

Operator Manual

Generator Set

6B Engine with PowerCommand® 1.2 Control

C90 D5

C90 D5 (Spec E)

C80 D6

C80 D6 (Spec E)

C100 D6

C100 D6 (Spec E)

C110 D5

C110 D5 (Spec E)

C135 D6

C135 D6 (Spec E)

C150 D5

C150 D5 (Spec E)

C170 D5

C170 D5 (Spec E)

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1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS. This manual contains important instructions that should be followed during installation and maintenance of the generator set and batteries.

Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

1.1 Warning, Caution, and Note Styles Used in This Manual

The following safety styles and symbols found throughout this manual indicate potentially hazardous conditions to the operator, service personnel, or equipment.

 DANGER
<i>Indicates a hazardous situation that, if not avoided, will result in death or serious injury.</i>
 WARNING
<i>Indicates a hazardous situation that, if not avoided, could result in death or serious injury.</i>
 CAUTION
<i>Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.</i>
NOTICE
Indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

1.2 General Information

This manual should form part of the documentation package supplied by Cummins with specific generator sets. In the event that this manual has been supplied in isolation please contact your authorized distributor.

NOTICE
It is in the operator's interest to read and understand all warnings and cautions contained within the documentation relevant to the generator set, its operation and daily maintenance.

1.2.1 General Safety Precautions

 WARNING
<i>Hot Pressurized Liquid</i> <i>Contact with hot liquid can cause severe burns.</i> <i>Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.</i>

⚠ WARNING***Moving Parts***

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

⚠ WARNING***Toxic Hazard***

Used engine oils have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not ingest, breathe the fumes, or contact used oil when checking or changing engine oil. Wear protective gloves and face guard.

⚠ WARNING***Electrical Generating Equipment***

Incorrect operation can cause severe personal injury or death.

Do not operate equipment when fatigued, or after consuming any alcohol or drug.

⚠ WARNING***Toxic Gases***

Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not breathe in or come into contact with exhaust gases.

⚠ WARNING***Combustible Liquid***

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death.

Do not store fuel, cleaners, oil, etc., near the generator set.

⚠ WARNING***High Noise Level***

Generator sets in operation emit noise, which can cause hearing damage.

Wear appropriate ear protection at all times.

⚠ WARNING***Hot Surfaces***

Contact with hot surfaces can cause severe burns.

The unit is to be installed so that the risk of hot surface contact by people is minimized. Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

⚠ WARNING***Electrical Generating Equipment***

Incorrect operation and maintenance can result in severe personal injury or death

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

⚠ WARNING**Toxic Hazard**

Ethylene glycol, used as an engine coolant, is toxic to humans and animals.

Wear appropriate PPE. Clean up coolant spills and dispose of used coolant in accordance with local environmental regulations.

⚠ WARNING**Combustible Liquid**

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death.

Do not use combustible liquids like ether.

⚠ WARNING**Automated Machinery**

Accidental or remote starting of the generator set can cause severe personal injury or death.

Isolate all auxiliary supplies and use an insulated wrench to disconnect the starting battery cables (negative [-] first).

⚠ WARNING**Fire Hazard**

Materials drawn into the generator set are a fire hazard. Fire can cause severe burns or death.

Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

⚠ WARNING**Fire Hazard**

Accumulated grease and oil are a fire hazard. Fire can cause severe burns or death.

Keep the generator set and the surrounding area clean and free from obstructions. Repair oil leaks promptly.

⚠ WARNING**Fall Hazard**

Falls can result in severe personal injury or death.

Make sure that suitable equipment for performing tasks at height are used in accordance with local guidelines and legislation.

⚠ WARNING**Fire Hazard**

Materials drawn into the generator set are a fire hazard. Fire can cause severe burns or death.

Keep the generator set and the surrounding area clean and free from obstructions.

NOTICE

Keep multi-type ABC fire extinguishers close by. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in the applicable region.)

NOTICE

Before performing maintenance and service procedures on enclosed generator sets, make sure the service access doors are secured open.

NOTICE

Stepping on the generator set can cause parts to bend or break, leading to electrical shorts, or to fuel, coolant, or exhaust leaks. Do not step on the generator set when entering or leaving the generator set room.

1.3 Generator Set Safety Code

Before operating the generator set, read the manuals and become familiar with them and the equipment. Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

⚠ WARNING***Electrical Generating Equipment***

Incorrect operation and maintenance can result in severe personal injury or death.

Read and follow all Safety Precautions, Warnings, and Cautions throughout this manual and the documentation supplied with the generator set.

1.3.1 Moving Parts Can Cause Severe Personal Injury or Death

- Keep hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect the battery charger from its AC source, then disconnect the starting batteries using an insulated wrench, negative (–) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps; keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts.
- If any adjustments must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

1.3.2 Positioning of Generator Set

The generator set should be placed on level ground with adequate open space around it. The immediate area around the generator set should be free of any flammable material.

