

Engine Workshop Manual

Our energy working for you.™



G-Drive Package

B5.9G Series

FOREWORD

This manual is designed to be of assistance to all Personnel concerned with the maintenance and overhaul of the B.5.9G Series Engine.

It presents a complete and detailed Description of the Engine, together with precise instruction on servicing and overhaul procedure and dimensions which should be closely followed when overhauling any part of the Engine to the Manufacturers standards.

Effective maintenance can only be carried out if the personnel concerned are fully conversant with the various components of the Engine.

Before maintenance operations are commenced, this manual should be carefully studied, and it should at all times be kept where it will be needed in the workshop.

Thoroughly read the Workshop Manual before operating the generator set.

Safe operation and top performance can be obtained only when equipment is operated and maintained property.

This manual is for guidance and assistance with recommendations for correct and safe procedures. Cummins Power Generation Limited cannot accept any liability whatsoever for problems arising as a result of following recommendations in this manual.

The information contained within the manual is based on information available at the time of going to print. In line with Cummins Power Generation Limited policy of continuous development and improvement, information may change at any time without notice. The Installers should therefore ensure that before commencing any work, they have the latest information available.

Consult your Authorised Distributor for further information or assistance if required. It is essential that the utmost care is taken with the application, installation and operation of any diesel engine due to their potentially dangerous nature. Careful reference should also be made to other Cummins Power Generation Limited literature, in particular the Health and Safety Manual 0908-0110.

Should you require further assistance contact: Cummin India Limited Power Generation Business Unit 35A/1/2, Erandwane Pune, 411038 India

Tel: +91 2030248600 Fax: +91 2066028090 E-mail: cpgiservicesupport@cummins.com Web Site: www.cumminspower.com

A024J818 (Issue 2) 01-2010

INDEX

Sr.	Contents	Page No.
1.	General Safety Instructions	7
2.	Engine Systems : Overview	9
3.	Engine Operation	13
4.	Fuel, Oil & Coolant Specifications	19
5.	Maintenance Schedule	23
6.	Engine Maintenance	25
7.	Adjustment, Replacement and Repair B Series	
8.	Trobule Shooting	

NOTES



Section 1

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.

NOTE : On receipt of engine by truck, ensure unloading of the engine by skilled personnel. The personnel have to use necessary personal protective equipment to avoid accipdents. Engines are to be un loaded using the lifting hooks fitted on the engines. During the engine installation ensure proper fitment of Anti Vibration Mounting Pad.

Warning : Ensure that the shipping bracket is removed during the engine installation.

- 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 no 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 bladed 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 lessor quality of replacements are necessary.
- Avoid inhalation of vapours, ingestion and prolonged contact with used engine oil.

CAUTION : Ensure aligment and torgue of related fosteners while connecting aternator to the engine fly wheel housing.

[_____

TECHNICAL DATA FOR CPCB ENGINES SUPPLIED FROM 1ST JAN., 2004 ONWARDS						
Engine	Engine Make	Cummins	Cummins	Cummins	Cummins	Cummins
	Model	6BT 5.9 G1	6BTA5.9G1 - I	6BTA 5.9 G2-I	6BTAA5.9G1-I	6BTAA5-9 G5
	Cooling	Water Cooled	Water Cooled	Water Cooled	Water Cooled	Water Cooled
	Aspiration H	Turbocharged	Turbocharged	Turbocharged	Turbocharged	Turbocharged
	No. of Cylinders	6	6	6	6	6
	RPM	1500	1500	1500	1500	1500
	Bore (mm)	102	102	102	102	102
	Stroke (mm)	120	120	120	120	120
	Compression Ratio	17.6:1	17.6:1	17.6:1	17.6:1	16.5:1
	Displacement (Ltrs.)	5.88	5.88	5.88	5.88	5.88
	Fuel	HSD	HSD	HSD	HSD	HSD
	Governor	Mechanical	Mechanical	Mechanical	Electronic	Electronic
	Starting System	12 V Electrical	12 V Electrical	12 V Electrical	12 V Electrical	12 V Electrical
	Lub Oil Specification	15W40	CH4 15W40	15W40	CH4 15W40	CH4 15W40
	Lub Oil Sump Capacity (Ltrs.)	14.3	14.3	14.3	14.3	14.3
	Lub Oil Consumption (LPH)	0.047	0.026	0.03	0.04	0.06
	Total Coolant Capacity (Ltrs.)	22	24.5	24.5	24.5	26
	Exhaust Pipe Size (mm)	100	100	100	100	100
	Battery Rating (AH)	150 AH 12 V	150 AH 12 V	150 AH 12 V	150 AH 12 V	150 AH 12V

