipped with two engine belt tensioners so the belts are neither too tight nor too loose. Belts that are too tight impose extra loads on the crankshaft, fan, and/or alternator bearings shortening both belt and bearing life. A loose belt will slip and generate excessive heat that may cause damage to the belt and accessory drive components.

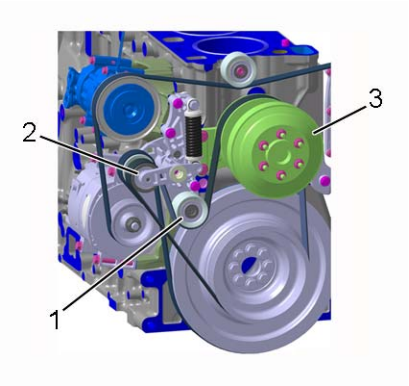
WARNING:

PERSONAL INJURY

To avoid injury from rotating belts and fans, do not remove and discard safety guards.

Inspect the belt tensioner for wear or damage. If necessary, replace tensioner.

Serpentine Belts — Two poly-V belts are used with DD15 Engine On-Highway Vehicle applications. One belt drives the fan hub (3) and the other belt drives the remaining accessories. To provide proper running tension, the current DD15 engine uses an automatic fan hub belt tensioner (1) and an accessory belt tensioner (2). Automatic belt tensioners require no adjustment.



Belt Replacement — Drive belts should be replaced every 2,000 hours or 300,000 miles (480,000 km).

Item 8 – Air System

All the connections in the air system should be checked to make sure they are tight and leak free. Check all hoses and ducting for punctures, deterioration, or other damage and replace, if necessary.

Item 9 – Air Cleaner

The DD15 engine is equipped with an engine-mounted air cleaner that is flat in design to accommodate various vehicle packages. The air cleaner element should be inspected every 50,000 miles (80,000 km) or more often if the engine is operating under severe dust conditions.

Replace the element, if necessary. Check the gaskets for deterioration and replace, if necessary. If the dry type air cleaner is equipped with an aspirator, check for aspirator damage or clogging. Clean, repair or replace, as necessary.

NOTICE:

Do not allow the air inlet restriction to exceed 20 in. H_2O (5.0 kPa) under any engine operating conditions. A clogged air cleaner element will cause excessive intake restriction and reduced air supply to the engine resulting in increased fuel consumption, inefficient engine operation, and reduced engine life.

Inspect the entire air system for leaks daily. Look especially for torn air inlet piping or boots and loose or damaged clamps. Have worn or damaged parts repaired or replaced, as required. Retighten loose connections.

Air Cleaner Replacement — Dry type air cleaner elements should be replaced when the maximum allowable air intake restriction has been reached. Refer to section When to Service the Dry Type Air Cleaner for additional information.

Item 10 – Exhaust System

Have the exhaust manifold retaining bolts and other connections checked for tightness. Have the exhaust pipe rain cap checked for proper operation, if so equipped.

Item 11 – Aftertreatment System

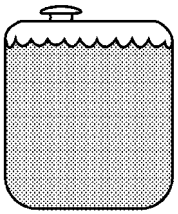
There is a need to periodically remove accumulated ash, derived from engine lubricating oil, from the Aftertreatment System (ATS). This ash does not oxidize in the filter during the regeneration process and must be removed through a cleaning procedure. All Detroit Diesel ATS-equipped engines will illuminate a dashboard warning lamp indicating the need for ash cleaning.

Item 12 – Air Compressor

The air compressor incorporates three of the major systems of a diesel engine (air, lubrication, and cooling). Proper inspection of air compressor would include inspecting for air, oil, and coolant leaks. Because the air compressor facilitates air, lubricating oil, and coolant flow, a failed air compressor could result in contamination between these three fluids. When failed, an air compressor can produce excessive crankcase pressure or allow an engine to ingest lubricating oil.

Fuel and Fuel Tank

Keep the fuel tank filled to reduce condensation.



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Before adding fuel, refer to section How to Select Diesel Fuel.

Refill the tank at the end of each day's operation to prevent condensation from contaminating the fuel. Condensation formed in a partially filled tank promotes the growth of microorganisms that can clog fuel filters and restrict fuel flow.

To prevent microbe growth, add a biocide to the fuel tank or primary fuel supply only as needed.

⚠ WARNING:

PERSONAL INJURY

To avoid injury from improper use of chemicals, follow the chemical manufacturer's usage, handling, and disposal instructions. Observe all manufacturer's cautions.

NOTICE:

Never use galvanized steel fuel tanks, fittings, pipes, or supply lines. The fuel reacts chemically with the zinc coating to form powdery flakes that can quickly clog the fuel filters and damage the fuel pumps and injectors.

Open the drain at the bottom of the fuel tank every 30,000 miles (50,000 kilometers) to drain off any water and/or sediment.

Every 120,000 miles (200,000 kilometers) or 12 months tighten all fuel tank mountings and brackets. At the same time, check the seal in the fuel tank cap, the breather hole in the cap and the condition of the flexible fuel lines. Repair or replace the parts, as necessary.

Fuel Lines, Flexible Hoses

A prestart inspection of hoses and fuel lines is recommended.

Leaks — Make a visual check for fuel leaks at all engine-mounted fuel lines and connections, and at the fuel tank suction and return lines. Since fuel tanks are susceptible to road hazards, leaks in this area may best be detected by checking for an accumulation of fuel under the tank.

WARNING:

FIRE

To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

Leaks are not only detrimental to machine operation, but they can also result in added expense caused by the need to replace lost fluids.

Hoses and Fittings — Check hoses daily as part of the prestart inspection. Examine hoses for leaks, and check all fittings, clamps and ties carefully. Make sure hoses are not resting on or touching shafts, couplings, heated surfaces including exhaust manifolds, any sharp edges, or other obviously hazardous areas. Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary. If fittings have loosened or cracked or if hoses have ruptured or worn through, take corrective action immediately.

Hose Service Life — A hose has a finite service life. With this in mind, all hoses should be thoroughly inspected at least every 500 operating hours (1,000 hours for fire-resistant fuel and lubricating oil hoses) and/or annually. Look for cover damage and/or indications of twisted, worn, crimped, brittle, cracked or leaking lines. Hoses with their outer cover worn through or with damaged metal reinforcements should be considered unfit for further service.

All hoses in and out of machinery should be replaced during major overhaul and/or after a maximum of five (5) years of service.

NOTE:
Fire-resistant fuel and lubricating oil hose assemblies do not require automatic replacement after five years of service or at major overhaul, but should be inspected carefully before being put back into service.

Turbocharger, Air-to-Air Charge Cooler, and Axial Power Turbine

Visually inspect the turbocharger and axial power turbine mountings, intake and exhaust ducting, and connections for leaks daily.

WARNING:

PERSONAL INJURY

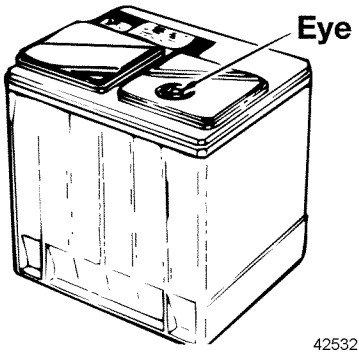
To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

Check the lubricating oil inlet and outlet lines for leaks or restrictions to oil flow. Check for unusual noise or vibration and, if excessive, stop the engine and do not operate until the cause is determined.