NOTICE

Access or service doors must be closed and locked before repositioning, and they must remain locked during transportation and siting.

NOTICE

The generator set is capable of operating at inclines of up to +/- 2.5 degrees.

1.3.3 Moving the Generator Set

WARNING

Heavy Load

Incorrect lifting or repositioning can cause severe personal injury or death.

Make sure that only suitably trained and experienced personnel transport and handle generator sets and associated components.

WARNING

Heavy Load

Incorrect lifting or repositioning can cause severe personal injury or death.

Do not lift the generator set by attaching to the engine or alternator lifting points. Do not stand under or near the generator set when lifting.

WARNING

Mechanical Hazard

Failed components may be ejected or operate incorrectly which can cause severe personal injury or death.

Do not climb the generator set; this may damage critical parts.

NOTICE

Make sure that any shipping brackets supplied with the generator set are fitted, before moving the generator set. Failure to install the shipping brackets before moving may result in damage to the generator set.

NOTICE

Access or service doors must be closed and locked before repositioning, and they must remain locked during transportation and siting.

It is essential that there are sufficient trained and experienced personnel in attendance to make sure the lifting and transportation of the generator set is undertaken in a safe and appropriate manner, and in accordance to local guidelines and legislation.

Before lifting the generator set, lifting points, angle of slings, mass, access to intended site, and the distance of movement should all be taken into account when organizing a suitable crane/hoist. Consult the generator set information supplied with the generator set for details of dimensions and mass.

- Make sure that the crane operating area is able to support the mass of the crane and the generator set.
- Make sure the equipment used for lifting is adequate to support the weight of the generator set.
- Attach the lifting device to the lifting points only using suitable shackles, chains, and spreader bars.
- Slowly tighten the slings. Inspect the lifting attachments before commencing a full lift to make sure they are attached correctly.
- Hoist the generator set slowly using the indicated lifting points only.
- Guide the generator set with ropes at a safe distance to prevent uncontrolled rotation when positioning the generator set.
- Move the generator set to the desired location and place in position, bringing the set down slowly.
- Loosen the slings; unhook and remove the shackles.

1.3.4 Positioning a Generator Set Using a Forklift Truck

⚠ WARNING**Heavy Load**

Incorrect lifting or repositioning can cause severe personal injury or death.

Make sure that only suitably trained and experienced personnel transport and handle generator sets and associated components.

⚠ WARNING**Heavy Load**

Incorrect lifting or repositioning can cause severe personal injury or death.

Do not attempt to lift a generator set with an undersized forklift truck.

NOTICE

Access or service doors must be closed and locked before repositioning, and they must remain locked during transportation and siting.

When using a forklift truck to transport/position the generator set, the dimensions, mass, and route must be taken into account when selecting an appropriate lifting truck.

It is essential that there are sufficient trained and experienced personnel in attendance to make sure the lifting and transportation of the generator set is undertaken in a safe and appropriate manner.

1. Insert the arms of the forklift into the forklift pockets. Make sure the generator set completely rests on the forklift arms.
2. Lift and handle the equipment slowly.
3. Lower the generator set in position.

1.4 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death

⚠ WARNING**Electric Shock Hazard**

Voltages and currents present an electrical shock hazard that can cause severe burns or death.

Contact with exposed energized circuits with potentials of 50 Volts AC or 75 Volts DC or higher can cause electrical shock and electrical arc flash. Refer to standard NFPA 70E or equivalent safety standards in corresponding regions for details of the dangers involved and for the safety requirements.

Guidelines to follow when working on de-energized electrical systems:

- Use proper PPE. Do not wear jewelry and make sure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- De-energize and lockout/tagout electrical systems prior to working on them. Lockout/Tagout is intended to prevent injury due to unexpected start-up of equipment or the release of stored energy. Please refer to the lockout/tagout section for more information.
- De-energize and lockout/tagout all circuits and devices before removing any protective shields or making any measurements on electrical equipment.
- Follow all applicable regional electrical and safety codes.

Guidelines to follow when working on energized electrical systems:

NOTICE

It is the policy of Cummins Inc. to perform all electrical work in a de-energized state. However, employees or suppliers may be permitted to occasionally perform work on energized electrical equipment only when qualified and authorized to do so and when troubleshooting, or if de-energizing the equipment would create a greater risk or make the task impossible and all other alternatives have been exhausted.

NOTICE

Exposed energized electrical work is only allowed as per the relevant procedures and must be undertaken by a Cummins authorized person with any appropriate energized work permit for the work to be performed while using proper PPE, tools and equipment.

In summary:

- Do not tamper with or bypass interlocks unless you are authorized to do so.
- Understand and assess the risks - use proper PPE. Do not wear jewelry and make sure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- Make sure that an accompanying person who can undertake a rescue is nearby.

