G POWER
G SAFE

Operation and Maintenance Manual

6B-CP

6C-CP

QSM11-DM

K19-CP

K38-CP

K50-CP

6B-CS

6C-CS

Forward

This manual contains information for the correct operation and maintenance of your Cummins engine. It also includes important safety information, engine / systems specifications, troubleshooting guidelines; listings of Cummins authorized repair locations and component manufacturers.

Read and follow all safety instructions. Refer to the WARNING in the General Safety Instructions in Section i - Introduction.

Keep this manual with the equipment. If the equipment is traded or sold, give the manual to the new owner.

The information, specifications and recommended maintenance guidelines in this manual are based on information in effect at the time of printing. Cummins Inc. reserves the right to make changes at any time without obligation. If you find differences between your engine and the information in this manual, contact your local Cummins authorized repair location or call 1-800-DIESELS (1-800-343-7357) toll free in the U.S. and Canada.

The latest technology and the highest quality components were used to produce this engine. When replacement parts are needed we recommend using only genuine Cummins or ReCon® exchange parts.

NOTE: Warranty information is located in Section W. Make sure you are familiar with the warranty or warranties applicable to your engine.

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General Information

Preventive maintenance is the easiest and least expensive type of maintenance. Follow the maintenance schedule recommendations outlined in **Maintenance Guidelines (Section 2).**

Keep records of regularly scheduled maintenance. Use the correct fuel, lubricating oil, and coolant in your engine as specified in **Maintenance Specifications (Section V).** Blending engine oil with fuel is prohibited for engines with an aftertreatment system.

Cummins Inc. uses the latest technology and the highest quality components to produce its engines. Cummins Inc. recommends using genuine Cummins new parts and ReCon® exchange parts.

Personnel at Cummins Authorized Repair Locations have been trained to provide expert service and parts support. If you have a problem that cannot be resolved by a Cummins authorized repair location, follow the steps outlined in the **Service Assistance (Section S).**

Product coverage, warranty limitations and owner responsibilities are available in **Warranty (Section W).**

About the Manual

This manual covers all C Power and C Safe gensets. Each engine has its own Operation and Maintenance Manual referred to here for specific procedures. The manuals and procedures can be found online at https://quickserve.cummins.com/qs2/portal/index.html, in the appropriate Operation and Maintenance Manual listed below.

C Power/C Safe Base Engine Bulletin Numbers

Genset	Operation and Maintenance Bulletin #	Troubleshooting and Repair Bulletin #	Parts Manual
6B CP/6B CS	402138	3666087	4056558
6C CP/6C CS	3810248	3666003	4056514
QSM11 DM	2883583	3666266	3672153
K19 CP	3666077	3666013	4056491
K38 CP	3810497	3810497	4056593
K50 CP	3810497	3810497	4056506

NOTE: The control panels and alternators have their own Manuals that explain their operation and maintenance procedures where applicable.

It is extremely important that the operator becomes familiar with these manuals before attempting to operate the genset. The manuals are available online at marine.cummins.com under the genset tab.

The manuals contain information needed to correctly operate and maintain the engine, alternator, and control panels as recommended by Cummins Inc.
For additional service literature and ordering locations, refer to **Service Literature (Section L)** in the appropriate Operation and Maintenance Manual.

Both metric and U.S. customary values are listed in this manual. The metric value is listed first, followed by the U.S. customary in brackets.

Numerous illustrations and symbols are used to aid in understanding the meaning of the text. Refer to Symbols in this section for a complete listing of symbols and their definitions.

How to Use the Manual

The engine O&M manuals are organized according to intervals at which maintenance on the engine is to be performed. A maintenance schedule, that states the required intervals and maintenance checks, is located in **Maintenance Guidelines (Section 2)** of each engine manual. Locate the interval at which you are performing maintenance; then follow the steps given in that section for all the procedures.

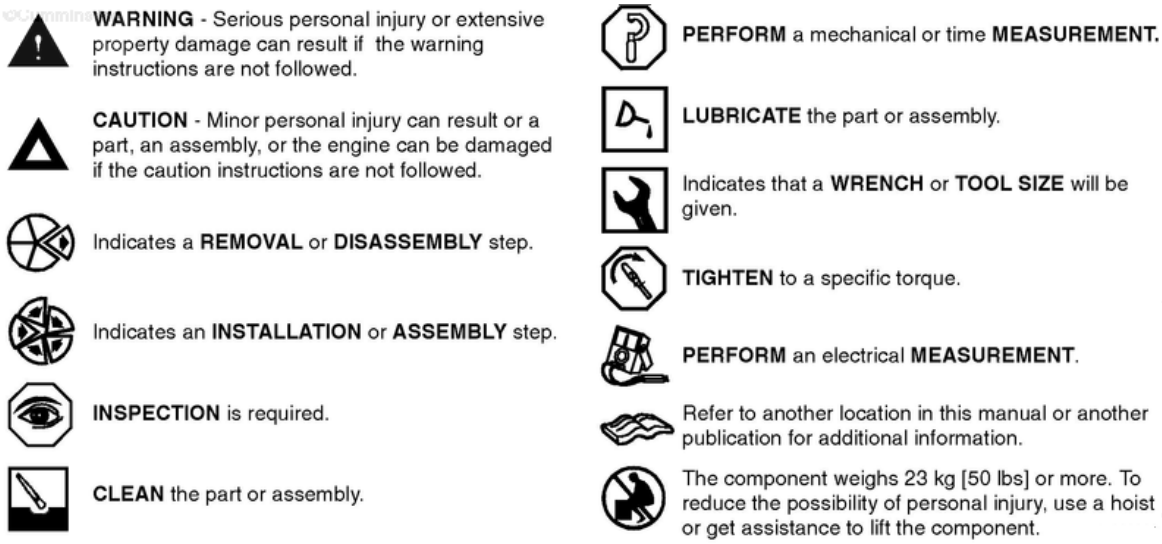
Keep a record of all the checks and inspections made. A maintenance record form is located in **Maintenance Guidelines (Section 2).**

Engine troubleshooting procedures for your engine are located in **Troubleshooting Symptoms (Section TS).**

Specifications for your engine are located in **Maintenance Specifications (Section V).**

Symbols

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



General Safety Instructions

WARNING

Improper practices, carelessness, or ignoring the warnings can cause burns, cuts, mutilation, asphyxiation or other personal injury or death.