Periodically inspect the air-to-air charge cooler for buildup of dirt, mud, etc. and wash off. Check the charge cooler, ductwork, and flexible connections for leaks and have repaired or replaced, as required.

Battery

Check the hydrometer “eye” of maintenance-free batteries for charge.



WARNING:

PERSONAL INJURY

To avoid injury from accidental engine startup while servicing the engine, disconnect/disable the starting system.

If lead-acid or low-maintenance batteries are used, check the specific gravity of each cell every 150 operating hours. Check more frequently in warm weather due to the more rapid loss of water through evaporation.

Maintain the electrolyte level according to the battery manufacturer's recommendations, but *do not overfill.* Overfilling can cause poor battery performance or early failure.

Keep the terminal side of the battery clean. When necessary, wash with a solution of baking soda and water. Rinse with fresh water. Do not allow the soda solution to enter the cells.

Inspect the cables, clamps and hold-down brackets regularly. Clean and reapply a light coating of petroleum jelly when needed. Have corroded or damaged parts replaced.

If the engine is to be out of service for more than 30 days, remove the batteries and store in a cool, dry place. Keep batteries fully charged, if possible. Replace any battery that fails to hold a charge.

Periodically check battery connections for corrosion and tightness. If necessary, remove connections and wire brush any corrosion from terminals and cable ends. Replace damaged wiring.

Engine (Steam Clean)

Steam clean the engine and engine compartment every 60,000 miles (100,000 km) or 2,000 hours, whichever comes first.

NOTICE:

Do not apply steam or solvent directly to the battery-charging alternator, starting motor, DDEC components, sensors or other electrical components, as damage may result.

Battery-Charging Alternator

Precautions must be taken when working on or around the alternator. The diodes and transistors in the alternator circuit are very sensitive and can be easily destroyed.

To avoid equipment damage, pay attention to the following:

WARNING:

Battery Explosion and Acid Burn

To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid:

- □ **Flush your skin with water.**
- □ **Apply baking soda or lime to help neutralize the acid.**
- □ **Flush your eyes with water.**
- □ **Get medical attention immediately.**

- □ Avoid grounding the output terminal. Grounding an alternator's output wire or terminal (which is always “hot,” regardless of whether or not the engine is running) and accidentally reversing the battery polarity will result in equipment damage.
- □ Do not reverse battery connections.
- □ Never disconnect the battery while the alternator is operating. Disconnecting the battery can result in damage to the battery diodes. In applications which have two (2) sets of batteries, switching from one set to the other while the engine is running will momentarily disconnect the batteries.
- □ If a booster battery is to be used, batteries must be connected correctly (negative to negative, positive to positive).
- □ Never use a fast charger with the batteries connected or as a booster for battery output.

For information on the alternator assembly, contact an authorized distributor, depending on manufacturer.

General Service Requirements – Alternators — Terminals should be checked for corrosion and loose connections and wiring inspected

for damage and frayed insulation. Have wiring repaired or replaced, as required.

Check torque on alternator mounting bolts and bracketing every 30,000 miles (50,000 km). Retighten, if necessary.

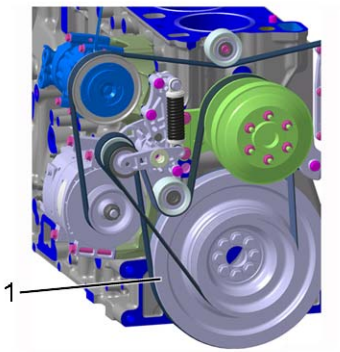
Fan Hub

If the fan bearing hub assembly has a grease fitting, use a hand grease gun to lubricate the bearings with one shot of quality lithium-based, multipurpose grease every 120,000 miles (200,000 km).

Care should be taken not to overfill the bearing housing.

Vibration Damper

The viscous vibration damper (1) should be inspected periodically and replaced if dented or leaking. Heat from normal engine operation may, over a period of time, cause the fluid within the damper to break down and lose its dampening properties. For this reason, the viscous vibration damper must be replaced at time of normal major engine overhaul, regardless of apparent condition.



HOW-TO SECTION

This section covers Detroit Diesel's recommendations on how to select lubricating oil, diesel fuel, and coolant and includes basic engine maintenance procedures which can be performed by the operator.

NOTICE:

The manufacturer's warranty applicable to the DD15 engine provides in part that the provisions of such warranty shall not apply to any engine unit that has been subject to misuse, negligence or accident. Accordingly, malfunctions attributable to neglect or failure to follow the manufacturer's fuel or lubricating recommendations may not be within the coverage of the warranty.

How to Select Lubricating Oil

NOTICE:

Lubricating oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil.

Lubricant Requirements

API CJ-4 oils are recommended for use in the DD15 engine.

Cold Weather Starting

At ambient temperatures below -10°C (14°F), SAE 5W-30, 10W-30, 5W-40, or 10W-40 oils may be used, provided they are API CJ-4 and have demonstrated field performance in Detroit Diesel engines. These oils must possess a High Temperature / High Shear (HT/HS) Viscosity of 3.7 cP minimum. Refer to Detroit Diesel service brochure, *Lubricating Oil, Fuel and Filters Requirements*, DDC-SVC-BRO-0001.

NOTICE:

Monograde oils should not be used in the DD15 engine, regardless of API service classification. Monograde oils gel at lower ambient temperatures, reducing lubricant flow, and do not provide adequate lubricity at higher engine operating temperatures resulting in severe engine damage.

The oils must be API CJ-4 and have demonstrated field performance in Detroit Diesel engines. For further information, refer to publication *Engine Requirements – Lubricating Oil, Fuel, and Filters*, DDC-SVC-BRO-0001, available from authorized Detroit Diesel distributors.

Synthetic Oils

Synthetic oils may be used in Detroit Diesel engines, provided they are API licensed and meet the performance and chemical requirements of non-synthetic oils outlined in this publication. Synthetic oils offer improved low-temperature flow properties, high-temperature oxidation resistance, and improved fuel mileage. However, they are generally more costly than non-synthetic oils.

Product information about synthetic oils should be reviewed carefully. Performance additive systems often respond differently in synthetic oils.

NOTE:
Their use does not permit extension of recommended oil drain intervals.

The Use of Supplemental Additives

Lubricants meeting the Detroit Diesel specifications outlined in this publication already contain a balanced additive treatment. Supplemental additives are generally not necessary and can even be harmful. These additives may be marketed as either oil treatments or engine treatments and are discouraged from use in Detroit Diesel engines.

Engine damage resulting from the use of such materials is not covered by your Detroit Diesel warranty. Detroit Diesel will not provide statements beyond this publication relative to their use.

When to Change Oil

The length of time an engine may operate before an oil change depends upon the lubricant and fuel used, engine oil consumption, and the operating cycle. Listed in Table 5, Table 6, and Table 7 are the recommended oil change intervals.

CAUTION:

USED ENGINE OIL

To avoid injury to skin from contact with the contaminants in used engine oil, wear protective gloves and apron.

The use of fuels with sulfur content above 15 PPM is not allowed in the DD15 engine.

