

Operation And Maintenance Manual

4B 3.9 / 6B 5.9 Engines



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Low Horsepower Business Unit

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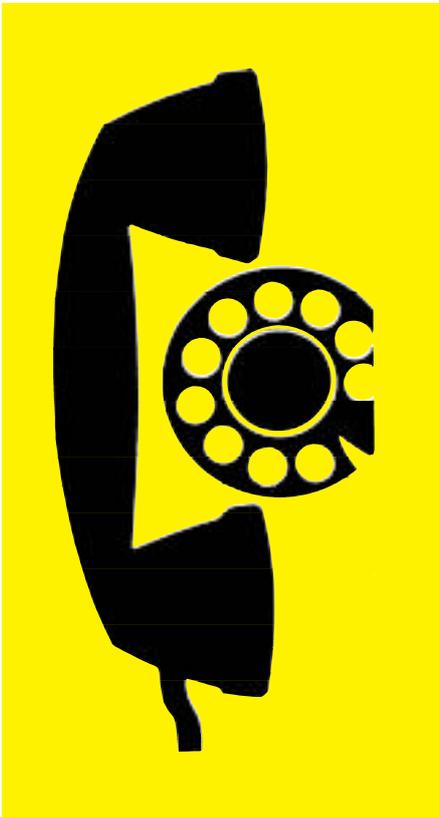
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In the very unlikely event of you are not receiving the normal prompt attention from our field force, following are the residence telephone numbers of our officers for assistance.



While asking for assistance please provide the following information.

1. Your Name & Phone or Fax Number.
2. Engine Serial Number.
3. Name of the Customer.
4. Engine Location.
5. General Description of Assistance required.



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Section 1

INTRODUCTION

This is an engine Operation & Maintenance Manual, not a repair manual. This manual contains information needed to correctly operate and maintain your engine as recommended by Cummins. This manual does not cover equipment maintenance procedures. Please consult the equipment manufacturer for specific maintenance recommendations.

This engine is manufactured by Tata Cummins Limited and engineered by Cummins Low Horsepower Business Unit to suit specific application. Service for this engine will be rendered by Cummins Diesel Sales & Services (CDS & S) through its authorised dealer's network. Please contact local service dealer or CDS & S Area / Regional / Zonal Office for any type of service / technical support. Please refer Section No. 12 for phone numbers and addresses of CDS & S offices and their dealers.

In order to get the optimum performance of the engine, please,

- adhere to maintenance practices specified in this manual
- use recommended fuel & oils
- use genuine Cummins parts
- get service only from authorised dealers of CDS & S
- use all safety & recommended installation practices.

In case you need any type of assistance, please contact Cummins India Ltd. - LHP Business Unit or CDS & S on the following addresses :

Section 2

GENERAL SAFETY INSTRUCTIONS

Improper practices or carelessness can cause burns, cuts, mutilation or other bodily injury or death.

Read & understand all of the safety precautions and warnings before performing any repair. This list contains the general safety precautions that must be followed to provide personal safety.

- Make sure that the work area surrounding the product is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances.
- Always wear protective glasses and protective shoes while working on the engine.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do not wear loose fitting or torn clothing.
- Disconnect the battery (negative) cable first and discharge before beginning any repair work.
- Use ONLY the proper engine barring techniques for manually rotating the engine. Do not attempt to rotate the crankshaft by pulling or prying the fan. This practice can cause serious personal injury, property damage or damage to fan blades causing premature failure of the engine.
- If the engine has been operating and the coolant is hot, allow the engine to cool before you slowly loosen the filler cap and relieve the pressure from the cooling system.
- Do not work on anything that is supported only by lifting jacks or a hoist. Always use blocks or proper stands to support the product before performing any service work.
- Be alert for possible pressure when disconnecting any device from a system that utilises pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can cause serious injury.
- Corrosion inhibitor contains alkali. Do not get the substance in your eyes. Avoid prolonged or repeated contact with your skin. Do not swallow internally. In case of contact, immediately wash skin with soap and water.
- To avoid burns, be alert for hot parts and hot fluids in lines, tubes and compartments.
- Always use tools that are in good condition. Use only genuine Cummins replacement parts.
- Always use the same fastener part number when replacing fasteners. Do not use fasteners of lesser quality if replacements are necessary.
- Avoid inhalation of vapours, ingestion and prolonged contact with used engine oil.

GENERIC SYMBOLS

Generic Symbols

The following group of symbols have been used in this manual to help communicate the intent of the instructions. When one of the symbols appears, it conveys the meaning defined below :



WARNING : Serious personal injury or extensive property damage can result if the warning instructions are not followed.



CAUTION : Minor personal injury can result or a part, an assembly or the engine can be damaged if the caution instructions are not followed.



Indicates a **REMOVAL** or **DISASSEMBLY** step.



Indicates an **INSTALLATION** or **ASSEMBLY** step.



INSPECTION is required.



CLEAN the part or assembly.



PERFORM a mechanical or time **MEASUREMENT**.



LUBRICATE the part or assembly.



Indicates that a **WRENCH** or **TOOL SIZE** will be given.



TIGHTEN to a specific torque.



PERFORM an electrical **MEASUREMENT**.



Refer to another location in this manual or another publication for additional information.



The component weighs 23 kg (50 lb) or more. To avoid personal injury, use a hoist or get assistance to lift the component.

Section 3

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE DATA

Bore	102 mm (4.02 in)
Stroke	120 mm (4.72 in)
Displacement	
4B	3.92 liters (239 in ³)
6B	5.88 liters (359 in ³)
Compression ratio	
4B 3.9 / 6B 5.9 Industrial, naturally aspirated	18.5 : 1
4BT 3.9 / 6BT 5.9 Industrial, turbocharged	17.5 : 1
4BTA 3.9 / 6BTA 5.9 Industrial, turbocharged and aftercooled	16.5 : 1
B3.9 / B5.9* Automotive, charge air cooled	17.6 : 1
Firing order	
6 cylinder	1-5-3-6-2-4
4 cylinder	1-3-4-2
Valve Settings	
Intake Valve Adjustment	0.25 mm (0.01 in)
Exhaust Valve Adjustment	0.51 mm (0.020 in)
Engine rotation (viewed from front of engine)	clockwise
Engine weight (with standard accessories)	
4 cylinder engines	325 to 350 kg (715 to 770 lb)
6 cylinder engines	410 to 440 kg (910 to 970 lb)

LUBRICATION SYSTEM

Oil pressure	
At idle (minimum allowable)	69 kPa (10 psi)
At rated speed (minimum allowable)	207 kPa (30 psi)
Regulating valve opening pressure	(1991) 449 kPa (65 psi)
(1994) 517 kPa (75 psi)	
Differential pressure to open oil filter bypass valve	(1991) 138 kPa (20 psi)
(1994) 172 kPa (25 psi)	
Oil capacity of standard engine	
4 cylinder engines	9.5 liters (10 U.S. Qts.)
6 cylinder engines	14.2 liters (15 U.S. Qts.)

Total system capacity

4 cylinder engines.....	11.0 liters (11.6 U.S. Qts.)
6 cylinder engines.....	16.4 liters (17.3 U.S. Qts.)

COOLING SYSTEM

Thermostat

Begins to open	81°C (180°F)
Fully open	95°C (203°F)

Pressure cap for 99°C (210°F) system 50 kPa (7 psi)

Pressure cap for 104°C (220°F) system..... 103 kPa (15 psi)

Coolant capacity (engine only)

4 cylinder (non-aftercooled, charge air cooled)*	7.0 liters (7.4 U.S. Qts)
4 cylinder (jacket water aftercooled).....	7.9 liters (8.4 U.S. Qts.)
6 cylinder (non aftercooled, charge air cooled)*	9.0 liters (9.5 U.S. Qts.)
6 cylinder (jacket water aftercooled).....	9.9 liters (10.5 U.S. Qts.)