1.4.1 AC Supply and Isolation

NOTICE

Local electrical codes and regulations (for example, *BS EN 12601:2010 Reciprocating internal combustion engine driven generating sets*) may require the installation of a disconnect means for the generator set, either on the generator set or where the generator set conductors enter a facility.

NOTICE

The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations. This equipment must be earthed (grounded).

It is the sole responsibility of the customer to provide AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box; these must comply with local electrical codes and regulations. Refer to the wiring diagram supplied with the generator set.

The disconnecting device is not provided as part of the generator set, and Cummins accepts no responsibility for providing the means of isolation.

1.5 Fuel and Fumes Are Flammable

Fire, explosion, and personal injury or death can result from improper practices.

- Do not fill fuel tanks while the engine is running unless the tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.

- Make sure all fuel supplies have a positive shutoff valve.
- Make sure the battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

1.5.1 Spillage

Any spillage that occurs during fueling, oil top-off, or oil change must be cleaned up before starting the generator set.

1.5.2 Fluid Containment

NOTICE

Where spillage containment is not part of a Cummins supply, it is the responsibility of the installer to provide the necessary containment to prevent contamination of the environment, especially water courses and sources.

If fluid containment is incorporated into the bedframe, it must be inspected at regular intervals. Any liquid present should be drained out and disposed of in line with local health and safety regulations. Failure to perform this action may result in spillage of liquids which could contaminate the surrounding area.

Any other fluid containment area must also be checked and emptied, as described above.

1.5.3 Do Not Operate in Flammable and Explosive Environments

Flammable vapor can cause an engine to over speed and become difficult to stop, resulting in possible fire, explosion, severe personal injury, and death. Do not operate a generator set where a flammable vapor environment can be created, unless the generator set is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the generator set are solely responsible for operating the generator set safely. Contact your authorized Cummins distributor for more information.

1.6 Exhaust Gases Are Deadly

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas, and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust system daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Make sure the unit is well ventilated.

1.6.1 Exhaust Precautions

WARNING

Hot Exhaust Gases

Contact with hot exhaust gases can cause severe burns.

Wear personal protective equipment when working on equipment.

⚠ WARNING**Hot Surfaces**

Contact with hot surfaces can cause severe burns.

The unit is to be installed so that the risk of hot surface contact by people is minimized. Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

⚠ WARNING**Toxic Gases**

Inhalation of exhaust gases can cause asphyxiation and death.

Pipe exhaust gas outside and away from windows, doors, or other inlets to buildings. Do not allow exhaust gas to accumulate in habitable areas.

⚠ WARNING**Fire Hazard**

Contaminated insulation is a fire hazard. Fire can cause severe burns or death.

Remove any contaminated insulation and dispose of it in accordance with local regulations.

The exhaust outlet may be sited at the top or bottom of the generator set. Make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position. Position the exhaust away from flammable materials - in the case of exhaust outlets at the bottom, make sure that vegetation is removed from the vicinity of the exhaust.

The exhaust pipes may have some insulating covers fitted. If these covers become contaminated they must be replaced before the generator set is run.

To minimize the risk of fire, make sure the following steps are observed:

- Make sure that the engine is allowed to cool thoroughly before performing maintenance or operation tasks.
- Clean the exhaust pipe thoroughly.

1.7 Earth Ground Connection

The neutral of the generator set may be required to be bonded to earth ground at the generator set location, or at a remote location, depending on system design requirements. Consult the engineering drawings for the facility or a qualified electrical design engineer for proper installation.

NOTICE

The end user is responsible to make sure that the ground connection point surface area is clean and free of rust before making a connection.

NOTICE

The end user is responsible for making sure that an earthing arrangement that is compliant with local conditions is established and tested before the equipment is used.

1.8 Decommissioning and Disassembly

NOTICE
Decommissioning and disassembly of the generator set at the end of its working life must comply with local guidelines and legislation for disposal/recycling of components and contaminated fluids. This procedure must only be carried out by suitably trained and experienced service personnel. For more information contact your authorized distributor.

2 Introduction

WARNING

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Make sure that only a trained and experienced electrician makes generator set electrical output connections, in accordance with the installation instructions and all applicable codes.

WARNING

Electrical Generating Equipment

Faulty electrical generating equipment can cause severe personal injury or death.

Generator sets must be installed, certified, and operated by trained and experienced person in accordance with the installation instructions and all applicable codes.

2.1 About This Manual

The purpose of this manual is to provide the users with sound, general information. It is for guidance and assistance with recommendations for correct and safe procedures. Cummins 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 policy of continuous development and improvement, information may change at any time without notice. The users should therefore make sure that before commencing any work, they have the latest information available. The latest version of this manual is available on QuickServe Online (<https://quickserve.cummins.com>).

Users are respectfully advised that, in the interests of good practice and safety, it is their responsibility to employ competent persons to carry out any installation work. Consult your authorized distributor for further installation information. It is essential that the utmost care is taken with the application, installation, and operation of any engine due to their potentially hazardous nature. Careful reference should also be made to other Cummins literature. A generator set must be operated and maintained properly for safe and reliable operation.