Disposing of Waste Oil

Dispose of used lubricating oil and filters in an environmentally responsible manner, according to federal (EPA) and/or state recommendations. The disposal of waste oil may be best addressed by the engine oil supplier, who may accept responsibility for proper disposal of this material as part of the business of providing lubricant.

How to Change Oil and Replace the Lubricating Oil Filter

The oil filter is an integral part of the lubrication system. Proper filter selection and maintenance are important to satisfactory engine performance and service life. The filter should be used to maintain a clean system, not to clean up a contaminated system. The maintenance intervals are listed in Table 5, Table 6, and Table 7.

Change oil and replace the lubricating oil filter as follows:

NOTE:
If the used oil was contaminated by fuel or coolant, drain the oil and then remove the oil pan, oil pump, and oil pump intake manifold to drain the remaining oil held back by the backflow valve. Refer to publication *DD15 Engine Workshop Manual*, DDC-SVC-MAN-0001.

1. Place the transmission in neutral, and set the parking brake.
2. Clean outside of the oil filter housing.

NOTE:
Change the engine oil only when the engine oil temperature is approximately 60°C (140°F). Changing cold oil will result in extended drain times.

3. Using a 36-mm socket, unscrew the oil filter cap and filter and allow the oil to drain into the housing. After draining is complete, remove the assembly from the housing.

NOTE:
Use care to prevent foreign objects from entering the filter housing.

4. Remove the filter element by pressing and twisting the side and detaching it from the cap.
5. Remove the oil filter O-ring and discard. Lightly coat a new O-ring with clean engine oil and install it on the filter cap.
6. Check the filter housing for any debris and remove if necessary.
7. Insert a new filter element into the oil filter cap.
8. Insert the filter element and cap assembly into the housing. Torque the cap to 40-50 N·m (30-37 lb·ft).
9. Drain oil from the oil pan as follows:
   [a] Place a suitable receptacle, 48 L (50 qt) or more, beneath the oil drain plug on the underside of the oil pan.
   [b] Carefully unscrew the oil drain plug, and allow the oil to drain out.
   [c] Inspect the plug seal ring for damage and replace if necessary.
10. Install the oil drain plug. Tighten the plug to 45 N·m (33 lb·ft).

NOTICE:

Do not add oil if the oil reading is between the two bends or in the crosshatch area on the dipstick. There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

11. Add new engine oil through the oil fill tube in the amount listed in Table 8. Verify the oil level reading is between the full and fill marks on the dipstick.

Oil Change Condition	Amount L (Qt)
Oil and Filter Change — Cold Engine	40.5 (42.8)
Oil and Filter Change — Hot Engine	41.6 (44.0)
Sump Oil Change Only	40.0 (42.3)

Table 8 DD15 Oil Change Quantities

NOTICE:

If no oil pressure is shown after approximately 10 seconds, stop the engine and determine the cause. Running engine with no oil pressure could result in engine damage.

12. Start the engine with the accelerator pedal in the idle position. Monitor the oil pressure gauge or indicator lamp. Keep the engine running at idling speed until the oil pressure reading is 14 psi (97 kPa) or more.
13. Check the filter housing for signs of leakage.

NOTICE:

Do not add oil if the oil reading is between the two bends or in the crosshatch area on the dipstick. There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

14. Stop the engine. Check the oil level again per the following guidelines. If necessary, add oil no more than 3.8 L (4.0 qt) at a time up to the maximum fill level on the oil dipstick.

NOTE:
The engine must be shut down for 60 minutes and on a level surface for an accurate oil level reading. Otherwise, the engine must be brought up to an operating temperature of 60°C (140°F), shut down, and allowed to sit for five minutes on a level surface.

How to Select Diesel Fuel

All diesel engines in 2007 are designed to operate on Ultra-Low Sulfur Diesel (ULSD) fuel.

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Quality

Fuel quality is an important factor in obtaining satisfactory engine performance, long engine life, and acceptable exhaust emission levels.

In general, fuels meeting the properties of ASTM Standard D 975 (grades 1-D and 2-D) have provided satisfactory performance.

The fuels used must be clean, completely distilled, stable, and noncorrosive. For more information regarding the significance of these properties and selection of the proper fuel, refer to publication, *Engine Requirements – Lubricating Oil, Fuel, and Filters* (DDC-SVC-BRO-0001), available from authorized Detroit Diesel distributors.

NOTICE:

Use only Ultra-Low Sulfur Diesel (ULSD) fuel (15 PPM sulfur content maximum), based on ASTM Standard D 2622 test procedure. Using fuel other than ULSD will damage the Aftertreatment Device.

Fuel Contamination

Generally, fuel contamination occurs as the result of improper fuel handling. The most common types of contamination are water, dirt, and microbial growth ("black slime"). The formation of varnishes and gums resulting from poor stability or extended storage ("stale fuel") also affects fuel quality. The best treatment for contamination is prevention by maintaining a clean storage system and choosing a reputable fuel supplier.

Supplemental additives are not recommended due to potential injector system or engine damage. Our experience has been that such additives increase operating costs without providing benefit.

The use of supplemental fuel additives does not necessarily void the engine warranty. **However, repair expenses which result from fuel system or engine component malfunctions or damage attributed to their use will not be covered.**

These products should be accompanied by performance data supporting their merit as well as the warranty statement. It is not the policy of Detroit Diesel to test, evaluate, approve or endorse such products.

Biodiesel — Detroit Diesel supports biodiesel as a renewable fuel. Biodiesel fuels are mono alkyl esters of long chain fatty acids commonly referred to as fatty acid methyl esters (FAME) and are derived from renewable resources through a chemical process called transesterification. Detroit Diesel approves the use of biodiesel fuel blends up to 5% maximum by volume in diesel fuel providing the following three conditions are met:

- The biodiesel used in the blend meets ASTM Standard D 6751 or EN 14214 specification.
- The biodiesel used in the blend is sourced from a BQ-9000 Accredited Producer.

□ The finished blend meets the fuel properties referenced in Detroit Diesel service brochure, *Lubricating Oil, Fuel and Filters Requirements* (DDC-SVC-BRO-0001) and either ASTM Standard D 975 or EN 590 specification.

Detroit Diesel is responsible for the materials and workmanship of its engines. Failures attributed to the use of fuels which do not meet industry standards are not the fault of Detroit Diesel and will not be covered by Detroit Diesel product warranty. While Detroit Diesel supports the use of B5, the use of unacceptable quality fuel that does not meet industry standards can result in warranty evocation.

Prohibited Additives

The following fuel additives are not allowed and MUST NOT be mixed with diesel fuel:

Used Lubricating Oil — Do not use fuel blended with used lubricating oil. Detroit Diesel specifically prohibits the use of used lubricating oil in diesel fuel.

NOTICE:

Do not burn used lubricating oil in fuel. It will cause the diesel particulate filter to prematurely plug with ash.

Used lubricating oil contains combustion acids and particulate materials which can severely erode fuel injector components, resulting in loss of power and increased exhaust emissions. In addition, the use of drained lubricating oil will increase maintenance requirements due to filter plugging and combustion deposits.

Fuel Additives with Sulfur or Sulfated Ash — Do not use non-approved fuel additives containing sulfur or sulfated ash.

Gasoline — The addition of gasoline to diesel fuel will create a serious fire hazard. The presence of gasoline in diesel fuel will reduce fuel cetane number and increase combustion temperatures.