INTAKE AIR AND EXHAUST SYSTEM

Maximum allowable intake restriction at rated speed and load (wit dirty air filter element)

Naturally Aspirated	50.8 cm H ₂ O (20 in H ₂ O)
Turbocharged	63.5 cm H ₂ O (25 in H ₂ O)

Maximum turbocharger outlet restriction at rated speed and load 76.2 mm Hg (3 in Hg)

Maximum exhaust restriction at rated speed and load

Automotive with oxidation catalyist load	152.4 mm Hg (6 in Hg)
Automotive	114.3 mm Hg (4.5 in Hg)
Industrial	76.2 mm Hg (3 in Hg)

FUEL SYSTEM

Fuel transfer pump maximum inlet restriction 100 mm Hg (4 in Hg)

Fuel transfer pump output pressure at rated speed

Distributor fuel injection pumps (maximum)	70 kPa (10 psi)
In-line fuel injection pumps (minimum)	172 kPa (25 psi)

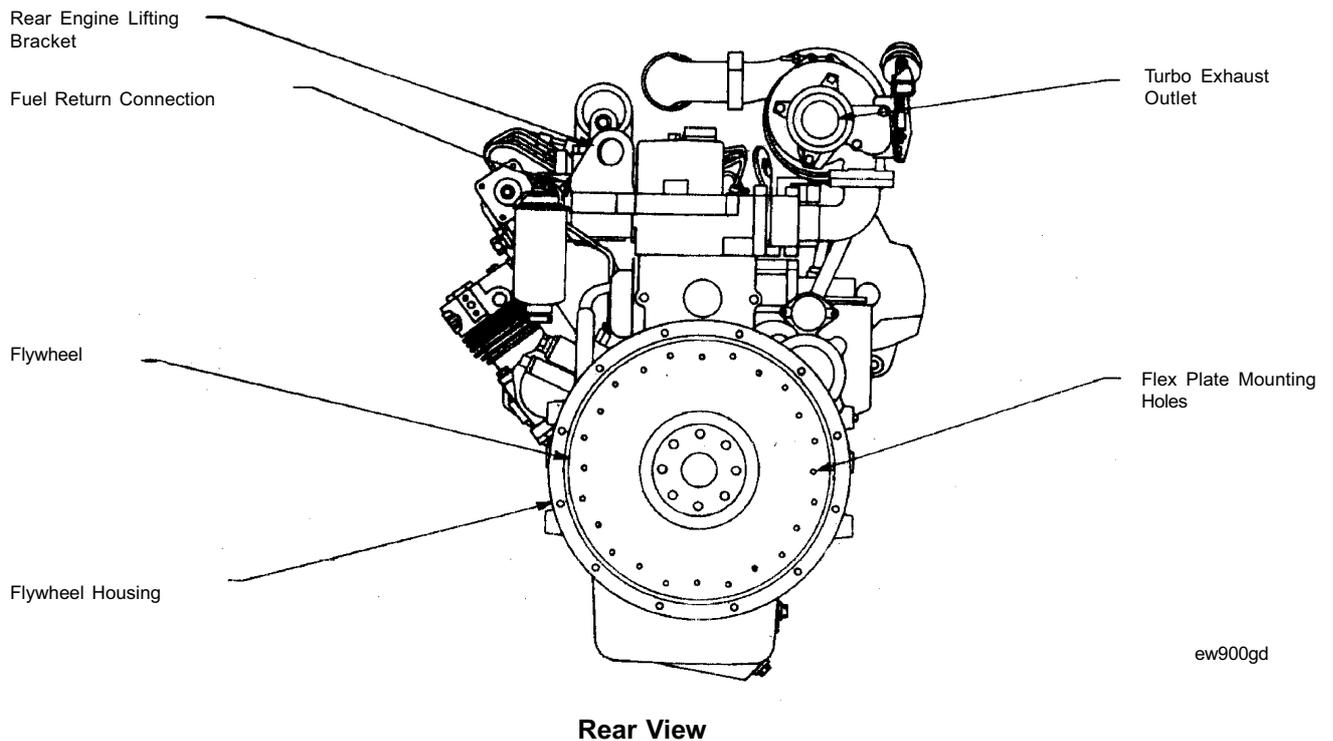
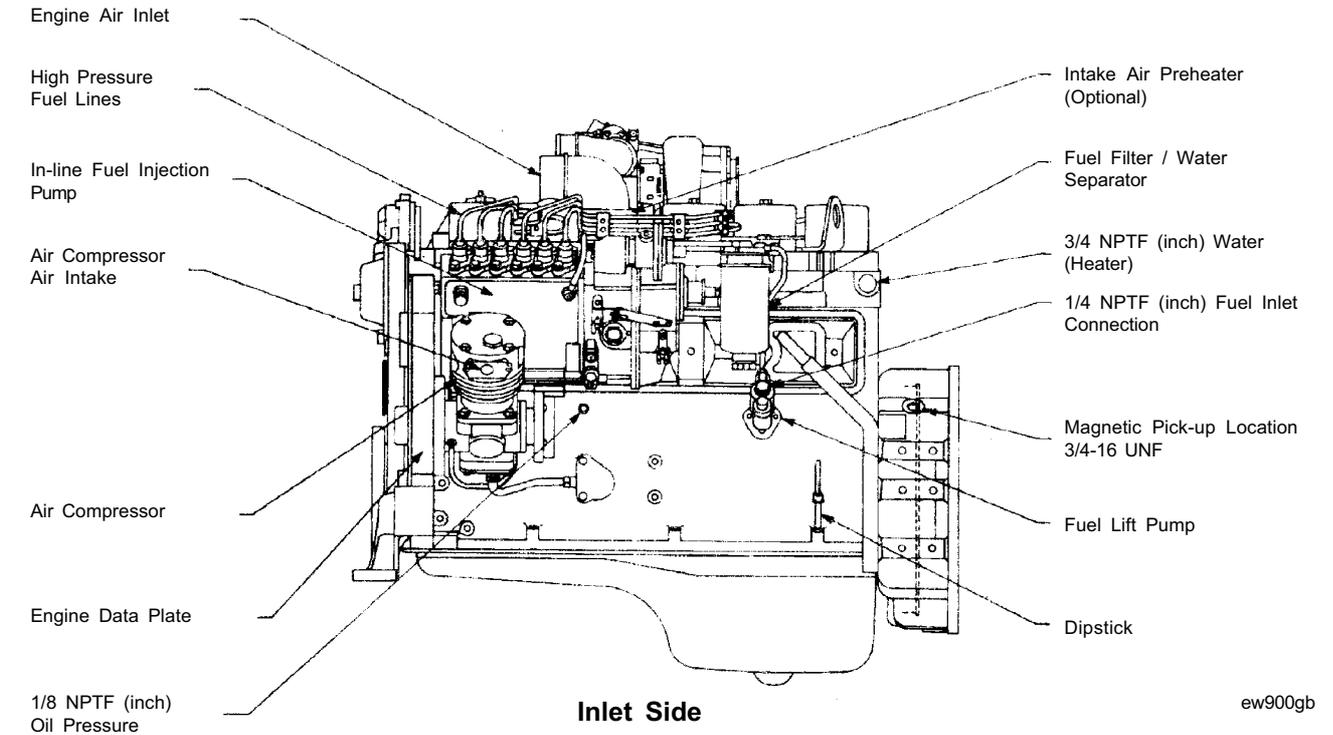
Fuel filter restriction (maximum pressure drop across filters)..... 35 kPa (5 psi)