For further assistance, contact your authorized distributor.

2.2 Schedule of Abbreviations

This list is not exhaustive. For example, it does not identify units of measure or acronyms that appear only in parameters, event/fault names, or part/accessory names.

AmpSentry, INSITE, and InPower are trademarks of Cummins Inc. PowerCommand is a registered trademark of Cummins Inc.

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
AC	Alternating Current	LED	Light-emitting Diode
AMP	AMP, Inc., part of Tyco Electronics	LTS	Long Term Storage
ANSI	American National Standards Institute	LVRT	Low Voltage Ride Through
ASOV	Automatic Shut Off Valve	MFM	Multifunction Monitor

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
ASTM	American Society for Testing and Materials (ASTM International)	Mil Std	Military Standard
ATS	Automatic Transfer Switch	MLD	Masterless Load Demand
AVR	Automatic Voltage Regulator	NC	Normally Closed
AWG	American Wire Gauge	NC	Not Connected
CAN	Controlled Area Network	NFPA	National Fire Protection Agency
CB	Circuit Breaker	NO	Normally Open
CE	Conformité Européenne	NWF	Network Failure
CFM	Cubic Feet per Minute	OEM	Original Equipment Manufacturer
CGT	Cummins Generator Technologies	OOR	Out of Range
CMM	Cubic Meters per Minute	OORH / ORH	Out of Range High
CT	Current Transformer	OORL / ORL	Out of Range Low
D-AVR	Digital Automatic Voltage Regulator	PB	Push Button
DC	Direct Current	PCC	PowerCommand® Control
DEF	Diesel Exhaust Fluid	PGI	Power Generation Interface
DPF	Diesel Particulate Filter	PGN	Parameter Group Number
ECM	Engine Control Module	PI	Proportional/Integral
ECS	Engine Control System	PID	Proportional / Integral / Derivative
EMI	Electromagnetic interference	PLC	Programmable Logic Controller
EN	European Standard	PMG	Permanent Magnet Generator
EPS	Engine Protection System	PPE	Personal Protective Equipment
E-Stop	Emergency Stop	PT	Potential Transformer
FAE	Full Authority Electronic	PTC	Power Transfer Control
FMI	Failure Mode Identifier	PWM	Pulse-width Modulation
FRT	Fault Ride Through	RFI	Radio Frequency Interference
FSO	Fuel Shutoff	RH	Relative Humidity
Genset	Generator Set	RMS	Root Mean Square
GCP	Generator Control Panel	RTU	Remote Terminal Unit
GND	Ground	SAE	Society of Automotive Engineers
LCT	Low Coolant Temperature	SCR	Selective Catalytic Reduction
HMI	Human-machine Interface	SPN	Suspect Parameter Number
IC	Integrated Circuit	SWL	Safe Working Load
ISO	International Organization for Standardization	SW_B+	Switched B+

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
LBNG	Lean-burn Natural Gas	UL	Underwriters Laboratories
LCD	Liquid Crystal Display	UPS	Uninterruptible Power Supply

2.3 Related Literature

Before any attempt is made to operate the generator set, the operator should take time to read all of the manuals supplied with the generator set, and to familiarize themselves with the warnings and operating procedures.

CAUTION

A generator set must be operated and maintained properly if you are to expect safe and reliable operation. The Operator manual includes a maintenance schedule and a troubleshooting guide .

The Health and Safety manual must be read in conjunction with this manual for the safe operation of the generator set:

- Health and Safety Manual (0908-0110)

The relevant manuals appropriate to your generator set are also available, the documents below are in English:

- Operator Manual PC1.2 (A035P105)
- Installation Manual (A035N982)
- Generator Set Service manual (A040K288)
- Controller Service Manual for PC1.2 (A034L440)
- Engine Service Manual (A024J818)
- Parts Manual for C90 D5, C90 D5 (Spec E), C110 D5, C110 D5 (Spec E), C80 D6, C80 D6 (Spec E), C100 D6, C100 D6 (Spec E) - (A035J031)
- Parts Manual for C135 D6, C135 D6 (Spec E), C150 D5, C150 D5 (Spec E), C170 D5, C170 D5 (Spec E) -(A043L962)
- Recommended Spares List (RSL) for C90 D5, C90 D5 (Spec E) (A040P080)
- Recommended Spares List (RSL) for C110 D5, C110 D5 (Spec E) (A040P082)
- Recommended Spares List (RSL) for C80 D6, C80 D6 (Spec E) (A040P085)
- Recommended Spares List (RSL) for C100 D6, C100 D6 (Spec E) (A041A670)
- Recommended Spares List (RSL) for C135 D6, C135 D6 (Spec E) (A043L970)
- Recommended Spares List (RSL) for C150 D5, C150 D5 (Spec E) (A043L972)
- Recommended Spares List (RSL) for C170 D5, C170 D5 (Spec E) (A043L974)
- Standard Repair Times -Engine- CQ Family (0900-0909)
- Standard Repair Times - Control PC1.2- EH Family (A028Z371)
- Global Commercial Warranty Statement (A028U870)

Contact your authorized distributor for more information regarding related literature for this product.