WARNING:

FIRE

To avoid increased risk of a fuel fire, do not mix gasoline and diesel fuel.

Tanks which contain a mixture of gasoline and diesel fuel should be drained and cleaned as soon as possible.

Detroit Diesel will not be responsible for any detrimental effects it determines resulted from adding drained lubricating oil or gasoline to the diesel fuel.

How to Replace the Fuel Filters

Filters are an integral part of the fuel system. Proper filter selection and maintenance are important to satisfactory engine operation and service life. Filters should be used to maintain a clean system, not to clean up a contaminated system. The maintenance intervals are listed in Table 5, Table 6, and Table 7.

WARNING:

PERSONAL INJURY

To prevent the escape of high pressure fuel that can penetrate skin, ensure the engine has been shut down for a minimum of 10 minutes before servicing any component within the high pressure circuit. Residual high fuel pressure may be present within the circuit.

Final Filter Replacement

Remove the final filter as follows:

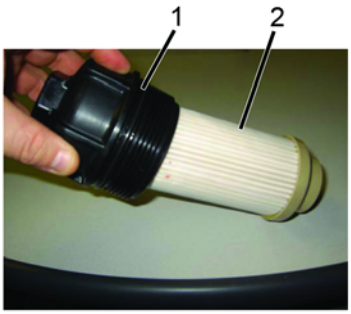
1. Using a 36-mm socket, unscrew the final filter cap.

NOTICE:

Do not tilt the final filter when removing it from the housing. Possible damage to the final filter or stand pipe may occur.

2. Pull the cap and final filter straight up and allow the fuel to drain back.

3. Remove the final filter (2) from the plastic cap (1) by placing the filter on a solid surface and apply pressure on the plastic cap at an angle.

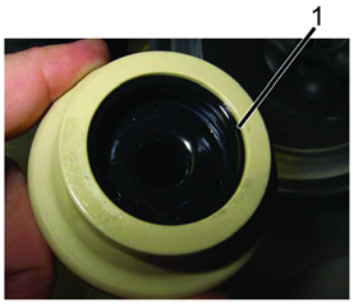


d470020

4. Discard the filter.
5. Inspect inside the housing for any large debris and clean if needed.
6. Discard plastic cap seal ring.

Install the final filter as follows:

1. Snap new final filter into the plastic cap.
2. Install a new plastic cap seal ring.
3. Apply a light coat of petroleum-based lithium grease to the cap seal ring (1) and to the lower seal on the final filter.



d470021

4. Install the final filter into the fuel filter module.
5. Turn the cap counterclockwise until a “click” sound is made, then turn clockwise and hand tighten.
6. Torque final filter cap to 50-60 N·m (37-44 ft·lb).
7. Prime fuel system using fuel priming valve or hand primer. Refer to section Priming the Fuel System.
8. After the engine has started, check for leaks.

Prefilter Replacement

Remove prefilter as follows:

1. Using a 36 mm socket, unscrew the prefilter cap.

NOTICE:

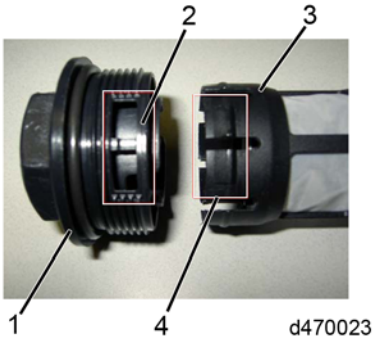
Do not tilt the prefilter when removing it from the housing. Possible damage to the prefilter or stand pipe may occur.

2. Pull the cap and prefilter straight up and out of the fuel filter housing.
3. Remove the prefilter from the plastic cap and discard
4. Discard the prefilter cap seal ring.

Install the prefilter as follows:

1. Snap new prefilter (3) into the plastic cap (1).

NOTE:
The prefilter should snap into the cap in two positions. The tabs (4) should align with the slot in the plastic cap (2).



2. Apply a thin coat of petroleum-based lithium grease to the prefilter cap seal ring.
3. Apply a thin coat of petroleum-based lithium grease to the inside and outside of the prefilter bottom seal.
4. Install the prefilter into the fuel filter module.
5. Turn the cap counterclockwise until a “click” sound is made, then turn clockwise and hand tighten.
6. Torque prefilter cap to 15-20 N·m (11-15 lb·ft).
7. Prime fuel system using fuel priming valve or hand primer. Refer to section Priming the Fuel System.
8. After the engine has started, check for leaks.

Coalescer Replacement

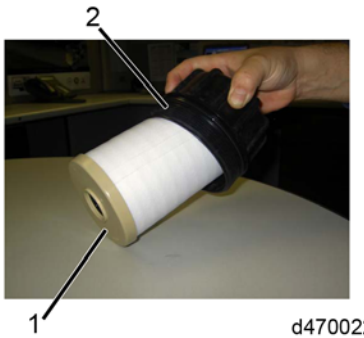
Remove the coalescer (water separator) as follows:

1. Using a 36–mm socket, unscrew the coalescer cap.

NOTICE:

Do not tilt the coalescer when removing it from the housing. Possible damage to the coalescer or stand pipe may occur.

2. Pull the cap and coalescer straight up and allow the fuel to drain back.
3. Remove the coalescer (1) from the plastic cap (2) by placing the filter on a solid surface and apply pressure on the plastic cap at an angle.

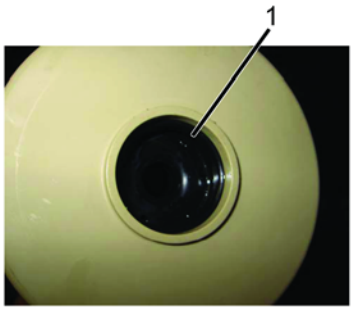


d470022

4. Discard the filter.
5. Inspect inside the housing for any large debris and clean it out if needed.
6. Discard plastic cap seal ring.

Install the coalescer as follows:

1. Snap a new coalescer into the plastic cap.
2. Install a new plastic cap seal ring.
3. Apply a light coat of petroleum-based lithium grease to the plastic cap seal ring and to the lower seal (1) on the coalescer filter.



d470019

4. Install the coalescer into the fuel filter module.
5. Turn the cap counterclockwise until a “click” sound is made, then turn clockwise and hand tighten.
6. Torque coalescer cap to 50-60 N·m (37-44 ft·lb).

7. Prime fuel system using fuel priming valve or hand primer. Refer to section Priming the Fuel System.
8. After the engine has started, check for leaks.

Engine Out of Fuel — How to Restart

When an engine has run out of fuel, there is a definite procedure to follow when restarting it.

NOTICE:

Never use the starting motor and fuel pump to prime the fuel filters. Prolonged use of the starting motor and fuel pumps to prime the fuel system can result in damage to the starter, fuel pump, and injectors.

NOTE:
Priming the engine with the starting motor and fuel pump causes erratic engine running due to the amount of air in the fuel lines and filters.

Use the following procedure to prime the fuel system:

1. Fill the fuel tank with the recommended grade of fuel. If only partial filling is possible, add a minimum of 10% of the total tank volume of fuel to the tank. For example, a 150-gallon tank would require a minimum of 15 gallons of fuel.