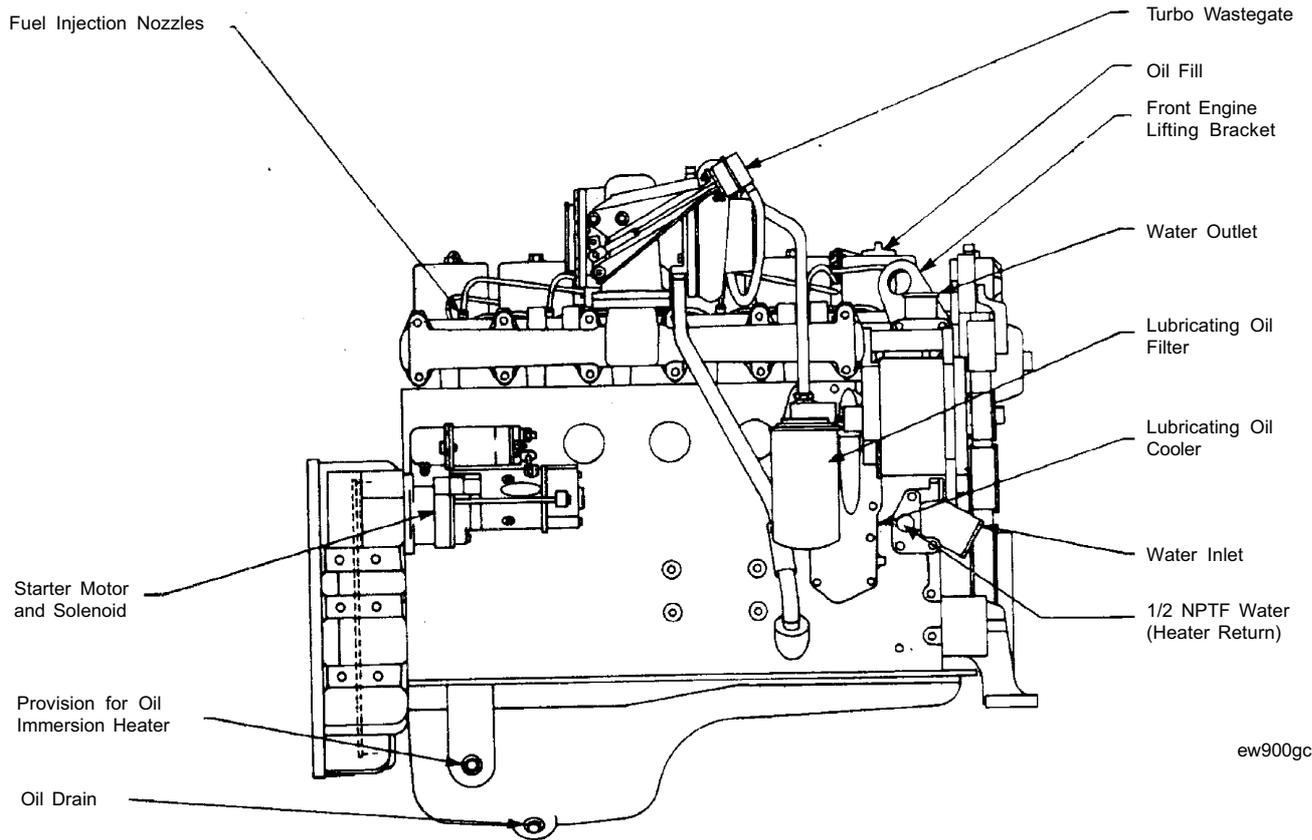
Fuel return restriction (maximum) 518 mm Hg (20.4 in Hg)

Section 4

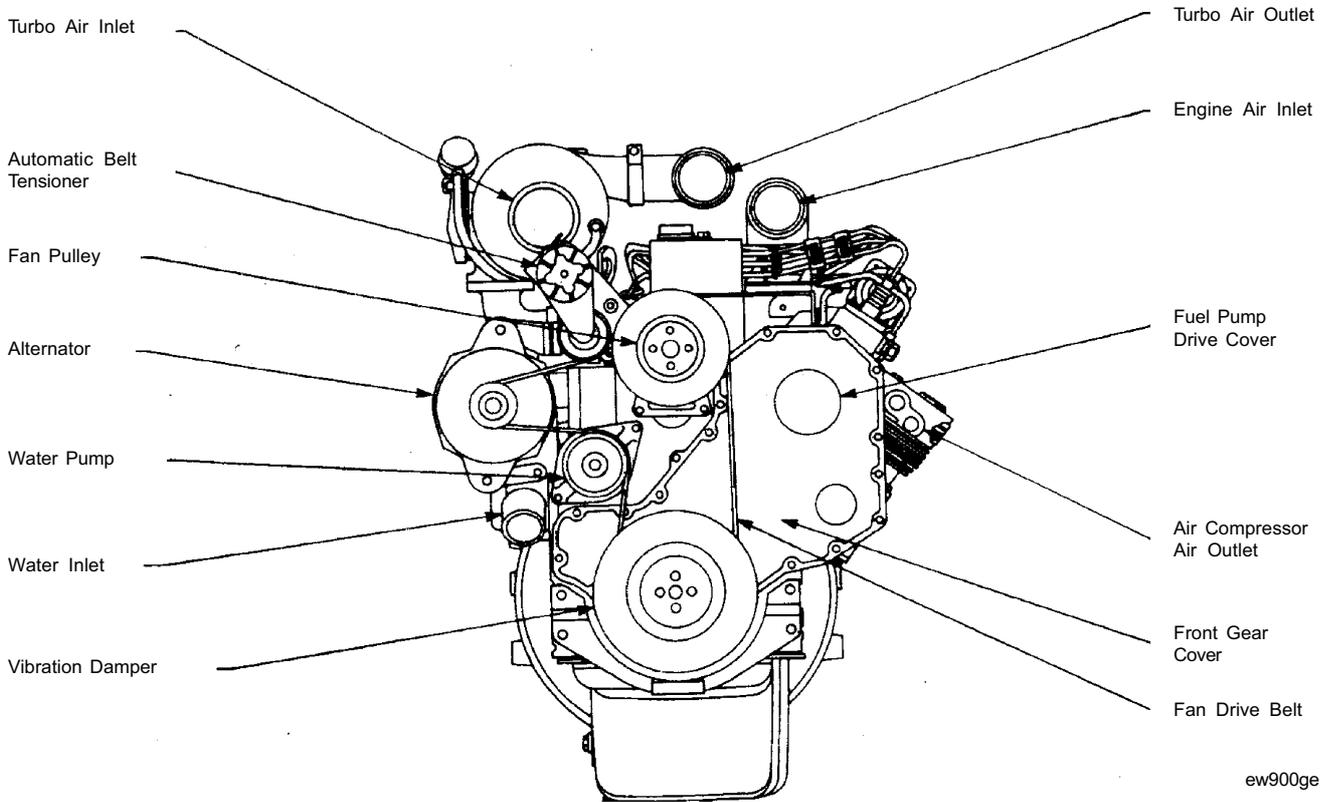
ENGINE DIAGRAMS

The illustrations which follow show the locations of the major external engine components, the filters, and other service and maintenance points. Some external components will be at different locations for different engine models.





Turbocharger Side View



Front View

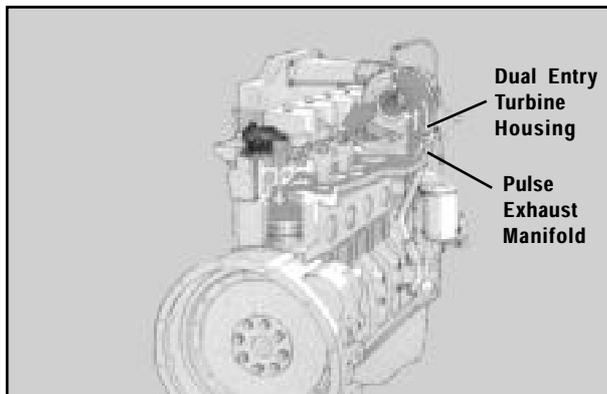
Section 5

ENGINE SYSTEMS OVERVIEW

This section describes flow through various engine systems. The information given here are of general nature. This is intended to help the user to understand four principle engine systems viz. Air, Fuel, Lub & Cooling system. Good understanding in engine systems will help in troubleshooting and preventive maintenance.

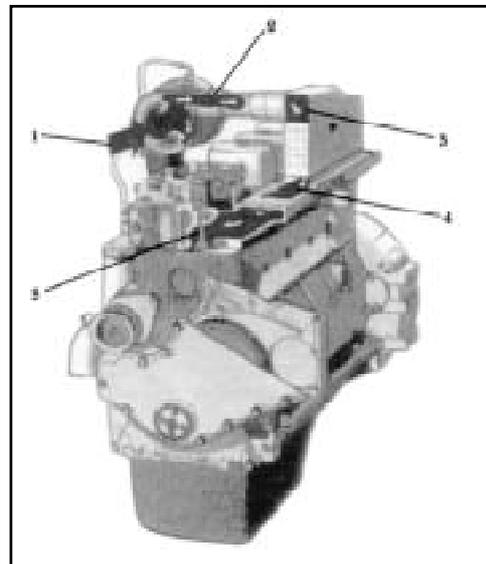
4.1 Air System :

Air enters through air cleaner to turbocharger inlet. Turbocharged air passes through intake manifold, gets distributed to all six power cylinders. After combustion, burnt gases go out through exhaust manifold & rotates the turbine wheel. Exhaust gases emit out through flexible bellow & muffler.