Read and 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. Special safety precautions are included in the procedures when they apply.

- Work in an area surrounding the product that is dry, well lit, ventilated, and free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- Always wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do not wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a **"Do Not Operate"** tag in the operator's compartment or on the controls.
- Use ONLY the proper engine barring techniques for manually rotating the engine. Do not attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before slowly loosening the filler cap to relieve the pressure from the cooling system.
- Always use blocks or proper stands to support the product before performing any service work. Do not work on anything that is supported ONLY by lifting jacks or a hoist.
- Relieve all pressure in the air, oil, fuel, and cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and ONLY disconnect liquid refrigerant (Freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems must be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To reduce the possibility of personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks must not be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do not get the substance in eyes. Avoid prolonged or repeated contact with skin. Do not swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. **IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.**

- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and must be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. **KEEP OUT OF REACH OF CHILDREN.**
- To reduce the possibility of burns, be alert for hot parts on products that have just been turned off, exhaust gas flow, and hot fluids in lines, tubes, and compartments.
- Always use tools that are in good condition. Make sure you understand how to use the tools before performing any service work. Use ONLY genuine Cummins® or Cummins ReCon® replacement parts.
- Always use the same fastener part number (or equivalent) when replacing fasteners. Do not use a fastener of lesser quality if replacements are necessary.
- When necessary, the removal and replacement of any guards covering rotating components, drives, and/or belts should only be carried out be a trained technician. Before removing any guards the engine must be turned off and any starting mechanisms must be isolated. All fasteners must be replaced on re-fitting the guards.
- Do not perform any repair when fatigued or after consuming alcohol or drugs that can impair functioning.
- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.
- Do not connect the jumper starting or battery charging cables to any ignition or governor control wiring. This can cause electrical damage to the ignition or governor.
- Always torque fasteners and fuel connections to the required specifications. Over tightening or under tightening can allow leakage. This is critical to the natural gas and liquefied petroleum gas fuel and air systems.
- Always test for fuel leaks as instructed, as odorant can fade.
- Close the manual fuel valves prior to performing maintenance and repairs and when storing the vehicle inside.
- Coolant is toxic. If not reused, dispose of in accordance with local environmental regulations.
- The catalyst reagent contains urea. Do not get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water. Do not swallow internally. In the event the catalyst reagent is ingested, contact a physician immediately.
- The catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. Always wear protective gloves and eye protection when handling the catalyst assembly. Do not get the catalyst material in your eyes. In Case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water.
- The Catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. In the event the catalyst is being replaced, dispose of in accordance with local regulations.
- 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.

General Repair Instructions

This engine or system incorporates the latest technology at the time it was manufactured; yet, it is designed to be repaired using normal repair practices performed to quality standards.

WARNING

Cummins Inc. does not recommend or authorize any modifications or repairs to components except for those detailed in Cummins Service Information. In particular, unauthorized repair to safety-related components can cause personal injury or death. Below is a partial listing of components classified as safety-related:

1. Air Compressor
2. Air Controls
3. Air Shutoff Assemblies
4. Balance Weights
5. Cooling Fan
6. Fan Hub Assembly
7. Fan Mounting Bracket(s)
8. Fan Mounting Capscrews
9. Fan Hub Spindle
10. Flywheel
11. Flywheel Crankshaft Adapter
12. Flywheel Mounting Capscrews
13. Fuel Shutoff Assemblies
14. Fuel Supply Tubes
15. Lifting Brackets
16. Throttle Controls
17. Turbocharger Compressor Casing
18. Turbocharger Oil Drain Line(s)
19. Turbocharger Oil Supply Line(s)
20. Turbocharger Turbine Casing
21. Vibration Damper Mounting Capscrews
22. Manual Service Disconnect
23. High Voltage Interlock Loop
24. High Voltage Connectors/Connections and Harnesses
25. High Voltage Battery System
26. Power Inverter
27. Generator Motor
28. Clutch Pressure Plate

- Follow all safety instructions noted in the procedures
- Follow the manufacturer’s recommendations for cleaning solvents and other substances used during repairs. Some solvents have been identified by government agencies as toxic or carcinogenic. Avoid excessive breathing, ingestion and contact with such substances. Always use good safety practices with tools and equipment
- Provide a clean environment and follow the cleaning instructions specified in the procedures
- The engine or system and its components must be kept clean during any repair. Contamination of the engine, system or components will cause premature wear.
- All components must be kept clean during any repair. Contamination of the components will cause premature wear.
- Perform the inspections specified in the procedures
- Replace all components or assemblies which are damaged or worn beyond the specifications
- Use genuine Cummins new or ReCon® service parts and assemblies

- The assembly instructions have been written to use again as many components and assemblies as possible. When it is necessary to replace a component or assembly, the procedure is based on the use of new Cummins or Cummins ReCon® components. All of the repair services described in this manual are available from all Cummins Distributors and most Dealer locations.
- Follow the specified disassembly and assembly procedures to reduce the possibility of damage to the components.