NOTE:
If a vehicle is on uneven ground, more fuel may be required.

2. Operate hand primer for three minutes or 250 strokes.
3. Crank engine for 20 seconds.
4. If engine does not start, allow for a 60–second cool down and repeat step 3.

NOTE:
The starting cycle can be repeated up to three times.

5. If engine starts, increase engine speed to 1800 rpm for three minutes to bleed the air from the system.
6. Reduce engine speed and check for fuel leaks.
7. If engine still fails to start, contact an authorized Detroit Diesel repair facility.

How to Clean the Engine

Important: Observe all environmental protection regulations.

High-Pressure Cleaning Equipment

Information on suitable cleaning and protective products is available from any authorized dealer. Note the equipment manufacturer's operating instructions.

NOTICE:

To prevent damage to engine components, keep the water moving at all times while cleaning. Never direct water onto electrical components, plug connectors, seals or flexible hoses.

CAUTION:

EYE INJURY

To avoid injury from flying debris, wear a face shield or goggles.

Comply with the minimum working distance between the high-pressure nozzle and the surface being cleaned:

- Approximately 28 in. (700 mm) for circular pattern jets
- Approximately 12 in. (300 mm) for 25-degree flat jets and dirt cutters

Engine Cleaning Procedure

Power clean a DD15 engine as follows:

1. Allow engine to cool down to room temperature before spraying the engine.

NOTICE:

Avoid all of the electrical connections with direct water or steam spray or damage can result.

2. Thoroughly clean the entire engine using a steam cleaner or high pressure washer with mild soap and warm water.

WARNING:

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

3. Once the engine is clean, blow the electrical connectors dry with compressed air to remove most of the standing water.

NOTE:
Do not use compressed air or pressurized water to clean or dry the engine if any part of the engine is disassembled.

4. Allow the engine to dry completely before making any kind of repair.
5. When reassembling, ensure that there is no standing water in any electrical connectors before seating the plug.

How to Clean the Cooling System

Important: Collect the used coolant, cleaning solutions, and washing liquids and dispose of them in an environmentally responsible manner.

Clean as follows:

NOTICE:

Clean at moderate pressures only to avoid damaging the radiator grille fins.

WARNING:

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

1. First remove debris (dust, insects, etc.) from the fins of the radiator grille.
2. Remove the debris by blowing them through with compressed air or spraying them out with water. Work from the rear of the radiator (in the opposite direction of the normal cooling air flow).
3. Drain the coolant when the engine is cold. For detailed procedures, see the vehicle/chassis maintenance manual. For types of coolant, refer to section How to Select Coolant.

4. If the HVAC unit is connected to the cooling system, open the regulating valves all the way.

Degreasing

Degrease as follows:

1. Fill the cooling system with a 5% solution (1.6 ounces per quart [50 grams per liter] of water) of a mildly alkaline cleaning agent, such as sodium carbonate.
2. Run the engine at moderate speed until the thermostat starts to open, at an operating temperature of approximately 60°C (140°F). Then run it for about five minutes longer. Shut down the engine and allow it to cool to approximately 50°C (112°F).

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

3. Drain all the cleaning solution.
4. Flush the cleaning solution from the cooling system.
   [a] Immediately after draining the cleaning solution, flush the system with clean water.
   [b] Once the clean water has drained, fill the system again with clean water.
   [c] Run the engine. Allow the engine to warm up to approximately 60°C (140°F), and then run it about five minutes longer.
   [d] Drain the hot water.
5. Fill the cooling system with new coolant. For detailed procedures, see the vehicle/chassis maintenance manual. For types of coolant, refer to section How to Select Coolant.

How to Select Coolant

This section covers selection of the required coolant for the DD15 engine.

Definitions

To help ensure complete understanding of the information, the definitions of the following terms are listed in Table 9.

Term	Definition
Antifreeze	Ethylene Glycol (EG) containing a corrosion inhibitor package and which meets an appropriate heavy-duty specification (i.e., TMC RP-329 Type A or ASTM Standard D 6210 Type A for ethylene glycol).
Coolant	The fluid mixture circulating in the engine cooling system, typically a mixture of 50% water and 50% antifreeze.
Drop-Out	Precipitated sludge or deposit formation on cooling system components.
Fully Formulated Conventional Antifreeze	Contains all the necessary inhibitors to protect a diesel engine, and does not, therefore, require a precharge of Supplemental Coolant Additive (SCA) before its first use.
Initial-Fill Coolant	The coolant that is used in a new or rebuilt engine, or any time the cooling system is emptied and then refilled with coolant.
OAT	Organic Acid Technology. An inhibitor system based on organic acid inhibitors.
NOAT	Nitrited Organic Acid Technology. An inhibitor system based on organic acid inhibitors and also containing Nitrite.
SCA	Supplemental Coolant Additive. SCAs are used in a preventive maintenance program to prevent corrosion, cavitation, and the formation of deposits.

Table 9 Coolant Terms

Approved Coolants

Required specifications for water and ethylene glycol inhibitor packages and inhibitor concentration are included in this section.

NOTICE:

To avoid engine damage from inadequate or over concentrated coolant, the required specifications must be adhered to before the coolant is replaced.

The approved coolants for the DD15 engine are listed in Table 10.

Coolant Fill Option	Product
Ethylene Glycol & Water + Corrosion Inhibitors *	Detroit Diesel *POWER COOL*
Ethylene Glycol & Water + Nitrited Organic Acid Technology Inhibitors	–

* Preferred Coolant

Table 10 Initial Fill Coolant Option

Once installed, this coolant should be maintained according to the procedures discussed under **Maintenance** in this section.

EG & Water Plus SCA Inhibitor — These products are available as fully formulated, phosphate-free, Extended Service Interval (ESI) coolants. They are commercially available from Detroit Diesel (recommended) and other manufacturers as either a concentrated antifreeze or as a premixed antifreeze. The premixed antifreeze is ready for use, while the concentrated coolant must be mixed with water prior to use.

Detroit Diesel *POWER COOL* (P/N: 23512138) is the preferred ethylene glycol (EG) coolant. If other commercial brands of ethylene glycol are used, they must be equivalent to the Detroit Diesel *POWER COOL*.

Fully formulated antifreeze does not require a dosage of SCA prior to initial use.

Mixing EG Antifreeze and Water — If a concentrated ethylene glycol (EG) antifreeze is purchased, mix the antifreeze with water meeting the required quality standards listed in Table 12 and fill the cooling system.

If a prediluted, fully formulated coolant is purchased, fill the cooling system. For best overall performance, a coolant consisting of 50% concentration of antifreeze (50% antifreeze, 50% water) is *recommended*.

An antifreeze concentration over 67% (67% antifreeze, 33% water) is *not recommended* due to poor heat transfer, reduced freeze protection (Inhibited Ethylene Glycol [IEG] only), and possible silicate dropout. An antifreeze concentration below 33% (33% antifreeze, 67% water) offers too little freeze and/or corrosion protection and is *not recommended*.

Always verify that the freeze point and nitrite concentration of the antifreeze/water mixture are correct by using a *POWER Trac*® 3–Way Coolant Test Strip. If chemical analysis is used, elements in the coolant must fall within the limits listed in Table 11.