Exhaust System

1. Exhaust Valve
2. Exhaust Manifold (Pulse-Type)
3. Dual Entry to Turbocharger
4. Turbocharger Exhaust Outlet.

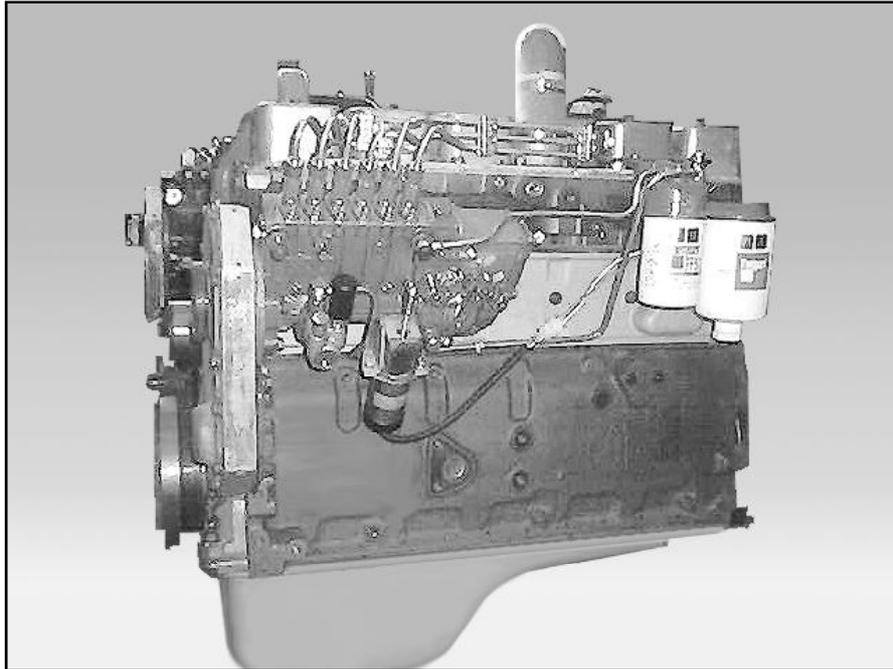


Intake System

1. Intake Air Inlet to Turbocharger
2. Turbocharger Air to Aftercooler
3. Aftercooler
4. Intake Manifold (Integral part of Cylinder Head)
5. Intake Valve

4.2 Fuel System :

Fuel is sucked from base tank (1) by suction inlet pipe (2) and suction strainer (3). Lift pump (4) lifts the fuel & delivers to the filtration system. There is a two stage cleaning of fuel; once by water separator (5) & then by microfine fuel filter (6). Cleaned fuel enters to MICO fuel injection pump (7) which pressurise and delivers the high pressured fuel to MICO DSLA type injectors fitted on each cylinder. Returned fuel is routed back to the tank through return pipe (8).

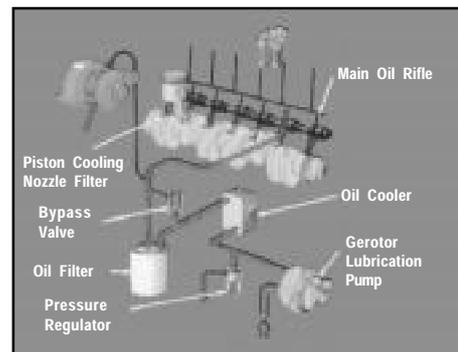


4.3 Lub system :

Lubricating pump draws oil from the oil pan & forces it to the lubrications system. The pressure regulating valve controls oil pressure. The filter bypass valve ensures supply of oil when filter gets choked. The piston pins are lubricated by the splash from piston cooling nozzles. Oil pump idler gear is forced lubricated. The reminder of the front gear train is lubricated by oil carry over splash.

The schematic given under shows the flow of lubricating oil to all parts of the engine.

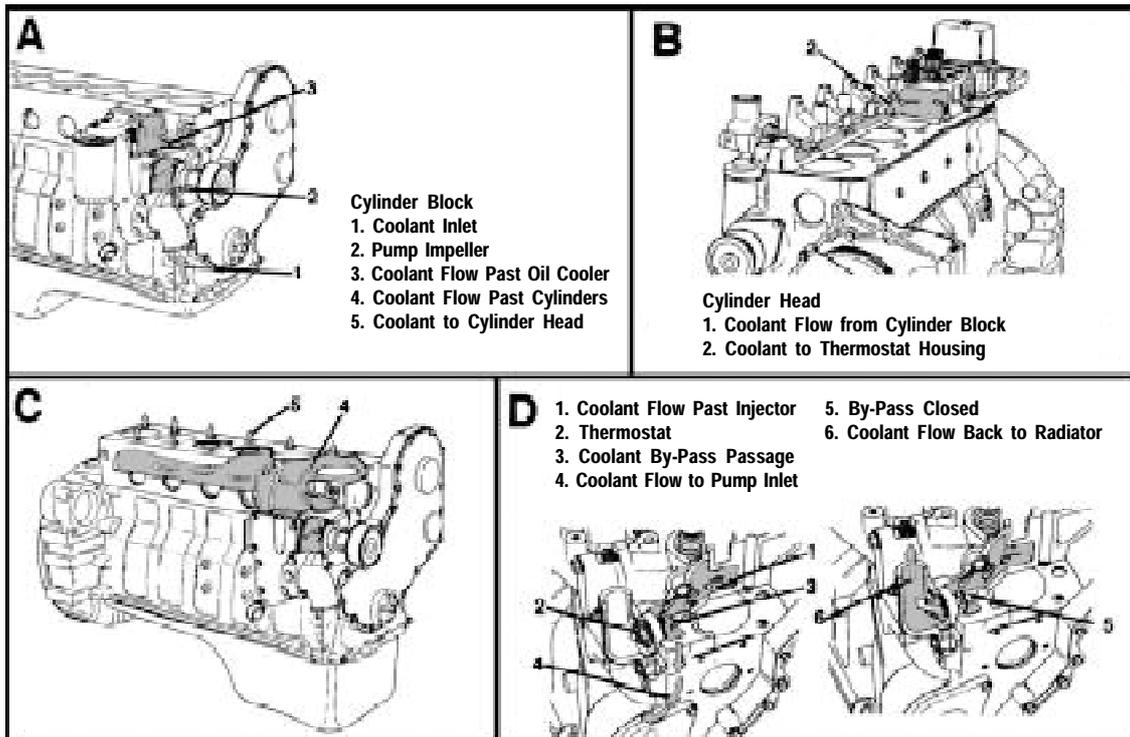
1. Lubricating Oil Pump
2. Pressure Regulating Valve
3. Oil Cooler
4. Filter Bypass Valve
5. Oil Filter
6. Turbocharger Oil Supply
7. Oil Return to Pan
8. Piston Cooling Nozzle
9. Oil Pump idler Gear



4.4 Cooling System :

Coolant is sucked by the engine driven water pump from the bottom tank of the radiator. Coolant passes through oil cooler, all cylinder jackets and cylinder head to reach finally at thermostat housing. Coolant get divided either to the inlet of the water pump or to the radiator depending on coolant temperature. Complete coolant get diverted to the radiator after coolant temperature reached 90 deg. C.

Flow of coolant through the engine is shown in the following sketch.



Section 6

ENGINE OPERATION

5.1 Starting the engine :

Before starting the engine, perform daily maintenance checks. Please refer Section 7 & 8 of this manual for details of maintenance checks.

Normal Starting Procedure :

1. Press starter push button, simultaneously turn the key to "Start" position.
2. Release the key switch immediately when engine cranks. Key will come to "Run" position.
3. Watch the lub oil pressure indication. Release the push button when engine oil pressure indicated is more than 1 kg/cm².

Caution :

To prevent damage to the starter, do not engage the starting motor more than 30 seconds. Wait 2 minutes between each attempt to start.

If the engine does not start after three attempts, check the fuel supply system. Absence of blue or white exhaust smoke during cranking indicates that no fuel is being delivered.

Move the throttle position to idle as soon as the engine starts.

Engine oil pressure must be indicated on the gauge within 15 seconds after starting.

Caution :

Avoid idling the engine for more than 10 Minutes.

Long idling periods may be harmful to your engine because combustion chamber temperatures can drop so low that the fuel will not burn completely. Carbon can then form which may clog the injector spray holes and also cause valve and piston rings to stick.