Welding on a Vessel with an Electronic Controlled Fuel System

CAUTION

Disconnect both the positive (+) and negative (-) battery cables from the low voltage battery before welding on the vehicle. Attach the welder ground cable no more than 0.61 meters [2 feet] from the part being welded. Do not connect the ground clamp of the welder to any of the sensors, wiring harness, electronic control units or the components. Direct welding of any electronic components must not be attempted. Sensors, wiring harness, and electronic control unit should be removed if nearby welding will expose these components to temperatures beyond normal operation. Additionally, all electronic control unit connectors must be disconnected

Complete rebuild instructions are available in the service manual which can be ordered or purchased from a Cummins Authorized Repair Location. Refer to **Service Literature** (**Section L) —** for ordering instructions.

General Cleaning Instructions

Description of Clean

Parts must be free of debris that can contaminate any engine system. This does not necessarily mean they have to appear as new.
Sanding gasket surfaces until the factory machining marks are disturbed adds no value and is often harmful to forming a seal. It is important to maintain surface finish and flatness tolerances to form a quality sealing surface. Gaskets are designed to fill small voids in the specified surface finish.

Sanding gasket surfaces where edge-molded gaskets are used is most often unnecessary. Edge-molded gaskets are those metal carriers with sealing material bonded to the edges of the gasket to seal while the metal portion forms a metal to metal joint for stability. Any of the small amounts of sealing material that can stick to the parts are better removed with a blunt-edged scraper on the spots rather than spending time polishing the whole surface with an air sander or disc.

For those gaskets that do not have the edge molding, nearly all have a material that contains release agents to prevent sticking. Certainly this is not to say that some gaskets are not difficult to remove because the gasket has been in place a long time, has been overheated or the purpose of the release agent has been defeated by the application of some sealant. The object however is just to remove the gasket without damaging the surfaces of the mating parts without contaminating the engine (don’t let the little bits fall where they cannot be removed).

Bead blasting piston crowns until the dark stain is removed is unnecessary. All that is required is to remove the carbon build-up above the top ring and in the ring grooves. There is more information on bead blasting and piston cleaning later in this document.

Cummins Inc. does not recommend sanding or grinding the carbon ring at the top of cylinder liners until clean metal is visible. The liner will be ruined and any signs of a problem at the top ring reversal point (like a dust-out) will be destroyed. It is necessary to remove the carbon ring to provide for easier removal of the piston assembly. A medium bristle, high quality, steel wire wheel that is rated above the rpm of the power tool being used will be just as quick and there will be less damage. Yes, one must look carefully for broken wires after the piston is removed but the wires are more visible and can be attracted by a magnet.

Oil on parts that have been removed from the engine will attract dirt in the air. The dirt will adhere to the oil. If possible, leave the old oil on the part until it is ready to be cleaned, inspected and installed, and then clean it off along with any attracted dirt. If the part is cleaned then left exposed it can have to be cleaned again before installation. Make sure parts are lubricated with clean oil before installation. They do not need to be oiled all over but do need oil between moving parts (or a good lube system priming process conducted before cranking the engine).

Bead blasting parts to remove exterior paint is also usually unnecessary. The part will most likely be painted again so all that needs happen is remove any loose paint.

Abrasive Pads and Abrasive Paper

The keyword here is “abrasive”. There is no part of an engine designed to withstand abrasion. That is they are all supposed to lock together or slide across each other. Abrasives and dirt particles will degrade both functions.

WARNING

Abrasive material must be kept out of or removed from oil passages and parts wear points. Abrasive material in oil passages can cause bearing and bushing failures that can progress to major component damage beyond reuse. This is particularly true of main and rod bearings.

Cummins Inc. does not recommend the use of emery cloth or sand paper on any part of an assembled engine or component including but not limited to removing the carbon ridge from cylinder liners or to clean block decks or counterbores.

Great care must be taken when using abrasive products to clean engine parts, particularly on partially assembled engines. Abrasive cleaning products come in many forms and sizes. All of them contain aluminum oxide particles, silicon carbide, or sand or some other similar hard material. These particles are harder than most of the parts in the engine. Since they are harder, if they are pressed against softer material they will either damage the material or become embedded in it. These materials fall off the holding media as the product is used. If the products are used with power equipment the particles are thrown about the engine. If the particles fall between two moving parts, damage to the moving parts is likely.

If particles that are smaller than the clearance between the parts while they are at rest (engine stopped), but larger than the running clearance then damage will occur when the parts move relative to each other (engine started).

While the engine is running and there is oil pressure, particles that are smaller than the bearing clearance are likely to pass between the parts without damage and be trapped in the oil filter. However, particles larger than the bearing clearance will remove material from one part and can become embedded in one of the parts. Once embedded in one part it will abrade the other part until contact is no longer being made between the two parts. If the damage sufficiently degrades the oil film, the two parts will come into contact resulting in early wear-out or failure from lack of effective lubrication.

Abrasive particles can fly about during cleaning it is very important to block these particles from entering the engine as much as possible. This is particularly true of lubricating oil ports and oil drilling holes, especially those located downstream of the lubricating oil filters. Plug the holes instead of trying to blow the abrasive particles and debris with compressed air because the debris is often simply blown further into the oil drilling.

All old gasket material must be removed from the parts gasket surfaces. However, it is not necessary to clean and polish the gasket surface until the machining marks are erased. Excessive sanding or buffing can damage the gasket surface. Many newer gaskets are of the edge molded type (a steel carrier with a sealing member bonded to the steel). What little sealing material that can adhere is best removed with a blunt-edged scraper or putty knife. Cleaning gasket surfaces where an edge-molded gasket is used with abrasive pads or paper is usually a waste of time.

WARNING

Excessive sanding or grinding the carbon ring from the top of the cylinder liners can damage the liner beyond reuse. The surface finish will be damaged and abrasive particles can be forced into the liner material which can cause early cylinder wear-out or piston ring failures.