Fully Formulated Glycol Coolant Concentration Limits	
Boron	125 – 500 PPM
Nitrite	900 – 3200 PPM
Nitrate	200 – 1000 PPM
Silicon	50 – 150 PPM
Phosphorous	0 PPM
pH	8.0 – 11.0

Table 11 Fully Formulated Glycol Coolant Concentration Limits with TMC RP-329 Chemistry Type A (50/50 Coolant/Water Mixture)

Water Requirements —
Distilled, reverse osmosis-purified, or de-ionized water which eliminates the adverse effects of minerals in tap water is preferred.

High levels of dissolved chlorides, sulfates, magnesium, and calcium in some tap water causes scale deposits and/or corrosion resulting in water pump failures and poor heat transfer, leading to overheating. If tap water is used, the mineral content in the water must be below the maximum allowable limits listed in Table 12.

	Maximum Allowable	
	Parts per Million	Grains per Gallon
Chlorides	40	2.5
Sulfates	100	5.8
Total Dissolved Solids	340	20
Total Hardness – Magnesium and Calcium	170	10

Table 12 Satisfactory Water Limits – Make-Up Water Only

Maintenance Intervals — Check the nitrite concentration at the regular intervals listed in Table 13 with a *Power Trac* 3–Way Test Strip.

NOTICE:

Do not add additional SCA to new, fully formulated antifreeze or coolant at the initial fill. This can result in dropout and/or the formation of deposits.

Coolant	Interval	Action
Ethylene Glycol* / Water + Conventional Corrosion Inhibitor	20,000 miles (32,000 km) or 3 months	Test nitrite concentration with test strip. Add SCA or dilute coolant as needed.
	300,000 miles (480,000 km)	Drain and clean system. Refill with new coolant.
Ethylene Glycol* / Water + OAT Inhibitor	300,000 miles (48,000 km) or 10,000 hours	Add *POWER COOL* Plus extender.
	600,000 miles (960,000 km), 4 years, or Engine Overhaul	Drain and clean system. Refill with new coolant.
Ethylene Glycol* / Water + NOAT Inhibitor	300,000 miles (48,000 km) or 10,000 hours	Add NOAT extender.
	600,000 miles (960,000 km), 4 years, or Engine Overhaul	Drain and clean system. Refill with new coolant.
Water Only + Conventional Corrosion Inhibitor	20,000 miles (32,000 km), 3 months, or 500 hours	Test nitrite concentration with test strip. Add SCA or dilute coolant as needed.
	Engine Overhaul	Drain and clean system. Refill with new coolant.
Water Only + OAT Inhibitor	300,000 miles (480,000 km), 2 years, or 10,000 hours	Add *POWER COOL* Plus extender.
	600,000 miles (960,000 km), 4 years, or Engine Overhaul	Drain and clean system. Refill with new coolant.
Water Only + NOAT Inhibitor	300,000 miles (480,000 km), 2 years, or 10,000 hours	Add NOAT extender.
	600,000 miles (960,000 km), 4 years, or Engine Overhaul	Drain and clean system. Refill with new coolant.

* Propylene glycol is an acceptable substitute for ethylene glycol.

Table 13 Coolant Maintenance Intervals

Coolants Not Recommended

The following coolants are *not recommended* for use in Detroit Diesel engines.

All Antifreezes and Coolants Containing Phosphate — These coolants are not recommended. Drop out, overheating and water pump seal failures can result from the use of coolant or inhibitor packages based on phosphate.

Automotive Type Coolants — These coolants generally contain high levels of phosphate and silicate, offer no liner pitting protection, and are *not suitable* for use in Detroit Diesel engines.

Methyl Alcohol-Based Antifreeze — This must not be used because of its effect on the non-metallic components of the cooling system and its low boiling point.

Glycol-Based Coolants Formulated for HVAC — These coolants formulated for Heating/Ventilation/Air Conditioning (HVAC) should not be used. These coolants generally contain high levels of phosphates, which can deposit on hot internal engine surfaces and reduce heat transfer.

Additives Not Recommended

The following additives are *not recommended* for use in the DD15 engine.

Soluble Oil Additives — These additives are not approved for use in Detroit Diesel engine cooling systems. A small amount of oil adversely affects heat transfer. For example, a 1.25% concentration of soluble oil increases fire deck temperature 6%. A 2.50% concentration increases fire deck temperature 15%. The use of soluble oil additives may result in engine overheating and/or failure.

Chromate Additives — These additives are not approved for use in Detroit Diesel engine cooling systems. Chromate additives can form chromium hydroxide, commonly called “green slime.” This, in turn, can result in engine damage due to poor heat transfer. Cooling systems operated with chromium-inhibited coolant must be chemically cleaned with Detroit Diesel *POWER COOL* dry chemical cooling system cleaner/conditioner listed in Table 17 (or equivalent sulfamic acid/sodium carbonate cleaner) and flushed.

SCA Test Procedures

Detroit Diesel *POWER Trac* 3–Way Coolant Test Strips should be used to measure nitrite and glycol concentrations. Part numbers are listed in Table 18. Cavitation/corrosion is indicated on the strip by the level of nitrite concentration. Freeze/boil over protection is determined by glycol concentration.

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

For best results, make the test while the coolant is between 10 – 60°C (50 – 140°F). Wait at least 60 seconds, but not longer than 75 seconds, before reading the nitrite level. Use the test strips as follows:

1. Dip the strip into coolant for one second. Remove and shake briskly to eliminate excess fluid.
2. Immediately compare the pad end (% glycol) to the color chart on the container.
3. Sixty seconds (one minute) after dipping, compare the nitrite pad to the color chart.
4. Color change of the additive indicator (middle pad) indicates the presence of inhibitor that is not approved by Detroit Diesel.

Promptly replace and tighten the test strip container cap after each use. Discard unused strips if they have turned light pink or tan.

A factory coolant analysis program is available through authorized Detroit Diesel service outlets. Part numbers are listed in Table 18 in the **Specifications** section.

Dropout

Excessive amounts of some inhibitors in the coolant can cause a gel or crystalline deposit that reduces heat transfer and coolant flow. The deposit, called “dropout,” takes the color of the coolant when wet, but appears as a white or gray powder when dry. It can pick up solid particles in the coolant and become gritty, causing excessive wear of water pump seals and other cooling system components.

WARNING:

PERSONAL INJURY

To avoid injury when using caustic cleaning agents, follow the chemical manufacturers usage, disposal, and safety instructions.

The wet gel can be removed by using a nonacid (alkali) type heavy-duty cleaner, such as Detroit Diesel *POWER COOL* On-Line Cleaner (sodium nitrite/sodium tetraborate). Part numbers are listed in Table 17.

NOTE:
If the gel is allowed to dry, it is necessary to disassemble the engine and clean it with a caustic solution or physically clean individual components.

Chronic Coolant System Problems

The most commonly seen coolant system problems result from maintenance and formulation factors such as:

- □ Hard water
- □ Dilution of the coolant by the addition of untreated water
- □ Over dosage or under dosage of corrosion inhibitors
- □ Improper corrosion inhibitor (most often phosphated)
- □ Mixing SCAs
- □ Improper testing

Detroit Diesel Cooling System Maintenance Products

The following products are available to do maintenance on the cooling system.