5.2 Stopping the engine :

Idle the engine a few minutes before routine shut down.

After full load operation, idle the engine 3 to 5 minutes before shutting it off. It will allow the lubricating oil and coolant to carry heat away from the combustion chamber, bearings, shafts etc. This is especially important **for Turbocharged engines**.

Turn the switch to the "Off" Position.

Do NOT Operate the engine on load when :

1. temperature of the coolant exceeds 98°C. (200°F).
2. lubricating oil pressure is low. 18 psi (210°F).

Minimum oil pressures required

Idle : **10 PSI**

Full Speed & Load : **30 PSI**

5.3 Operating the engine :

- Do not operate the engine at full throttle below peak torque engine speed for extended periods (More than 1 minute) of time.
- Allow the engine to idle 3 to 5 minutes before shutting it off after a full load operation.
- Monitor the oil pressure and coolant temperature gauges frequently. Shut off the engine if oil pressure or coolant temperature does not meet specifications.
- Continuous operation of the engine with low or high coolant temperature can damage the engine.
- Most failures give an early warning. Look and listen for changes in performance, sound or engine appearance that can indicate service or engine repair is needed. Some changes to look for are as follow:
 - ◆ Engine misfires
 - ◆ Vibration
 - ◆ Unusual engine noise
 - ◆ Fuel, oil or coolant leakage
 - ◆ Sudden change in engine operating temperature or oil pressure
 - ◆ Excessive smoke
 - ◆ Loss of power
 - ◆ An increase in oil consumption
 - ◆ An increase in fuel consumption

Engine preservation procedure

Introduction

On any engine not in service, whether installed in equipment or waiting to be installed, the unpainted surfaces and various internal passages are subject to rust and corrosion.

Every engine going out of factory is processed and is suitable for storage upto six months from the date of despatch. However sometimes engines are required to be stored for more than six months, also on many occasions engines as installed in equipment are not put in service. Hence it is necessary to process such engines for storage. Based on above the procedure for preservation can be catagorised as below.

- i. Engine preservation procedure for engines to be stored upto six months, from the date of engine shipment from factory.
- ii. Engine preservation procedure to be carried out for engine storage beyond six months from date of shipment from factory.
- iii. Engine preservation procedure for engines installed in equipment.

Note

The rate of corrosion varies with climatic condition. Variance in climatic condition makes it very difficult to state the length of time an engine can be stored without rust and corrosion damage. However the procedures outlined below are useful for various climatic conditions except for arctic conditions and vary low temperatures. For such conditions, please refer to Cummins India Limited for engine storage requirements.

1. Engine preservation procedure for engines to be stored upto six months, from the date of engine shipment from factory.

Note

Every engine going out of factory is processed for storage upto six months. Hence no additional processing is required except proper storage, as given on next page.

- i) If engine has to be stored in the engine box, as received from factory

Sr. No.	Description
a	Store engine box along with kit boxes, in enclosed place protected from water / rain water, dust etc.
b	Tag all these boxes indicating following, <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p style="text-align: center; margin: 0;">ENGINE SHIPMENT DATE :</p> <p style="text-align: center; margin: 0;">THE ENGINE HAS BEEN TREATED FOR PRESERVATION FOR A PERIOD OF SIX MONTHS FROM THE ENGINE SHIPMENT DATE MENTIONED ABOVE.</p> </div>
c	Do not stack any material on engine box to avoid damage to engine / engine box.

ii) If engine has to be stored with out engine box, and / or skid.

Sr No.	Description
a	Store engine along with kit boxes, in enclosed place protected from water / rain water, dust etc.
b	Tag all these boxes indicating following, <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">ENGINE SHIPMENT DATE :</p> <p style="text-align: center;">THE ENGINE HAS BEEN TREATED FOR PRESERVATION FOR A PERIOD OF SIX MONTHS FROM ENGINE SHIPMENT DATE MENTIONED ABOVE.</p> </div>
c	Ensure that all engine openings and opening on kit items such as radiators, air cleaners, silencers etc. are covered by water proof protective caps / plastic tapes.
d	Do not rotate the engine, as engine is in dry condition.

2) **Engine preservation procedure to be carried out for engine storage beyond six months from date of shipment from factory.**

The engine system wise details of the process are described below.

Cooling System Passage :

SR. NO.	DESCRIPTION	REMARKS
a	Prepare engine for Ensis, Long storage Process.	Fabricate and install a plate to close the water pump inlet connection.
b	Fill the cooling system with Ensis oil Rustilo DW 901, (Castrol India make) up to thermostat outlet connection, using external priming pump trolley.	Leave the drain cocks open until all air is completely vented out. Progressively close the cocks until the ensis oil flows from the thermostat housing.
c	Keep the Ensis oil in the engine for 5 minutes and then drain it completely, from engine.	Remove the fabricated plate at water pump inlet and close the opening by plastic cap. (Collect the drained oil in clean container for reuse.)

ii) Fuel Passage :

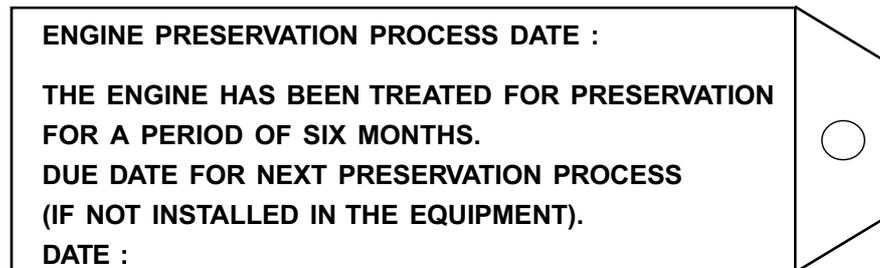
No external treatment is required.

iii) Lubricating Oil Passage :

SR. NO.	DESCRIPTION	REMARKS
a	Prepare engine for Lub oil priming.	Use lub oil priming pump for priming.
b	Prime the engine with engine lub oil 15W40. (CF-4 category)	Use engine Lub oil trolley pump for priming. Circulate the lub oil till the lub pressure gauge shows 1 kg/cm sq. pressure. It will take max five min. to reach this lub oil pressure. Bar the engine during the process.
c	Drain the Lub oil from the oil pan.	

Note :

- a) The above procedure for engine preservation is to be carried out / repeated at the end of every six months during the storage period. The procedure may have to be done at OEM works or at customer's place depending upon location of engine.
- b) Loosen the belt tension on fan belt, alternator belt, water pump belt and other accessories driven by belt.
- c) Tag the engine indicating preservation process date and due date for next preservation (6 months period).



3) Engine preservation procedure for engines installed in equipments.

Many times, the engines shipped from factory are installed on the equipment or Genset within six months from date of shipment from factory. However these engines as installed in the equipment are not put in the service for a long period. For such engines the engine coolant and engine lub oil is generally filled in the engine. Hence no special ensis process is required, but periodic running of engine as given below is mandatory requirement.

Run the engine once in eery week for 5 to 10 min. at Low idle RPM. "B" check to be carried out at every six months as mentioned in Section 6.

4) Preparing a preserved (treated) engine for putting in service.

When an engine is removed from storage and put into service the operation listed below should be performed.

- i) Clean off all accumulated dirt from exterior of engine
- ii) Remove all protective caps, tape and wrappings from connections such as Breathers, Fuel in and out, connection Water in and out connections etc.
- iii) Use suitable solvent, cleaner or decreaser to remove rust preventive compound from unpainted external surfaces of the engine.
- iv) Refill oil pan with fresh lubricating oil. Replace the fuel, lub oil filters and lub oil bypass filters, only in case wherein engine is stored beyond six months from the date of shipment.
- v) Check and correct the engine belt tensioning.
- vi) Refer Section 1 for engine starting instructions.
- vii) In case of any doubts, contact CSS & S / Dealer.

Down-Hill Operation

The Cummins Diesel Engine is effective as a brake on downhill grades, but care must be exercised not to overspeed the engine going downhill. The governor has no control over engine speed when it is being pushed by the loaded vehicle. Overspeeding will cause severe damage to the engine.

Section 7

FUEL, OIL & COOLANT SPECIFICATIONS

For proper operation of any engine, it is essential that good quality of lubricating oil, fuel and engine coolant are used, so that your engine will perform at its optimum level.