Conformance Standards: IS 4722, BS 5000, IS 1460, ISO 8528, BS 5514, ISO 3046

Rating definition

- Prime power rating is applicable for supplying continuous electric power (at variable load) in lieu of commercially pur-_ chased power.
- Prime power is available for an unlimited number of hours per year in a variable load application. _
- 10% overload is available for 1 hour in every 12 hours of operation. _
- Rating definition is as per ISO 3046 / BS 5514. _
- Fuel consumption data is based on diesel having specific gravity of 0.85 and conforming to IS 1460 _
- Fuel consumption data is based on oil having specific gravity of 0.89 and meeting CH4 API categories _
- Fuel consumption tolerance is +5%. _

Due to continuous product development, all specifications are subject to change without notice.

Section 2

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 :

Intake System

Aftercooler

Intake Valve

1.

2. 3.

4.

5.

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.



Intake Air Inlet to Turbocharger Turbocharger Air to Aftercooler

Intake Manifold (Integral part of Cylinder Head)

Exhaust System

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



4.2 Fuel System :

A024J818 (Issue 2) 01-2010

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

CAUTION : Ensure adequate tightness on feed pump fuel inlet banjo to avoid fuel starvation.

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 pines 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



A024J818 (Issue 2) 01-2010

4.4 Cooling System :

B Series cooling system is a 10 PSI closed pressurised 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.



1.1 Exhaust System

Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlets away from any air inlets to avoid gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation and light loads. Regularly inspect the exhaust system both visually and audibly to see that the entire system remains fume tight and safe for operation.



WARNING : inhalation of exhaust gasses can result in severe personal injury or death. use extreme care during installation to provide a tight exhaust system. terminate exhaust pipes away from enclosed or sheltered areas, windows, doors and vents.



WARNING : Exhaust pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard. shield or insulate exhaust pipes if there is danger of personal contact or when routed through walls or near other combustible materials.

NOTES

Section Manual

B.5.9.G Series Engine

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.

CAUTION :

To prevent damage to the starter, do not engage the starting motor more than 10 to 12 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 blur 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.

5.2 Stopping the engine :

Remove the load from the engine. Run the engine few minutes before routine shut down, on no load.

It will allow the lubricating oil and coolant to carry heat away from the combusion chamber, bearings, shafts etc. This is especially emportant for Turbocharged engines.

Minimum oil pressures required

Idle	:	10 PSI
Full Speed & Load	:	30 PSI

5.3 Operating the engine :

A WARNING : Guarding should not be removed when the engine is is running condition.

- 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:

- i) Engine misfires
- ii) Vibration
- iii) Unusual engine noise
- iv) Fuel, oil or coolant leakage
- v) Sudden change in engine operating temperature or oil pressure
- vi) Excessive smoke
- vii) Loss of power
- viii) An increase in oil consumption
- ix) 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.
- 1. Engine preservation procedure for engines to be stored upto six months, from the date of engine shipment from factory.
- B 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.

Sr. No.	Description
а	Store engine box along with kit boxes, in enclosed place protected from water / rain water, dust etc.
b	Tag all these boxes indicating following, ENGINE SHIPMENT DATE : THE ENGINE HAS BEEN TREATED FOR PRESERVATION FOR A PERIOD OF SIX MONTHS FROM THE ENGINE SHIPMENT DATE MENTIONED ABOVE.
с	Do not stack any material on engine box to avoid damage to engine / engine box.

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

Thank you very much for your reading. Please Click Here Then Get More Information.