Tape off or plug all openings to any component interior before using abrasive pads or wire brushes. If really necessary because of time to use a power tool with abrasive pads, tape the oil drillings closed or use plug and clean as much of the surface as possible with the tool but clean around the oil hole/opening by hand so as to prevent contamination of the drilling. Then remove the tape or plug and clean the remaining area carefully and without the tool. DO NOT use compressed air to blow the debris out of oil drilling on an assembled engine! More likely than not, the debris can be blown further into the drilling. Using compressed air is fine if both ends of the drilling are open but that is rarely the case when dealing with an assembled engine.

Gasket Surfaces

The object of cleaning gasket surfaces is to remove any gasket material, not refinish the gasket surface of the part.

Cummins Inc. does not recommend any specific brand of liquid gasket remover. If a liquid gasket remover is used, check the directions to make sure the material being cleaned will not be harmed.

Air powered gasket scrapers can save time but care must be taken to not damage the surface. The angled part of the scraper must be against the gasket surface to prevent the blade from digging into the surface. Using air powered gasket scrapers on parts made of soft materials takes skill and care to prevent damage. Do not scrape or brush across the gasket surface if at all possible.

Solvent & Acid Cleaning

Several solvent and acid-type cleaners can be used to clean the disassembled engine parts (other than pistons. See Below). Experience has shown that the best results can be obtained using a cleaner that can be heated to 90° to 95° Celsius (180° to 200° Fahrenheit). Kerosene emulsion based cleaners have different temperature specifications, see below. A cleaning tank that provides a constant mixing and filtering of the cleaning solution will give the best results. Cummins Inc. does not recommend any specific cleaners. Always follow the cleaner manufacturer's instructions. Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful not to damage any gasket surfaces. When possible, steam clean the parts before putting them in the cleaning tank.

WARNING

When using solvents, acids, or alkaline materials for cleaning, follow the manufacturers recommendations for use. Wear goggles and protective clothing to reduce the possibility of personal injury.

Experience has shown that kerosene emulsion based cleaners perform the best to clean pistons. These cleaners should not be heated to temperature in excess of 77°C (170°F). The solution begins to break down at temperatures in excess of 82°C (180°F) and will be less effective.

Do not use solutions composed mainly of chlorinated hydrocarbons with cresols, phenols and/or cresylic components. They often do not do a good job of removing deposits from the ring groove and are costly to dispose of properly.

Solutions with a pH above approximately 9.5 will cause aluminum to turn black; therefore do not use high alkaline solutions.

Chemicals with a pH above 7.0 are considered alkaline and those below 7.0 are acidic. As you move further away from the neutral 7.0, the chemicals become highly alkaline or highly acidic.

Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful to not damage any gasket surfaces. When possible use hot high pressure water or steam clean the parts before putting them in the cleaning tank. Removing the heaviest dirt before placing in the tank will allow the cleaner to work more effectively and the cleaning agent will last longer. Rinse all the parts in hot water after cleaning. Dry completely with compressed air. Blow the rinse water from all the cap screw holes and the oil drillings.

If the parts are not to be used immediately after cleaning, dip them in a suitable rust proofing compound. The rust proofing compound must be removed from the parts before assembly or installation on the engine.

Steam Cleaning

Steam cleaning can be used to remove all types of dirt that can contaminate the cleaning tank. It is a good method for cleaning the oil drillings and coolant passages.

WARNING

When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

Do not steam clean the following components:

- Electrical Components
- Wiring Harnesses
- Injectors
- Fuel Pump
- Belts and Hoses
- Bearings (ball or taper roller)
- Electronic Control Module (ECM)
- ECM Connectors
- Dosing Control Unit
- Nox Sensor.

Plastic Bead Cleaning

Cummins Inc. does not recommend the use of glass bead blast or walnut shell media on any engine part. Cummins Inc. recommends using only plastic bead media, part number 3822735 or equivalent on any engine part. Never use sand as a blast media to clean engine parts. Glass and walnut shell media when not used to the media manufacturer's recommendations can cause excess dust and can embed in engine parts that can result in premature failure of components through abrasive wear.

Plastic bead cleaning can be used on many engine components to remove carbon deposits. The cleaning process is controlled by the use of plastic beads, the operating pressure and cleaning time

CAUTION

Do not use bead blasting cleaning methods on aluminum pistons skirts or the pin bores in any piston, piston skirt or piston crown. Small particles of the media will embed in the aluminum or other soft metal and result in premature wear of the cylinder liner, piston rings, pins and pin bores. Valves, turbocharger shafts, etc., can also be damaged. Follow the cleaning directions listed in the procedures.

CAUTION

Do not contaminate wash tanks and tank type solvent cleaners with the foreign material and plastic beads. Remove the foreign material and plastic beads with compressed air, hot high pressure water or steam before placing them in tanks or cleaners. The foreign material and plastic beads can contaminate the tank and any other engine parts cleaned in the tank. Contaminated parts may cause failures from abrasive wear.

Plastic bead blasting media part number 3822735, can be used to clean all piston ring grooves. Do not sure any bead blasting media on piston pin bores or aluminum skirts.

Follow the equipment manufacturer's cleaning instructions. Make sure to adjust the air pressure in the blasting machine to the bead manufacturer's recommendations. Turning up the pressure can move material on the part and cause the plastic bead media to wear out more quickly. The following guidelines can be used to adapt to manufacturer's instructions:

1. Bead size: U.S. size Number 16 — 20 for piston cleaning with plastic bead media, Part Number 3822735
2. Operating Pressure — 270 kPa (40 psi) for piston cleaning. Pressure should not cause beads to break.
3. Steam clean or wash the parts with solvent to remove all of the foreign material and plastic beads after cleaning. Rinse with hot water. Dry with compressed air.

CAUTION

The bead blasting operation must not disturb the metal surface. If the metal surface is disturbed the engine can be damaged due to increased parts clearance or inadequate surface finish on parts that move against other parts.