2.4 After Sales Services

Cummins offers a full range of maintenance and warranty services.

2.4.1 Maintenance

WARNING

Electrical Generating Equipment

Incorrect operation and maintenance can result in severe personal injury or death

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

For expert generator set service at regular intervals, contact your local distributor. Each local distributor offers a complete maintenance contract package covering all items subject to routine maintenance, including a detailed report on the condition of the generator set. In addition, this can be linked to a 24-hour call-out arrangement, providing year-round assistance if necessary. Specialist engineers are available to maintain optimum performance levels from generator sets. Maintenance tasks should only be undertaken by trained and experienced technicians provided by your authorized distributor.

2.4.2 Warranty

For details of the warranty coverage for your generator set, refer to the *Global Warranty Statement* listed in the Related Literature section.

In the event of a breakdown, prompt assistance can normally be given by factory trained service technicians with facilities to undertake all minor and many major repairs to equipment on site.

Extended warranty coverage is also available.

For further warranty details, contact your authorized service provider.

NOTICE

Damage caused by failure to follow the manufacturer's recommendations will not be covered by the warranty. Please contact your authorized service provider.

2.4.2.1 Warranty Limitations

For details of the warranty limitations for your generator set, refer to the warranty statement applicable to the generator set.

2.4.3 How to Obtain Service

When a product requires servicing, contact the nearest Cummins distributor. To locate the distributor, refer to www.cummins.com/support and select Distributor Locator. When contacting the distributor, always supply the complete model, specification, and serial number as shown on the nameplate.