Detroit Diesel *POWER COOL* SCAs — Detroit Diesel *POWER COOL* SCAs are water-soluble chemical compounds. These products are available in coolant filter elements, liquid packages, and in fully formulated Detroit Diesel *POWER COOL* antifreeze.

Detroit Diesel *POWER COOL* Cleaners — Detroit Diesel *POWER COOL* Liquid On-Line Cleaner is used for light deposits. Detroit Diesel *POWER COOL* Dry Chemical Cleaner/Conditioner is used for heavy deposits or scale.

Summary of Coolant Recommendations

The Detroit Diesel coolant recommendations for the DD15 engine are:

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

- Always maintain the engine coolant to meet Detroit Diesel specifications.
- Only use water that meets the specifications listed in Table 12. Distilled, demineralized (reverse osmosis) or de-ionized water is preferred.
- The proper dosage of inhibitors *must* be included in the coolant at initial fill for all Detroit Diesel engines. This dosage is usually included in the fully formulated antifreeze used, or it may need to be added if water alone or if less than 50% antifreeze is used. *The user is urged to use the full text of this section to determine the proper dosage.* Mixing of different manufacturers' technologies (brands) could cause cooling system problems.
- Maintain the inhibitor at the prescribed concentration. Test the nitrite concentration by using a titration kit or Detroit Diesel *POWER Trac* 3-Way Coolant Test Strips. Add SCA only if the nitrite concentration is below 900 PPM.

NOTE:
If the nitrite concentration exceeds 3,200 PPM, the coolant must be drained and replaced with new coolant. A thorough cleaning of the cooling system may be required.

- Do not use another manufacturer's test kit to measure the SCA concentration of Detroit Diesel maintenance products.
- Premix coolant makeup solutions to the proper concentration before adding to the cooling system.
- Do not mix OAT and other coolants in the same engine.
- Do not use automotive coolants.
- Where antifreeze/boil over protection is required, use only antifreeze that meets TMC RP-329 Type A specification or ASTM Standard D 6210 Type A for EG. Always maintain coolant at the proper level.

□ Do not use the following in Detroit Diesel engine cooling systems:

- Soluble Oil
- High Silicate, Automotive-Type Antifreeze
- Chromate SCAs
- Methoxy Propanol-Based Coolant
- Methyl Alcohol-Based Coolant
- Sealer Additives or Coolant Containing Sealer Additives
- HVAC Coolant
- Phosphate-Inhibited Coolant

Coolant Life of Glycol Coolant — A *properly maintained* cooling system, filled with phosphate-free coolant consisting of a 50/50 mix of antifreeze and water per TMC RP-329 "Type A" (EG) specifications can be operated to the limits recommended. The proper maintenance involves periodic evaluation using *POWER Trac* 3-Way Coolant Test Strips and the addition of SCA as needed, indicated by the strip test. To verify coolant acceptability, submit a sample for laboratory analysis once a year. Submit the sample in a Detroit Diesel *POWER Trac* Coolant Test Bottle. Required part numbers are listed in Table 18.

How to Drain and Flush the Cooling System and Change Coolant Filter

The DD15 engine is equipped with a coolant filter. The coolant filter contains supplemental corrosion inhibitors. The maintenance intervals are listed in Table 13.

Service the cooling system as follows:

1. Place the transmission in neutral, and set the parking brake.

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

NOTE:
Change the coolant filter only after the vehicle has cooled and no residual pressure is present.

2. Clean outside of the coolant filter housing.

NOTE:
Use care to prevent foreign objects from entering the filter housing.

3. Using a 36-mm socket, unscrew cap and filter and allow the coolant to drain into the housing. After draining, remove the assembly from the housing.
4. Remove the filter from the plastic cap by placing the filter on a solid surface and apply pressure on the plastic cap at an angle.
5. Remove coolant filter O-ring and discard it. Lightly lubricate a new O-ring with clean engine oil and install it on the filter cap.
6. Check filter housing for any debris and remove if necessary.
7. Insert a new filter element into the cap.
8. Insert element and cap assembly into the housing. Torque the cap to 55-60 N·m (41-44 lb·ft).
9. Check coolant level and adjust if necessary.
10. Start engine with the accelerator pedal in the idle position. Monitor all gauges or indicator lamps.
11. Check the filter housings for signs of leakage.

⚠ WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

In addition to the cleaning procedure, other components of the cooling system should be checked periodically to keep the engine operating at peak efficiency.

Hoses

Cooling system hoses should be inspected and any hose that shows obvious signs of damage or feels abnormally soft or hard should be replaced. Damaged clamps should also be replaced. All external leaks should be corrected as soon as detected.

NOTE:
If Detroit Diesel *POWER COOL* antifreeze/coolant (or equivalent fully formulated, precharged antifreeze is used, a precharge element is not required. Coolant inhibitor levels *must* be checked at the intervals listed in Table 13.

When to Service the Dry Type Air Cleaner

Replace dry type air cleaner elements when the maximum allowable air cleaner restriction [20 in. H_2O (5.0 kPa)] has been reached. Some air cleaners are equipped with a restriction indicator which aids in determining the servicing interval.

Cleaning and/or reusing dry paper type air cleaner elements is not recommended unless the cleaning method used removes clogging without damaging the element. Inspection and cleaning of elements *must* be done in accordance with the air cleaner manufacturer's recommendations, if any.

TROUBLESHOOTING

This section covers basic troubleshooting of engine operation or performance malfunctions and their probable causes. In addition to operating the engine carefully and maintaining it properly make sure to correct any malfunction promptly.

Abnormal Coolant Temperature

Abnormal Coolant Temperature Symptoms and Probable Causes		
Probable Causes	**Above Normal**	**Below Normal**
Restricted cooling system passages	X	—
Restricted radiator core passages	X	—
Slipping fan drive belts	X	—
Faulty temperature-controlled fan	X	—
Obstruction in front of radiator or intercooler	X	—
Low coolant level	X	—
Damaged hoses	X	—
Faulty thermostat	X	—
Faulty water pump	X	—
Faulty radiator pressure cap	X	—
Air in coolant	X	—
Thermostat not fully closed	—	X
Leakage around thermostat seal	—	X
Faulty temperature-controlled fan	—	X

Hard Starting

Hard Starting Symptoms and Probable Causes			
Probable Causes	**Engine Will Not Rotate**	**Low Cranking Speed**	**Engine Cranks But Will Not Start**
Low Battery Voltage	X	X	—
Loose cranking motor connections	X	—	—
Faulty cranking motor	X	X	—
Faulty cranking motor switch	X	X	X
Internal seizure	X	—	—
Improper lubricating oil	—	X	—
Circuit breaker/electronic control malfunction	—	—	X
Fuse blown or missing	—	—	X
Insufficient Fuel Supply			
Air in fuel	—	—	X
Out of fuel	—	—	X
Loose fuel connections	—	—	X
Cracked fuel lines	—	—	X
Obstructed fuel filters/lines	—	—	X
Faulty fuel pumps	—	—	X
Faulty injector operation	—	—	X
Restricted fuel fitting missing	—	—	X
DDEC Malfunction	—	—	X
Installation/operation of fuel check valve or shutoff valve	—	—	X
Low Compression			
Worn intake and exhaust valves	—	—	X
Worn piston rings/liners	—	—	X
Leaking cylinder head gasket	—	—	X
Improper intake or exhaust valve adjustments	—	—	X

Aftertreatment System

Engines that meet the EPA 2007 emissions standards are equipped with an a Aftertreatment System that prevents 95% of the particulate matter (soot) from leaving the exhaust. This will eliminate the use of visible smoke diagnostics unless there is a system failure issue. White smoke or steam at start up or during cold weather operation is still a characteristic of engine operation. Abnormal amounts of black/blue smoke may merit further investigation.