When cleaning pistons, it is not necessary to remove all the dark stain from the piston. All that is necessary is to remove the carbon on the rim and in the ring grooves. This is best done by directing the blast across the part as opposed to straight at the part. If the machining marks are disturbed by the blasting process, then the pressure is too high or the blast is being held on one spot too long. The blast operation must not disturb the metal surface.

Walnut shell bead blast material is sometimes used to clean ferrous metals (iron and steel). Walnut shell blasting produces a great amount of dust particularly when the pressure if the air pressure on the blasting machine is increased above media manufacturer's recommendation. Cummins Inc. recommends not using walnut shell media to clean engine parts due to the risk media embedment and subsequent contamination of the engine.

Cummins Inc. does not recommend you use glass bead media to clean any engine parts. Glass media is too easily embedded into the material particularly in soft materials and when air pressures greater than media manufacturer's recommend are used. The glass is an abrasive so when it is in a moving part, that part is abrading all the parts in contact with it. When higher pressures are used the media is broken and forms a dust of a very small size that floats easily in the air. This dust is very hard to control in the shop, particularly if only compressed air (and not hot water) is used to blow the media after it is removed from the blasting cabinet (blowing the part off inside the cabinet may remove large accumulations but never removes all the media).

Bead blasting is best used on stubborn dirt/carbon build-up that has not been removed by first steam/higher pressure washing then washing in a heated wash tank. This is particularly true of pistons. Steam and soak the pistons first then use the plastic bead method to safely remove the carbon remaining in the grooves (instead of running the risk of damaging the surface finish of the groove with a wire wheel or end of a broken piston ring. Make sure the parts are dry and oil free before bead blasting to prevent clogging the return on the blasting machine.

Always direct the bead blaster nozzle "across" rather than directly at the part. This allows the bead to get under the unwanted material.

Keep the nozzle moving rather than hold on one place. Keeping the nozzle directed at one-place too long causes the metal to heat up and be moved around. Remember that the spray is not just hitting the dirt or carbon. If the machining marks on the piston groove or rim have been disturbed then there has not been enough movement of the nozzle and/or the air pressure is too high.

Never bead blast valve stems. Tape or use a sleeve to protect the stems during bead blasting. Direct the nozzle across the seat surface and radius rather than straight at them. The object is to remove any carbon build up and continuing to blast to remove the stain is a waste of time.

Fuel System

When servicing fuel system components that can be exposed to potential contaminants, prior to disassembly clean the fittings, mounting hardware and the area around the component.

If the surrounding areas are not cleaned, dirt or contaminants can be introduced into the fuel system. The internal drillings of some injectors are extremely small and susceptible to plugging from contamination. Some fuel injection systems can operate at very high pressures. High pressure fuel can convert simple particles of dirt and rust into a highly abrasive contaminant that can damage the high pressure pumping components and fuel injectors.

Electrical contact cleaner can be used if steam cleaning tools are not available. Use electrical contact cleaner rather than compressed air, to wash dirt and debris away from fuel system fittings. Diesel fuel on exposed fuel system parts attracts airborne contaminants.

Choose lint free towels for fuel system work. Cap and plug fuel lines, fittings, and ports whenever the fuel system is opened. Rust, dirt, and paint can enter the fuel system whenever a fuel line or other component is loosened or removed from the engine. In many instances, a good practice is to loosen a line or fitting to break the rust and paint loose, and then clean off the loosened material.

When removing fuel lines or fittings from a new or newly-painted engine, make sure to remove loose paint flakes/chips that can be created when a wrench contacts painted line nuts or fittings, or when quick disconnect fittings are removed.

Fuel filters are rated in microns. The word micron is the abbreviation for a micrometer, or one millionth of a meter. The micron rating is the size of the smallest particles that will be captured by the filter media. As a reference, a human hair is 76 microns [0.003 in] in diameter. One micron measures 0.001 mm [0.00004 in.]. The contaminants being filtered out are smaller than can be seen with the human eye, a magnifying glass, or a low powered microscope.

The tools used for fuel system troubleshooting and repair are to be cleaned regularly to avoid contamination. Like fuel system parts, tools that are coated with oil or fuel attract airborne contaminants. Remember the following points regarding your fuel system tools:

- Fuel system tools are to be kept as clean as possible.
- Clean and dry the tools before returning them to the tool box.
- If possible, store fuel system tools in sealed containers.
- Make sure fuel system tools are clean before use.

Acronyms and Abbreviations

The following list contains some of the acronyms and abbreviations used in this manual.

ANSI	American National Standards Institute	**IEC**	International Electrotechnical Commission
API	American Petroleum Institute	**km/l**	Kilometers per Liter
ASTM	American Society of Testing and Materials	**kPa**	Kilopascal
BTU	British Thermal Unit	**LNG**	Liquid Natural Gas
BTDC	Before Top Dead Center	**LPG**	Liquified Petroleum Gas
°C	Celsius	**LTA**	Low Temperature Aftercooling
CO	Carbon Monoxide	**MIL**	Malfunction Indicator Lamp
CCA	Cold Cranking Amperes	**MPa**	Megapascal
CARB	California Air Resources Board	**mph**	Miles Per Hour
C.I.B.	Customer Interface Box	**mpq**	Miles Per Quart
C.I.D.	Cubic Inch Displacement	**N•m**	Newton-meter
CNG	Compressed Natural Gas	**NOx**	Mono-Nitrogen Oxides
CPL	Control Parts List	**NG**	Natural Gas
cSt	Centistokes	**O2**	Oxygen
DEF	Diesel Exhaust Fluid	**OBD**	On-Board Diagnostics
DOC	Diesel Oxidation Catalyst	**OEM**	Original Equipment Manufacturer
DPF	Diesel Particulate Filter	**OSHA**	Occupational Safety and Health Administration
ECM	Engine Control Module	**PID**	Parameter Identification Descriptions
EFC	Electronic Fuel Control	**ppm**	Parts Per Million
EGR	Exhaust Gas Recirculation	**psi**	Pounds Per Square Inch
EPA	Environmental Protection Agency	**PTO**	Power Takeoff
°F	Fahrenheit	**REPTO**	Rear Power Take Off
ft-lb	Foot-Pound Force	**RGT**	Rear Gear Train
FMI	Failure Mode Indentifier	**rpm**	Revolutions Per Minute
GVW	Gross Vehicle Weight	**SAE**	Society of Automotive Engineers
Hg	Mercury	**SCA**	Supplemental Coolant Additive
hp	Horsepower	**SCR**	Selective Catalytic Reduction
H_2O	Water	**STC**	Step Timing Control
inHg	Inches of Mercury	**SID**	Subsystem Identification Descriptions
in H_20	Inches of Water	**VDC**	Volts of Direct Current
ICM	Ignition Control Module	**VS**	Variable Speed