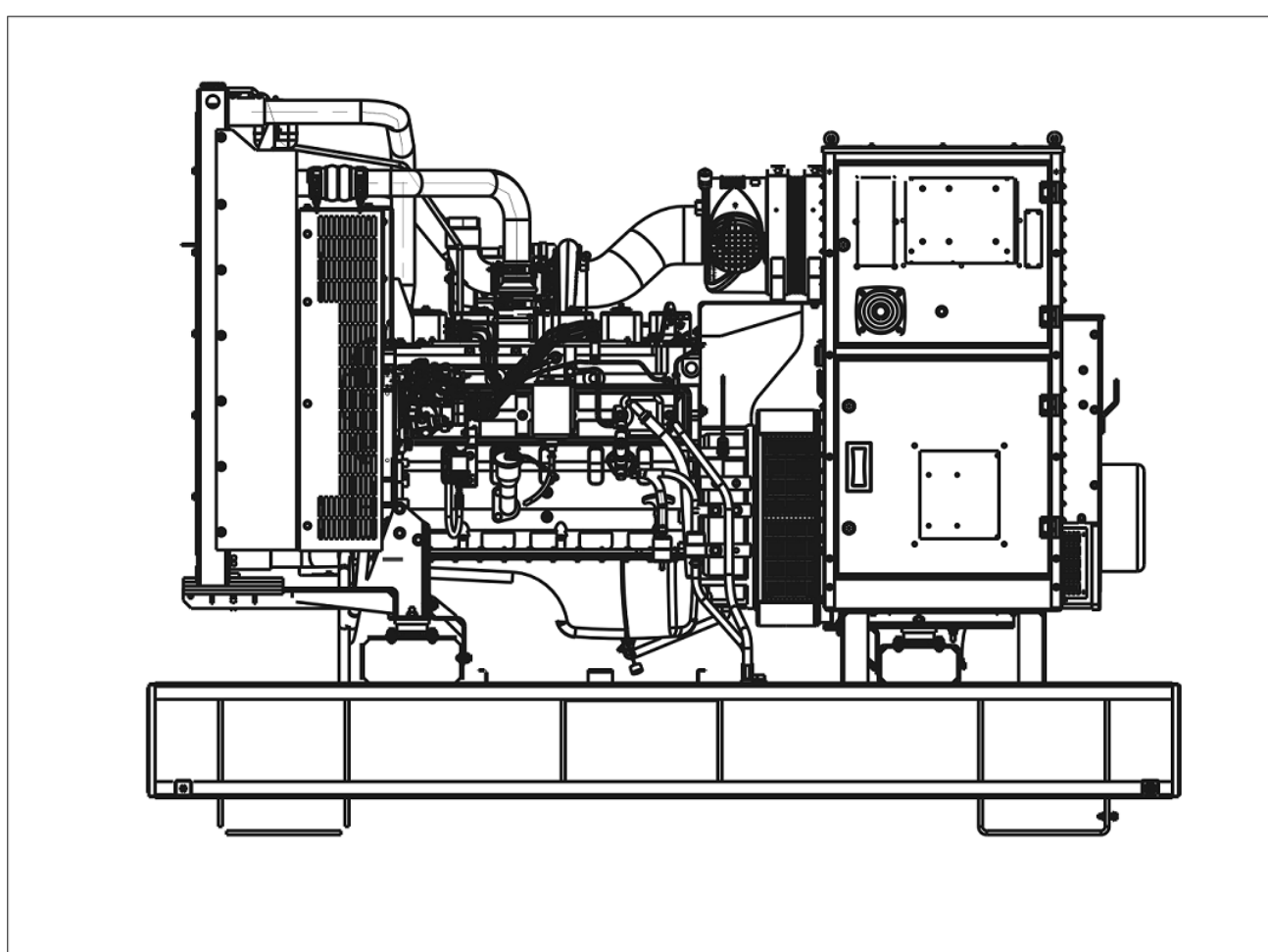


FIGURE 2. 6B ENGINE GENERATOR SET

3.3 Generator Set Rating

Refer to the generator set nameplate for generator set rating. Refer to [Section 5.4 on page 46](#) for operation at temperatures or altitudes above those stated on the nameplate.

3.4 Engine

For additional engine specific information, refer to the relevant engine manual for your generator set.

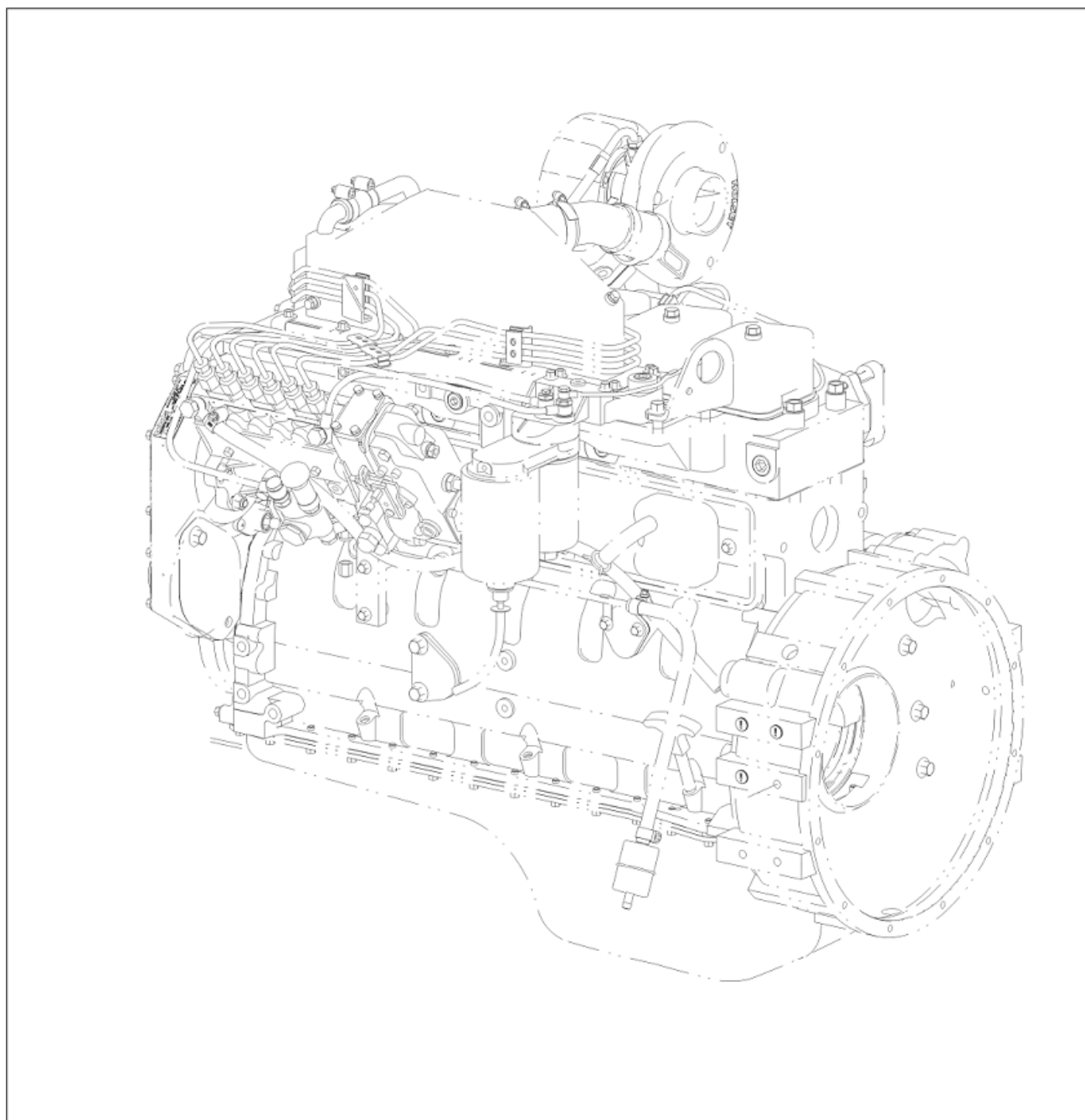


FIGURE 3. TYPICAL 6B ENGINE

3.4.1 Generator Set Performance Data

3.4.1.1 Acoustic Information

3.4.1.1.1 Acoustic Information (1500 RPM)

TABLE 1. ACOUSTIC DATA (1500 RPM)