6.1 Fuel Specifications :

- Use only good quality ASTM No. 2-D climatized diesel fuel.
- In extreme cold conditions, a winter blend of fuel should be used to avoid waxing in the fuel filters.
- Do not use diesel contaminated by dirt or water. Contaminated fuel can cause severe damage to engine fuel system.
- Maintain fuel storage tanks properly.

Table 6.1 Fuel Oil Properties : Recommended specifications

Property	Recommended Specifications
Viscosity (ASTM D445)	1.3 to 5.8 centistokes (1.3 to 5.8 mm per second) at 1.4F (40C)
Cetane Number (ASTM D-613)	40 Minimum above 32 F 45 minimum below 32 F
Sulfur Content (ASTM D-129 or 1552)	Not to exceed 1.0 mass percent
Active Sulfur (ASTM D1796)	Copper Strip Corrosion not to exceed No. 2 rating after three hours at 122F (50C)
Water and Sediment (ASTM D1796)	Not to exceed 0.1 volume percent
Carbon Residue (Rams bottom, ASTM D524 or Conradson, ASTM D189)	Not to exceed 0.35 mass percent on 10 volume percent residuum
Density (ASTN D 287)	42 to 30 API gravity at 60F (0.816 to 0.876 g/cc at 15 C)
Cloud Point (ASTM D97)	10 F (6 C) below lowest ambient temperature which the fuel is expected to operate
Ash (ASTM D 482)	Not to exceed 0.02 mass percent (0.05 mass percent with lubricating oil blending)
Distillation (ASTM D 86)	The distillation curve must be smooth and continuous.
Acid Number (ASTM D 664)	Not to exceed 0.1 Mg KOA per 100 ML.

6.2 Lubricating oil Specifications :

The lubricating oil used in a diesel engine performs the following functions :

1. It provides a film between the moving parts to reduce wear & friction.
2. It acts as a heat transfer media to carry heat away from the critical areas, thus provides cooling.
3. It dampens & cushions the components that operate under high stress, such as gears & tubes.
4. It protects the critical components from oxidation & corrosion.

In order to get all these functions done, it is essential that recommended lubricating oil **MUST** be used in the engine.

Recommendations :

Quality of Lubricating oil is one of the key drive factors to decide the performance, durability and total cost of operation of diesel engine. Hence we have always been recommending the best available/suitable engine oil to be used in our engine.

Cummins India Limited strongly recommends the use of SAE 15W40 lub oil with API, CF4 classification for all Cummins engines to get the various advantages and optimum performance from the engine.

This oil should have a minimum TBN of 10.5 to counteract the higher sulphur content of high speed diesel available in India.

Note :

Above limits are for reference only and exact applicable values can be obtained from the respective oil manufacturer against specific brand of oil.

The responsibility of meeting oil quality lies with the oil manufacturer and Cummins will not be responsible for problems occurring on engines due to poor quality of oil.

If in doubt about the lub oil quality, contact lub oil manufacturing company and get the oil analysed in laboratories.

Cautions :

Beware of spurious oils in the market. Bad quality of lubricating oil is detrimental to engine performances. Hence, oil should always be procured from the original manufacturer or the authorized distributors.

Lubricating oil to be used on the engine must meet all the qualities as per manufacturer's specifications. Cummins recommends audit checks of fresh engine oil to ensure the quality of oil. Facility to check suitability of oil for using it in the engine is available with Cummins Service Network.

Do not intermix different brands of oil since two different brands may not be compatible with each other. It is therefore recommended that the brand which is used for initial fill, should only be used for top-up.

However, in case of non-availability of specific brand, different brand of oil may be used at the time of oil change. In that case, drain all the existing oil and flush the lub oil system with new brand oil and then charge the system with new brand oil.

Coolant Recommendations / Specifications

Antifreeze is essential in any climate.

It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Do not use more than 50 percent antifreeze in the mixture unless additional freeze protection is required. Never use more than 68 percent antifreeze under any condition.

Use soft water in the Coolant mixture contaminants in hard water neutralize the corrosion inhibitor Components. Water must not exceed 300 ppm hardness or contain more than 100 ppm of either chloride or sulphate.

Specification : Use low silicate antifreeze which meets ASTM 4985 test criteria.

Concentration : Antifreeze must be used in any climate for both freeze and boiling point protection.

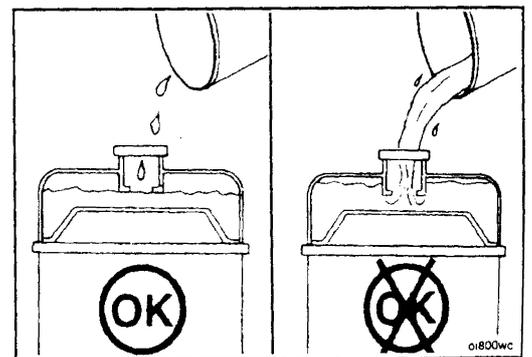
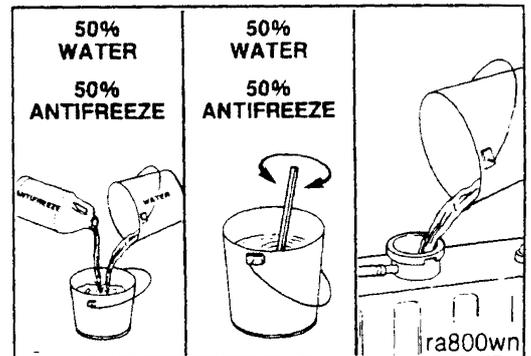
Use a 50 percent concentration level (40 percent to 60 percent range) of ethylene glycol or propylene glycol in most climates.

Antifreeze at 68 percent concentration provides the maximum freeze protection and must never be exceeded under any condition. Antifreeze protection decreases above 68 percent.

Ethylene Glycol	Propylene Glycol
40% = -23C	40% = -21C
50% = 37C	50% = -33C
60% = 54C	60% = - 49C
68% = -71C	68% = -63C

Caution : Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50C (120F) before adding coolant.

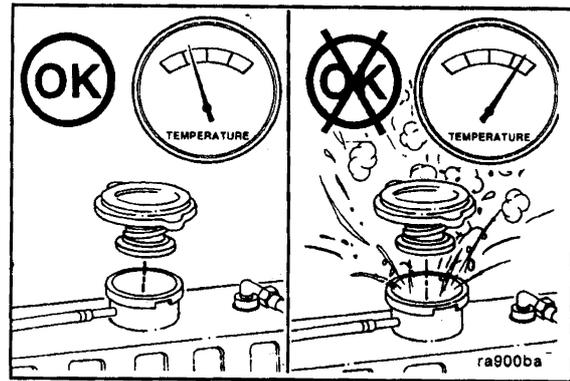
NOTE : On applications that use a coolant recovery system, check to make sure the coolant is at the appropriate level on the coolant recovery tank depending on engine temperature.



Coolant Level Check

Warning : Do not remove the radiator cap from a hot engine. Wait until the temperature is below 50C (120F) before removing the pressure cap. Failure to do so can result in personal injury from heated coolant spray or steam. Remove the filler cap slowly to relieve coolant system pressure.

NOTE : Never use a sealing additive to stop leaks in the coolant system. This can result in coolant system plugging and inadequate coolant flow causing the engine to overheat. The coolant level must be checked daily.



Properties of Water :

Coolant used in cooling system is mixture of water & corrosion inhibitor : Water quality is important for cooling system performance. Therefore it is important that high quality water is used which is free from suspended matter/mud. Distilled or Deionised water can be used in cooling system, however coolant treatment by using corrosion inhibitor is must. Water used in cooling system must meet following specifications.

Hardness (as CaCO ₃)	-	170 ppm max.
Chlorides (as Cl)	-	40 ppm max.
Sulfur (as SO ₄)	-	100 ppm max.
pH	-	5 to 9

It is suggested to get Water quality checked from authorised laboratories if water quality is in doubt.

NOTE : For optimum cooling system efficiency always operate engine with radiator cap in place.