Section E – Engine and System Identification

Engine Identification

The engine data plate shows important facts about the engine. The engine serial number and CPL provide data for ordering parts and service. The engine data plate must not be changed unless approved by Cummins Inc.

Refer to the appropriate engine Owners and Maintenance Manual **Procedure 100-001 in Section E,** for the correct engine data plate location and information. Have the following engine data available when communicating with a Cummins authorized repair location.

The following information on the data plate is mandatory when sourcing service parts:

- Engine serial number
- Model
- Horsepower and rpm rating
- CPL
- Emission statement (if applicable).

Engine Diagrams

The illustrations contain information about engine components, filter locations, drain points, and access locations for instrumentation and engine controls. The information and configuration of components shown in these illustrations are of a general nature. Some component locations will vary, depending on applications and installations.

Refer to the appropriate engine Operation and Maintenance Manual, **Procedure 100-002 in Section E**, for the correct engine diagrams.

Cummins Service Engine Model Nomenclature

The Cummins® Service Engine Model Nomenclature procedure describes how engines are identified within Cummins service organization. This method was introduced for models after and including manufacture year 2007.

Section 1 – Operating Instructions

General Information

Correct care of the engine will result in longer life, better performance, and more economical operation.

Use the following procedure for daily maintenance checks. Refer to the appropriate Operation and Maintenance Manual, **Procedure 102-002 in Section 2**.

The new Cummins® engine associated with this manual does not require a”break-in” procedure. While a break-in procedure is not required, a new engine can be more sensitive than a used engine when it comes to improper operation. Before starting the engine for the first time, please familiarize yourself with proper engine operation procedures.

U.S. legislation requires that stationary compression ignition internal combustion engines designated for emergency use are limited to emergency operations and required maintenance and testing.

Normal Starting Procedure

Refer to the appropriate Operation and Maintenance Manual for the Normal Starting Procedure, **Procedure 101-014 in Section 1.**

NOTE: The engine can possibly be equipped with electronic monitoring and controls. These devices and their use are described in separate individual manuals.

Cold Weather Starting

Follow the Normal Starting Procedures in this section in cold weather.

WARNING

Do not use starting fluids with this engine. Use of starting fluid can cause an explosion, fire, personal injury, severe damage to the engine, and property damage.

Starting Procedure after Extended Shutdown or Oil Change

Follow the Normal Starting Procedures in this section in cold weather.

Operating the Engine

Follow the Operating Instructions in the appropriate Operation and Maintenance Manual, **Procedure 101-015 in Section 1**.

Engine Operating Range

Follow the instructions for the Engine Operating Range in the appropriate Operation and Maintenance Manual **Procedure 101-008 in Section 1**.

Engine Shutdown

Follow the engine shutdown procedures in the appropriate Operation and Maintenance Manual, **Procedure 101-009 in Section 1.**

Section 2 – Maintenance Guidelines-Overview

General Information

Cummins Inc. recommends that the system be maintained according to the Maintenance Schedule, **Procedure 102-002 in Section 2,** in the appropriate Operation and Maintenance Manual.

If the system is operating in ambient temperatures below -18°C [0°F] or above 38°C [100°F], perform maintenance at shorter intervals. Shorter maintenance intervals are also required if the system is operated in a dusty environment or if frequent stops are made. For gas fueled generator sets, shorter maintenance intervals are also required, if operating at loads below 70% for prolonged periods. Contact your local Cummins® Authorized Repair Location for recommended maintenance intervals.

Some of these maintenance procedures require special tools or must be completed by qualified personnel. Contact your local Cummins® Authorized Repair Location for detailed information.

If your system is equipped with a component or accessory not manufactured or supplied by Cummins Inc., refer to the component manufacturer’s maintenance recommendations.

OEM supplied equipment and components can impact on the performance and reliability of the engine if they are not correctly maintained.

Tool Requirements

Most of the maintenance operations described in this manual can be performed with common hand tools, metric and SAE wrenches, sockets, and screwdrivers.

Each manual has a list of special service tools required for some of the maintenance operations in each Operation and Maintenance Manual, **Procedure 102-004 in Section 2.**

Maintenance Schedule

Perform maintenance at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance. Maintenance Schedules are provided in each Operation and Maintenance Manual in **Procedure 102-002 in Section 2.**

Maintenance Record Form

A maintenance record form is provided to record service intervals in each Operation and Maintenance Manual, **Procedure 102-001 in Section 2.** The same record is used for all engines.

Section 3 – Maintenance Procedures at Daily Intervals

Preventative maintenance begins with day-to-day awareness of the system. Before starting the system, check the appropriate fluid levels and look for items listed below:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Worn or damage low and high voltage harnesses
- Any change in system appearance.
- Odor of fuel
- Odor of electronic devices

System Operation Report

The system must be maintained in top mechanical and electronic condition if the operator is to get optimum satisfaction from its use. The maintenance department needs daily running reports from the operator to make necessary adjustments in the time allocated. The daily running report also helps to make provisions for more extensive maintenance work as the reports indicate the necessity. Comparison and intelligent interpretation of the daily report, along with a practical follow-up action, will eliminate most failures and emergency repairs.