Abnormal Engine Operation

Abnormal Engine Operation Symptoms and Probable Causes			
Probable Causes	**Rough Running or Frequent Stalling**	**Low Power**	**Detonation**
Misfiring cylinder	X	X	—
Insufficient fuel	X	X	—
High return fuel temperature	X	X	—
Low compression	X	X	—
DDEC malfunction	X	X	—
High air inlet restriction/exhaust back pressure	—	X	—
Engine application	—	X	—
High air inlet temperature	—	X	—
High altitude operation	—	X	—
Incorrect engine gear train timing	—	X	—
Low coolant temperature	—	—	X
Oil picked up by inlet airstream	—	—	X
Faulty injector operation	—	—	X
Incorrect injector height setting	—	X	X

Abnormal Operating Conditions

Abnormal Operating Condition Symptoms and Probable Causes		
Probable Causes	**High Lubrication Oil Consumption**	**Low Oil Pressure**
Loose connections	X	—
Cracked lines	X	—
Damaged gaskets or seal rings	X	—
* Lubrication oil loss at breather tube	X	—
* Lubrication oil loss at dipstick tube	X	—
Leaking oil cooler	X	—
Leaking valve stem seals	X	—
Worn/broken oil control rings	X	
Scored liner and/or piston	X	—
Excessive engine installation angle	X	—
Crankcase overfilled	X	—
Oil in air tanks (air compressor malfunction)	X	—
Plugged crankcase breather	X	—
Oil level low	—	X
Improper engine oil viscosity (fuel in the oil)	—	X
Faulty oil pressure regulator valve	—	X
Worn crankshaft, camshaft or connecting rod bearings	—	X
Faulty oil pressure relief valve	—	X
Air leaks in oil pump (suction side)	—	X
Worn or damaged oil pump	—	X
Faulty oil pressure gauge	—	X
Faulty electrical components (for gauge)	—	X
Plugged oil line or orifice	—	X

* Indicates high crankcase pressure

CUSTOMER ASSISTANCE

The satisfaction and goodwill of the owners of Detroit Diesel engines are of primary concern to Detroit Diesel and its distributor/dealer organizations.

Road Service in the U.S. or Canada

If you require road service for any reason in the U.S. or Canada, you may call the **1–800–445–1980** customer assistance phone number. An operator will assist you in determining what type of service is required. Not all problems are engine related and not all problems are covered by engine or vehicle warranties. *YOU MAY BE RESPONSIBLE FOR REPAIR EXPENSES.*

Before calling Customer Assistance, please do the following:

- □ Check coolant level.
- □ Check fuel level.
- □ Check DDEC fuses.
- □ Check for fuel leaks.
- □ Make sure manual shutoff valve (if installed) on the fuel filter adaptor or fuel supply line is open.
- □ Check the oil level on the dipstick.
- □ Check diagnostic codes.

If you call, have the following information available:

- □ Engine serial number
- □ Vehicle make, model, and VIN
- □ Odometer mileage (kilometers) or hourmeter hours
- □ Vehicle owner/company name

Working with Detroit Diesel Service Outlets

As the owner of a Detroit Diesel product, you have a complete network of Detroit Diesel service outlets in the U.S. and Canada, plus many outlets worldwide that are prepared to meet your parts and service needs:

- □ Service by trained personnel
- □ Sales team to help determine your specific power requirements
- □ In many areas, emergency service 24 hours a day
- □ Complete parts support
- □ Product information and literature

We recognize however, that despite the best intentions of everyone concerned, misunderstandings may occur. Normally, any situation that arises in connection with the sale, operation or service of your product will be handled by the authorized service outlet in your area (in the U.S. and Canada, check the Yellow Pages or service locator at www.detroitdiesel.com for Detroit Diesel service outlet nearest you).

SPECIFICATIONS

This section lists the various Detroit Diesel *POWER COOL* engine products.

Fuel and Lubricating Oil Filters

Consult with a Detroit Diesel Distributor to obtain the proper fuel filters and lubricating oil filters.

ENGINE OIL CAPACITIES

The engine oil capacities for the DD15 Engine On-Highway Vehicle application are listed in Table 14. Contact your local Detroit Diesel service center if you need more specific information.

NOTE:
There are approximately 3.8 L (4.0 qt) from the fill mark to the full mark. Overfilling the oil pan can cause engine damage.

Description	Amount L (Qt)
Total Engine Oil Volume	44.5 (47.0)
Main Galleries	3.0 (3.1)
Average Oil and Filter Change	41.6 (44.0)

Table 14 DD15 Engine Oil Capacities

Detroit Diesel *POWER COOL* Engine Products

Maintenance of the cooling system requires the chemical makeup of the system to be balanced.

Detroit Diesel *POWER COOL* Fully Formulated IEG Coolant

The part numbers and sizes of concentrated Detroit Diesel *POWER COOL* and preblended 50:50 Detroit Diesel *POWER COOL* are listed in Table 15.

Coolant Type	Part Number	Description
Concentrated	23512138	One Gallon Jug – 6 Per Case
	23512139	55 Gallon Drum
	23529295	330 Gallon Tote
	23512140	Bulk Delivery – 1,000 Gallon Min.
Preblended 50:50	23528203	One Gallon Jug – 6 Per Case
	23518918	55 Gallon Drum
	23528544	330 Gallon Tote
	23513503	Bulk Delivery – 1,000 Gallon Min.

Table 15 Detroit Diesel *POWER COOL* Fully Formulated IEG Coolant

Detroit Diesel *POWER COOL* Supplemental Additive Need Release Coolant Filters

Coolant Type	Part Number	Description
For Detroit Diesel *POWER COOL* IEG Coolant	NF2091	For 0 – 8 Gallon Systems
	23516489	For 8 – 20 Gallon Systems

Table 16 Detroit Diesel *POWER COOL* Supplemental Additive Need Release Coolant Filters

Detroit Diesel *POWER COOL* Cooling System Cleaners

Coolant Type	Part Number	Description
On-Line Cleaner	200164	One-Half Gallon Jug – 6 Per Case
	200105	5 Gallon Pail
	200155	55 Gallon Drum
Twin Pack	201549	Twin Pack – 2 Per Case

Table 17 Detroit Diesel *POWER COOL* Cooling System Cleaners

POWER Trac Coolant Testing and Analysis Products

Application	Part Number	Description
Indicates Nitrite, Molybdate & Glycol Levels	23519401	3-Way Coolant Test Strips (Single Foil Packs)
Indicates Nitrite, Molybdate & Glycol Levels	23519402	3-Way Coolant Test Strips (Bottle of 50)
Indicates Nitrite, Molybdate & Glycol Levels	23522774	3-Way Coolant Test Strips (Bottle of 10)
Complete IEG Coolant Analysis	23516921	Coolant Analysis Bottle (Carton of 6)

Table 18 *POWER Trac* Coolant Testing and Analysis Products