Section 8

MAINTENANCE SCHEDULE

A Check	B Check	C Check	D Check
<ul style="list-style-type: none"> <input type="checkbox"/> 0-50 hrs / 0-30 days Cooling System <input type="checkbox"/> Fill coolant and recommended ensure proper venting. <input type="checkbox"/> Check coolant level in Radiator. Fuel System <input type="checkbox"/> Clean fuel strainer, fuel tank breather. <input type="checkbox"/> Check fuel shut off mounting & tighten the mounting screw. <input type="checkbox"/> Adjust the speed control level if required. Air System <input type="checkbox"/> Check plugs in intake pipe for proper sealing. <input type="checkbox"/> Check function of vacuum indicator. <input type="checkbox"/> Check hoses and clamp for proper sealing. Other <input type="checkbox"/> Check leaks if any. <input type="checkbox"/> Check G / set and G/ set room. Exhaust System <input type="checkbox"/> Ensure smoke level is normal and no leak from Piping. <input type="checkbox"/> Check for Proper support to Exh. pipe. <input type="checkbox"/> Check and record exhaust back pressure (inches of Hg) Electrical System <input type="checkbox"/> Check battery condition. 	<ul style="list-style-type: none"> <input type="checkbox"/> 225-250 hours / every 3 months <input type="checkbox"/> Repeat all A Checks. Lubrication <input type="checkbox"/> Change engine oil. <input type="checkbox"/> May be switched over to equivalent oil of CF-4, Grade 15W40 including Cummins Volvoline Oil. <input type="checkbox"/> Change engine full flow oil filter. <input type="checkbox"/> Record oil pressure. Cooling System <input type="checkbox"/> Check coolant level & top up if necessary. <input type="checkbox"/> Check the condition and tension of radiator drive belt. <input type="checkbox"/> Check the radiator fins for contamination or blockage. Fuel System <input type="checkbox"/> Change fuel/water separator element. <input type="checkbox"/> Clean fuel strainer, fuel tank breather. <input type="checkbox"/> Check fuel shut off mounting & tighten the mounting screw. <input type="checkbox"/> Adjust the throttle lever if required. Air System <input type="checkbox"/> Clean element in reverse direction with clean dry air pressure. Electrical System <input type="checkbox"/> Check battery terminals. 	<ul style="list-style-type: none"> <input type="checkbox"/> 475-500 hours / every 6 months <input type="checkbox"/> Repeat all A & B Checks <input type="checkbox"/> Check Toppet clearances and adjust, if necessary. Lubrication <input type="checkbox"/> Check dipstick clamping and correct if required. <input type="checkbox"/> Clean condition of hoses. Cooling System <input type="checkbox"/> Check condition of hoses and replace if faulty. <input type="checkbox"/> Check fan drive belt. Fuel System <input type="checkbox"/> Check fuel shut off mounting & tighten the mounting screw. <input type="checkbox"/> Check fan drive belt. <input type="checkbox"/> Check fuel pipes and replace if required. Air System <input type="checkbox"/> Check air cleaner sealing. <input type="checkbox"/> Check sealing of radiator. Mechanical System <input type="checkbox"/> Adjust valve lashes as recommended. Electrical System <input type="checkbox"/> Clean battery terminals. <input type="checkbox"/> Check wiring harness for tightness of terminal clamping. <input type="checkbox"/> Check wiring harness and connections and tighten if required. 	<ul style="list-style-type: none"> <input type="checkbox"/> 950-1000 hours / every 12 months <input type="checkbox"/> Repeat all A, B & C Checks <input type="checkbox"/> Check Fan belt tension, replace if necessary. <input type="checkbox"/> Fuel tank cleaning. <input type="checkbox"/> Check operating parameters & record. Cooling System <input type="checkbox"/> Replace the coolant. <input type="checkbox"/> Check radiator fins and radiator fan blades for damage. Fuel System <input type="checkbox"/> Check fuel lift pump diaphragm. <input type="checkbox"/> Clean and check fuel injector nozzles. Lubrication System <input type="checkbox"/> Check leakage and replace hoses if required. Air System <input type="checkbox"/> Check hump hose and replace if required. Mechanical System <input type="checkbox"/> Adjust valve lashes and recommended. Electrical System <input type="checkbox"/> Check battery switches and replace if required. <input type="checkbox"/> Check starter / battery charging alternator and repair if required.

1ST FREE CHECK

FREE CHECK COUPON FOR 'B' SERIES ENGINE FOR INDUSTRIAL APPLICATION (0 TO 50 HOURS OR WITHIN 30 DAYS FROM INSTALLATION)

ESN: _____ MACHINE SR. NO.: _____ HRS: _____ DATE: _____
MODEL: _____ RATING: _____ DELIVERY DATE: _____

√ Tick mark

COOLING SYSTEM :

FILL COOLANT AS RECOMMENDED & ENSURE PROPER VENTING

ENSURE THE COOLING SYSTEM IS FREE FROM LEAKAGES

ENSURE COOLANT LEVEL IN RESERVOIR BOTTLE

FUEL SYSTEM :

CLEAN FUEL STRAINER & FUEL TANK BREATHER

CHECK PROPER MOUNTING OF FUEL SHUTT OFF COIL

ENSURE THE SPEED CONTROL LEVER IS ADJUSTED PROPERLY

INTAKE AIR SYSTEM :

ENSURE ALL PLUGS ARE TIGHT & PROPERLY SEALED

ENSURE ALL HOSES AND CLAMP ARE PROPERLY TIGHTENED

CHECK PROPER FUNCTIONING OF VACUUM INDICATOR

EXHAUST SYSTEM :

ENSURE SMOKE LEVEL IS NORMAL & NO LEAKAGE FROM PIPING

CHECK FOR PROPER SUPPORT TO EXH PIPE

CHECK & RECORD EXHAUST BACK PRESSURE (INCH OF Hg)

ELECTRICAL SYSTEM :

CHECK BATTERY CONDITION AS RECOMMENDED.

Hours Run : _____ Lube Oil Press: _____ Kg/sq.cm Coolant Temp: _____ Deg C

THE WARRANTY STANDS NULL AND VOID IF SERVICE IS NOT CARRIED OUT AS SITPULATED.

(# COST OF SPARES AND CONSUMABLES TO BE BORNE BY CUSTOMER. ANY OTHER REPAIRS NOT COVERED UNDER WARRANTY CLAUSE WILL BE BORNE BY CUSTOMER)

1ST Free Check:
All the checks-points attended by a service representative of M/S _____
To the satisfaction & the equipment is working in normal condition.

Sign : Sign :
Name : Name :
Designation : Designation :
Customer : Dealer :
Name & Add

(Copy – Customer / Dealer / HO) (Approved By ASM – CDSS)

2ND FREE CHECK

FREE CHECK COUPON FOR 'B' SERIES ENGINE FOR INDUSTRIAL APPLICATION (225 TO 250 HOURS OR WITHIN 3 MONTHS FROM COMMISSIONING)

ESN: _____	MACHINE SR. NO.: _____	HRS: _____	DATE: _____
MODEL: _____	RATING: _____	DELIVERY DATE: _____	

	√ Tick Mark
(REPEAT ALL EARLIER FREE CHECK POINTS)	<input type="checkbox"/>
LUBRICATION SYSTEM :	<input type="checkbox"/>
<input type="checkbox"/> CHANGE LUBE OIL WITH CF4 – SAE 15W40 OR EQUIVALENT & MAINTAIN LEVEL	<input type="checkbox"/>
<input type="checkbox"/> CHANGE ENGINE FULL FLOW LUBE OIL FILTER	<input type="checkbox"/>
<input type="checkbox"/> RECORD LUBE OIL PRESSURE	<input type="checkbox"/>
COOLING SYSTEM :	
<input type="checkbox"/> CHECK COOLANT LEVEL & TOP UP IF NECESSARY	<input type="checkbox"/>
<input type="checkbox"/> CHECK CONDITION OF FAN BELT & ADJUST TENSION IF REQD	<input type="checkbox"/>
<input type="checkbox"/> CLEAN RADIATOR FINS & ENSURE FREE FROM DUST/ BLOCKAGE	<input type="checkbox"/>
FUEL SYSTEM :	
<input type="checkbox"/> CHANGE FUEL FILTER / WATER SEPARATOR	<input type="checkbox"/>
INTAKE AIR SYSTEM :	
<input type="checkbox"/> CLEAN ELEMENT WITH DRY AIR IN REVERSE DIRECTION	<input type="checkbox"/>
ELECTRICAL SYSTEM :	
<input type="checkbox"/> CLEAN BATTERY TERMINALS.	<input type="checkbox"/>
<input type="checkbox"/> CHECK THE BATTERY CONDITION.	<input type="checkbox"/>
Hours Run : _____ Lube Oil Press: _____ Kg/sq.cm Coolant Temp: _____ Deg C	

THE WARRANTY STANDS NULL AND VOID IF SERVICE IS NOT CARRIED OUT AS SITPULATED.