Report to the maintenance department any of the following conditions that may apply:

- Low lubricating oil pressure
- Low power
- Power increases or engine surge
- Erratic or no accelerator control or response
- Any warning lights flashing or staying on

- Abnormal water or oil temperature
- Unusual system noise
- Excessive smoke
- Excessive use of coolant, fuel, or lubricating oil
- Any fuel, coolant, or lubricating oil leaks
- Loose or damaged parts
- Worn or damaged belts
- Worn or damaged low or high voltage harnesses

Unusual System Noise

During daily maintenance checks, listen for any unusual system noise(s) that can indicate that service is required.

Follow the **Maintenance Procedures at Daily Intervals in Section 3**, in the appropriate Operation and Maintenance Manual.

Section 4 – Maintenance Procedures

Maintenance procedures and intervals are different for each engine. Information for each procedure and interval can be found on line at https://quickserve.cummins.com/qs2/portal/index.html, in the appropriate Operation and Maintenance Manual listed below.

C Power/C Safe Base Engine Bulletin Numbers			
Genset	**Operation and Maintenance Bulletin #**	**Troubleshooting and Repair Bulletin #**	**Parts Manual**
6B CP/6B CS	402138	3666087	4056558
6C CP/6C CS	3810248	3666003	4056514
QSM11 DM	2883583	3666266	3672153
K19 CP	3666077	3666013	4056491
K38 CP	3810497	3810497	4056593
K50 CP	3810497	3810497	4056506

Section 5 – Adjustment, Repairs and Replacement

Adjustments, Repairs and Replacement of parts are different for each engine. Information for each procedure and interval can be found in **Section 5** of the appropriate Operation and Maintenance Manual.

Section D – System Diagrams

The following drawings show the flow through the engine systems. Although the parts can be different for various applications and installations, the flow remains the same. The systems shown are:

- Fuel system
- Lubricating oil system
- Coolant system
- Intake air system
- Exhaust system.

Knowledge of the engine systems can help in troubleshooting, servicing, and general maintenance of the engine.

Refer to **Section D** in the appropriate engine Operation and Maintenance Manual for the system diagrams.

Section L – Service Literature

For additional service literature, literature ordering location and a customized parts catalog refer to **Section L** in the appropriate engine Operation and Maintenance Manual.

Section S – Service Assistance

For routine service and parts assistance, emergency and technical service, help in problem solving, division and regional offices, distributors and branches, international regional offices and distributors, refer to **Section S** in the appropriate manual.

Section SS – Seasonal Storage

This section includes procedures for short term (shorter than 6 months) and long term (longer than 6 months) storage for marine engines. Follow the **Long Term Storage Procedure – 000-005** and the **Short Term Storage Procedure – 000-006** in the Operation and Maintenance Manual in **Section SS** or contact the nearest Cummins® Authorized Repair Location for additional information.

Section TS – Trouble Shooting Symptoms

This guide describes some typical operating problems, their causes, and some acceptable corrections to those problems. Unless noted otherwise, the problems listed are those which an operator can diagnose and repair.

Follow the suggestions below for troubleshooting:

- Study the complaint thoroughly before acting
- Refer to the engine system diagrams
- Do the easiest and most logical things first
- Find and correct the cause of the complaint

Refer to the appropriate Operation and Maintenance Manual – **Section TS** for the trouble shooting trees for each engine.

Section V – Maintenance Specifications

This section has the general engine specifications, fuel, lubricating oil, cooling system, air intake, exhaust, and electrical system specifications, along with fuel filter, lubricating oil, coolant recommendations. This section also includes fraction, decimal, and millimeter conversion charts, newton-meter to foot pound conversion table, torque values and belt tension charts.

Refer to the proper Operation and Maintenance Manual for the specifications and values for the engine.

Section W – Cummins C Power/C Safe Warranty

(Cummins Warranty for Marine Generator Sets - #4082004)

Coverage

Product Warranted

This warranty applies to new marine generator sets sold by Cummins Inc., herein after "Cummins", branded as C Power and C Safe products and used in marine generator set applications anywhere in the world where Cummins approved service is available* and delivered to the first user on or after January 1, 2006. This warranty excludes all generator sets branded and sold as Onan or Cummins Power Generation. The 'Product' consists of a new Cummins Engine, alternator and accessories, which are approved and supplied by Cummins, have a Cummins part number and which are either fitted by Cummins or a Cummins authorized distributor.

Base Generator Set Warranty

This warranty covers failures of the Product, under normal use and service, which result from defects in Cummins material or factory workmanship (Warrantable Failure). Coverage begins with the sale of the Engine by Cummins and continues for one year with unlimited hours. The Duration commences on either the date of delivery of the Product to the first end-user, or the date the unit is first leased, rented or loaned, or when the product has been operated for 50 hours, whichever occurs first. The warranty is valid subject to appropriate usage under the generator set power rating below:

Prime Power

Engines with this rating are available for an unlimited number of hours per year in variable load applications. Variable load is not to exceed a 70 percent average of the Prime Power rating during any operating period of 250 hours. Total operating time at 100 percent Prime Power shall not exceed 500 hours per year.

Equipment Covered by the Base Warranty

The "Generator Set" consists of:

1. The engine and all components mounted on it with a valid Cummins part number.
2. All items with a Cummins part number mounted on the Generator Set and/or generator set base frame as shipped from the producing factory.
3. Cummins supplied Generator set control panel (GCP) including items shipped loose which are part of the GCP.