(# COST OF SPARES AND CONSUMABLES TO BE BORNE BY CUSTOMER. ANY OTHER REPAIRS NOT COVERED UNDER WARRANTY CLAUSE WILL BE BORNE BY CUSTOMER)

2 ND Free Check :	
All the checks-points attended by a service representative of M/S _____	
To the satisfaction & the equipment is working in normal condition.	
Sign :	Sign :
Name :	Name :
Designation :	Designation :
Customer :	Dealer :
Name & Add	
(Copy – Customer / Dealer / HO)	(Approved By ASM – CDSS)

3RD FREE CHECK

FREE CHECK COUPON FOR 'B' SERIES ENGINE FOR INDUSTRIAL APPLICATION (475 TO 500 HOURS OR WITHIN 6 MONTHS FROM COMMISSIONING)

ESN: _____	MACHINE SR. NO.: _____	HRS: _____	DATE: _____
MODEL: _____	RATING: _____	DELIVERY DATE: _____	

	√ Tick Mark
(REPEAT ALL EARLIER FREE CHECK POINTS)	<input type="checkbox"/>
LUBRICATION SYSTEM :	
<input type="checkbox"/> CHECK CONDITION OF HOSES & ENSURE NO LEAKAGE	<input type="checkbox"/>
COOLING SYSTEM :	
<input type="checkbox"/> CHECK CONDITION OF HOSES & REPLACE IF FAULTY	<input type="checkbox"/>
<input type="checkbox"/> CHECK CONDITION OF FAN BELT & REPLACE IF REQD	<input type="checkbox"/>
FUEL SYSTEM :	
<input type="checkbox"/> CHECK CONDITION OF FUEL PIPES & REPLACE IF REQD	<input type="checkbox"/>
INTAKE AIR SYSTEM :	
<input type="checkbox"/> CHECK CONDITION OF ELEMENT & REPLACE IF FAULTY	<input type="checkbox"/>
EXHAUST SYSTEM :	
<input type="checkbox"/> CLEAN EXHAUST PIPING IF REQUIRED	<input type="checkbox"/>
MECHANICAL SYSTEM :	
<input type="checkbox"/> ADJUST VALVE LASHES AS RECOMMENDED	<input type="checkbox"/>
ELECTRICAL SYSTEM :	
<input type="checkbox"/> CHECK BATTERY CONDITION.	<input type="checkbox"/>
<input type="checkbox"/> CHECK WIRING HARNESS & ALL BATTERY & CONTROL SAFETY TERMINALS.	<input type="checkbox"/>
Hours Run : _____ Lube Oil Press: _____ Kg/sq.cm Coolant Temp: _____ Deg C	

**THE WARRANTY STANDS NULL AND VOID IF SERVICE IS NOT CARRIED OUT AS SITPULATED.
(# COST OF SPARES AND CONSUMABLES TO BE BORNE BY CUSTOMER. ANY OTHER
REPAIRS NOT COVERED UNDER WARRANTY CLAUSE WILL BE BORNE BY CUSTOMER)**

3 rd Free Check:	
All the checks-points attended by a service representative of M/S _____	
To the satisfaction & the equipment is working in normal condition.	
Sign :	Sign :
Name :	Name :
Designation :	Designation:
Customer :	Dealer :
Name & AddM	
(Copy – Customer / Dealer / HO)	(Approved By ASM – CDSS)

4TH FREE CHECK

FREE CHECK COUPON FOR 'B' SERIES ENGINE FOR INDUSTRIAL APPLICATION (950 TO 1000 HOURS OR WITHIN 1 YEAR FROM COMMISSIONING)

ESN: _____ MACHINE SR. NO.: _____ HRS: _____ DATE: _____

MODEL: _____ RATING: _____ DELIVERY DATE: _____

√ Tick Mark

(REPEAT ALL EARLIER FREE CHECK POINTS)

LUBRICATION SYSTEM :

CHECK LEAKAGE & REPLACE HOSES IF REQUIRED

COOLING SYSTEM :

REPLACE THE COOLANT AS RECOMMENDED & CLEAN THE RADIATOR PROPERLY.

FUEL SYSTEM :

CHECK CONDITION OF FUEL PIPES & REPLACE IF REQD

CHECK FUEL LIFT PUMP DIAPHRAGM & REPLACE IF REQUIRED

CHECK FUEL INJECTORS & CALIBRATE IF REQD

INTAKE AIR SYSTEM :

CHECK ALL HOSES & REPLACE IF REQUIRED

MECHANICAL SYSTEM :

ADJUST VALVE LASHES AS RECOMMENDED

ELECTRICAL SYSTEM :

CHECK SAFETY CONTROL SWITCH & REPLACE IF REQUIRED.

CHECK STARTER / BATTERY / CHARGING ALTERNATOR & REPAIR IF REQUIRED

Hours Run : _____ Lube Oil Press: _____ Kg/sq.cm Coolant Temp: _____ Deg C

THE WARRANTY STANDS NULL AND VOID IF SERVICE IS NOT CARRIED OUT AS SITPULATED.

(# COST OF SPARES AND CONSUMABLES TO BE BORNE BY CUSTOMER. ANY OTHER REPAIRS NOT COVERED UNDER WARRANTY CLAUSE WILL BE BORNE BY CUSTOMER)

4th Free Check:

All the checks-points attended by a service representative of M/S _____

To the satisfaction & the equipment is working in normal condition.

Sign : _____

Sign : _____

Name : _____

Name : _____

Designation : _____

Designation: _____

Customer : _____

Dealer : _____

Name & AddM _____

(Copy – Customer / Dealer / HO)

(Approved By ASM – CDSS)

Section 9

ENGINE MAINTENANCE

8.1 Daily :

Preventive Maintenance begins with a day-to-day awareness of condition of the engine & its systems.

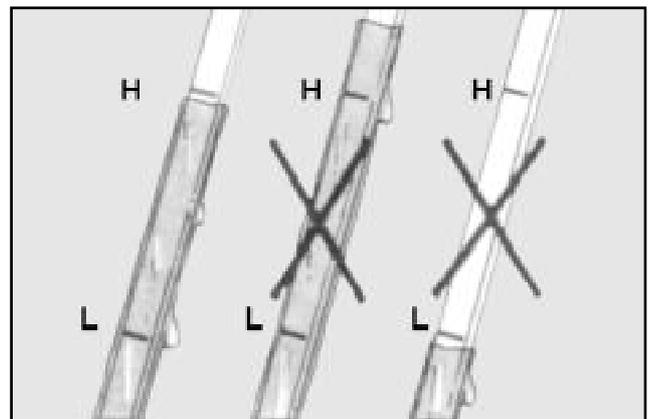
Before Start up, check oil & coolant level and look for leaks, loose parts, frayed belts etc.

Check Oil Level :



Never operate the engine with the oil level below “L” (Lower) mark or above “H” (Higher) mark.

Lubricating oil Capacity between Low & High marks is 2.10 Litres.



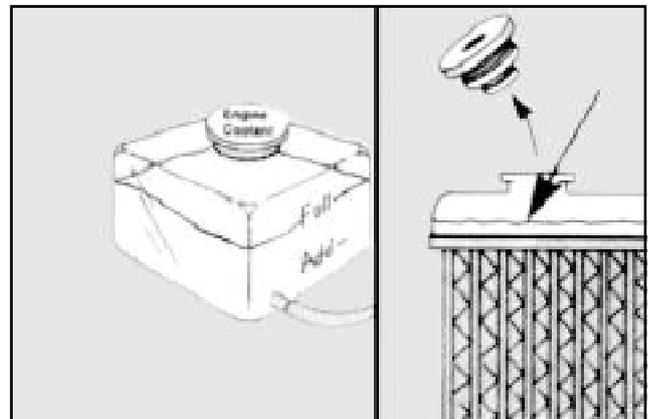
Check Coolant Level :



Check the coolant level by removing radiator cap.

Caution :

Never remove the cap when the coolant is Hot. Always use caution when removing the cap to avoid personal injury.



Check fuel water trap :

Drain the water from fuel/water separator.