Engine Extended Major Components Warranty

The Extended Major Components Warranty applies to engines other than B and C Series used in Cummins branded generator sets. It covers Warrantable Failures of the engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts). Bushing and bearing failures are not covered. This coverage begins with the expiration of the Base Generator Set Warranty and ends after three years or 10,800 hours of operation, whichever occurs first, from the date of delivery to the first end-user, or the date the unit is first leased, rented, or loaned, or when the Product has been operated for 50 hours, whichever occurs first.

Consumer Products

This warranty on Consumer Products in the United States is a limited warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the product.

In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

These warranties are made to all Owners in the chain of distribution and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

During Base Generator Set Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Product resulting from a Warrantable Failure when performed during normal business hours. All labor costs will be paid in accordance with Cummins published Standard Repair Time guidelines. When it is necessary for mechanics to make on-site warranty repairs, Cummins will cover reasonable travel expenses, including meals, mileage and lodging, for mechanics to travel to and from the repair dock. Cummins will pay for the lubricating oil, antifreeze, filter elements, and other maintenance items that are not reusable due to the Warrantable Failure. Cummins will pay for reasonable labor costs for Generator Set removal and reinstallation when necessary to repair a Warrantable Failure.

During the Engine Extended Major Components Warranty

Cummins will pay for the repair or, at its option, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner Responsibilities

(During base generator set warranty)

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements, and other maintenance items replaced during warranty repairs unless such items are not reusable due to the Warrantable Failure.

During the Engine Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor cost for Engine removal and reinstallation. When Cummins elects to repair a part instead of replacing it, the Owner is not responsible for the labor needed to repair the part. Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Part. Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during repair of a warrantable failure.

During the Base Generator Set and Engine Extended Major Components Warranties

Owner is responsible for the operation and maintenance of the Product as specified in the applicable Cummins Operation and Maintenance Manual including the provision of Cummins approved fuels, oils and coolant. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer, or other repair location approved by Cummins of any Warrantable Failure and makes the Generator Set available for repair by such facility. Locations in the United States and Canada are listed in the Cummins U. S. and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

In the event of any Product failure, Owner is responsible for the cost of towing the boat to the repair dock and for all associated docking and harbor charges.

Owner is responsible for communication expenses, meals, lodging, and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for maintaining the Engine hour meter in good working order at all times and ensuring that the hour meter accurately reflects the total hours of operation of the Product. Owner is responsible for the costs to investigate complaints, unless the problem is caused by a defect in Cummins material or factory workmanship. Owner is responsible for non-Engine repairs, “downtime” expensed, cargo damage, fines, all applicable taxes, all business costs, and other losses resulting from a Warrantable Failure.

CUMMINS RIGHT TO FAILED COMPONENTS

Failed components claimed under warranty remain the property of Cummins Inc. Cummins has the right to reclaim any failed component that has been replaced under warranty. Cummins
Inc. reserves the right to interrogate Electronic Control Module (ECM) data for purposes of failure analysis.

Emission Warranty

Products Warranted

This Emission Warranty applies to new Engines sold by Cummins that are used in the United States** in marine propulsion and marine auxiliary applications and that are required by United States CFR 94.1107 to have an Emission Warranty. This Warranty applies to Engines built on or after January 1, 2004 that are certified to CFR 94.1107.

Coverage

Cummins warrants to the ultimate purchaser and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins, with all United States Federal emission regulations applicable at the time of manufacture and that it is free from defects in material or factory workmanship which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 5,000 hours of operation, whichever occurs first, as measured from the date of delivery of the engine to the first user, or the date the unit is first leased, rented, or loaned, or when the Engine has been operated for 50 hours, whichever occurs first, or (B) The Base Engine Warranty.

Limitations

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; over fueling; over speeding; lack of maintenance of cooling, lubrication or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to the Engine.

Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, dirt or other contaminants in the fuel or oil. Cummins is not responsible for failures resulting from:

1. Use or application of the Product inconsistent with its rating designation set forth above.
2. Incorrect Installation.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that oil consumption exceeds Cummins published standards. Cummins is not responsible for failures of maintenance components supplied by Cummins beyond 90 days after the coverage duration start date. Maintenance components include, but are not limited to: sea water pump impellers; zinc plugs; oil filters; fuel filters; air-filters; water filters; fuel/water separator filters; expansion tank pressure caps.

Failures of belts and hoses supplied by Cummins are not covered beyond 90 days after the date of delivery of the Product to; the first user, or the date the unit is first leased, rented or loaned, or when the product has been operated for 50 hours, whichever occurs first. Except for the accessories noted previously, Cummins does not warrant accessories which bear the name of another company. Cummins parts, Cummins approved rebuilt parts, or repaired parts. Cummins is not responsible for failures resulting from the use of parts not supplied by Cummins.

A new Cummins or Cummins-approved rebuilt part used to replace a warranted part assumes the identity of the Warranted Part it replaces and is entitled to the remaining coverage there under.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS. CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. THESE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE GENERATOR SETS. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In the United States** and Canada, this warranty gives you specific legal rights. You may also have other rights which vary from state to state.

Outside the United States** and Canada, in case of consumer sales, in some countries the
Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the Owner may have against third parties.

* Locations in the United States and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

** United States includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico, and the U. S. Virgin Islands.

Last Modified: 13-Nov-2006

Section AS – Alternator Servicing

Each genset has a different alternator which has a manual available on the marine website, marine.cummins.com under the Genset tab – Publications and Manuals. Below is a list matching the engine packages with an alternator.

Engine	Alternator Model Designation
6B C Power and C Safe	UCM274E
6C C Power and C Safe	UCM274H
QSM11 C Power	HCM434F1
K19 C Power	HCM534E
K38 C Power	PM734B2
K50 C Power	PM734D2

Section C – Control Panels

There are three different control panel options available for the gensets, each one having its own procedures for starting and stopping the genset. Information on how each panel operates is available on the marine website at marine.cummins.com, under the Genset tab - Publications and Manuals.