Model	C90 D5, C90 D5 (Spec E), C110 D5, C110 D5 (Spec E), C150 D5, C150 D5 (Spec E), C170 D5, C170 D5 (Spec E)
Engine	6B
Enclosed Set Acoustic Data – LWA (Based on using a standard Cummins' canopy, and 50 Hz set operating with doors closed) ^{1, 2}	97 dB
Open Set Acoustic Data – dB(A) at 1m ³ – SPL (or enclosed set with doors open)	-
2. Based on 75% load 3. Based on 110% load For Noise Spectrum Figures, refer also to your authorized distributor. In line with the Cummins Power Generation policy of continuous improvement, these figures are subject to change.	

3.4.1.1.2 Acoustic Information (1800 RPM)**TABLE 2. ACOUSTIC DATA (1800 RPM)**

Model	C80 D6, C80 D6 (Spec E)	C100 D6, C100 D6 (Spec E)	C135 D6, C135 D6 (Spec E)
Engine	6B	6B	6B
(Based on using a standard Cummins' canopy, and 60 Hz set operating with doors closed) ^{1, 2} Enclosed Set Acoustic Data – LWA	97 dB	97 dB	97 dB
1. Doors closed figures are measured using 2000/14/EC guaranteed sound power levels 2. Based on 75% load 3. Based on 110% load For Noise Spectrum Figures, refer also to your authorized distributor. In line with the Cummins Power Generation policy of continuous improvement, these figures are subject to change.			

3.4.1.2 Engine Fuel Consumption**TABLE 3. FUEL CONSUMPTION L/HR (GAL/HR) AT 1500 RPM (50 HZ)**

Model	C90 D5, C90 D5 (Spec E)	C110 D5, C110 D5 (Spec E)	C150 D5, C150 D5 (Spec E)	C170 D5, C170 D5 (Spec E)
Engine	6BTA5.9 G5	6BTA5.9 G5	6BTA5.9 G6	6BTA5.9 G7
Engine Performance Data at 50Hz ¹	27 (7.02)	27 (7.02)	32 (8.48)	33 (8.71)
1. Standby/Full Load Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.				

TABLE 4. FUEL CONSUMPTION L/HR (GAL/HR) AT 1800 RPM (60 HZ)

Model	C80 D6, C80 D6 (Spec E)	C100 D6, C100 D6 (Spec E)	C135 D6, C135 D6 (Spec E)
Engine	6BTA5.9 G6	6BTA5.9 G6	6BTA5.9 G6
Engine Performance Data at 60Hz ¹	41 (10.66)	41 (10.66)	43 (11.35)

1. Standby/Full Load

Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

3.5 Sensors

Various generator set parameters are measured by sensors, and the resulting signals are processed by the control board.

Engine-mounted sensors monitor a number of different systems, such as:

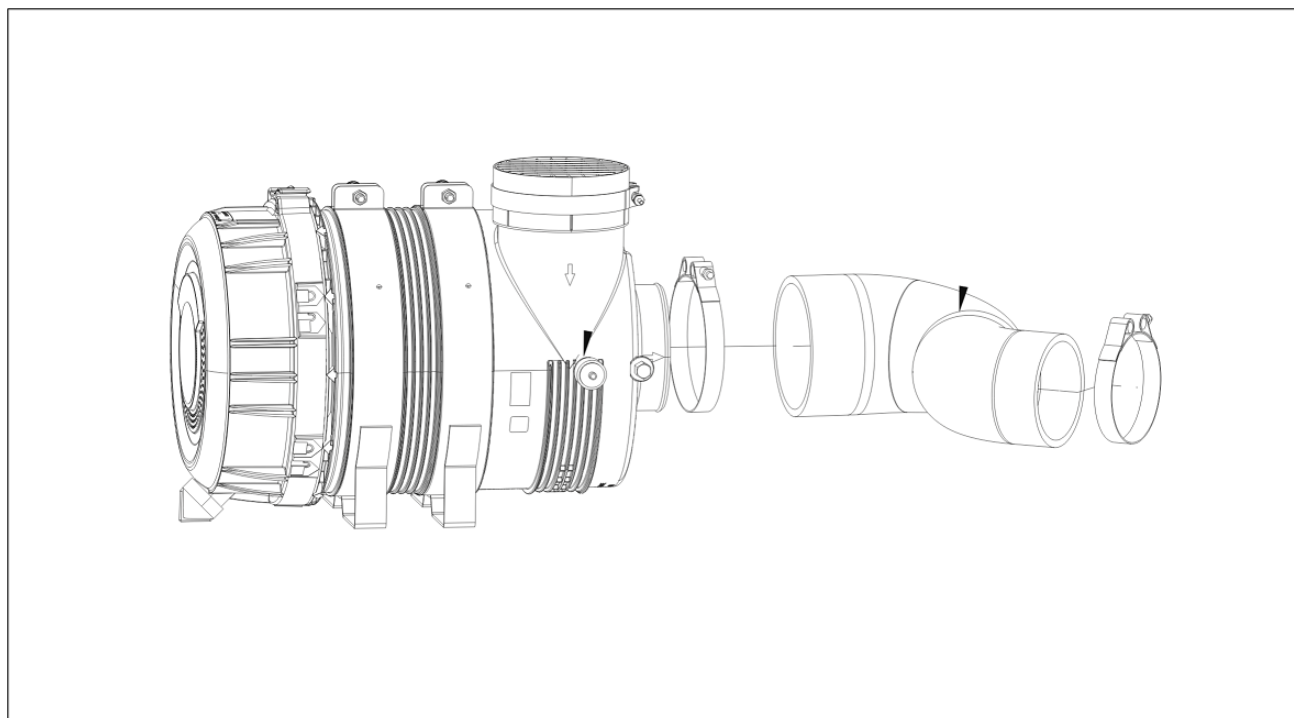
- Lube Oil Pressure
- Cooling System Temperature

3.6 Air Cleaner

An air cleaner includes an element that must be replaced periodically. Some air cleaners include a service indicator that indicates when an air cleaner element is dirty and must be replaced.

3.6.1 Heavy Duty Air Cleaner

A heavy duty air cleaner is used in dusty environments. This shows the heavy duty air cleaner.

**FIGURE 4. AIR CLEANER ASSEMBLY**

3.7 System Options

3.7.1 Mains (Utility) Powered Battery Charger

⚠ CAUTION

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Disconnect the battery charger before isolating the battery.

This unit maintains the battery in a fully charged condition without over-charging. The unit also provides rapid charging, when necessary, at a current up to the rated output.

The charger's electronic control circuit allows the charger to be left in circuit during engine cranking and to operate in parallel with the charge alternator.

The charger will supply current to the battery system until the battery terminal voltage becomes equal to the set float voltage, at which point only a trickle charge current is present. When the battery becomes discharged due to a load being present and the terminal voltage falls, the charger will again supply current to restore the voltage of the battery to the float voltage.

3.7.2 Fuel Filters

The fuel filter used for 6B engine is of Combo type filter (Dual Filter)

The fuel filter assembly provides an all-in-one fuel filtration, fuel/water separator, and fuel warmer system.

The filter cover allows you to view the fuel level. When new, the fuel level in the filter is low. As it is used, the fuel level rises to show how much filter life remains.

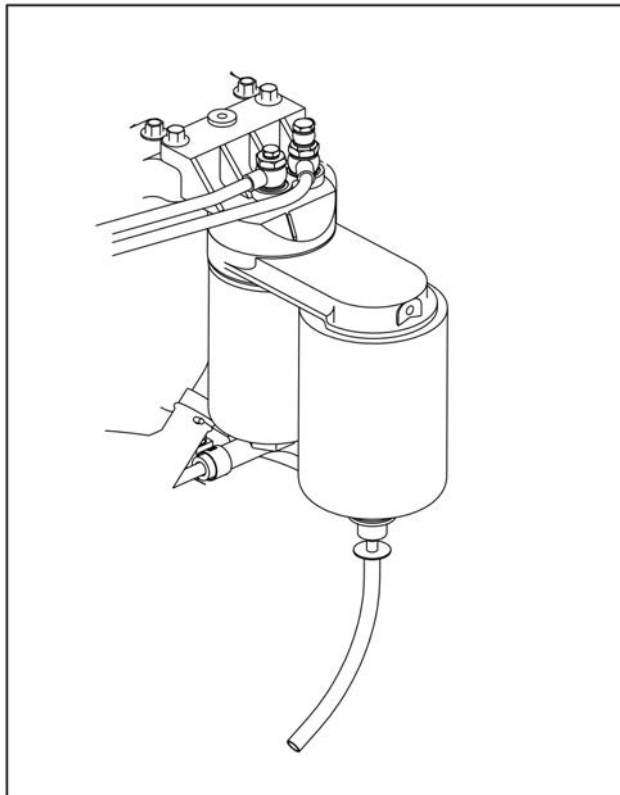


FIGURE 5. DUAL FUEL FILTER

3.7.3 Skintight Enclosure

The following figure displays the enclosure option.

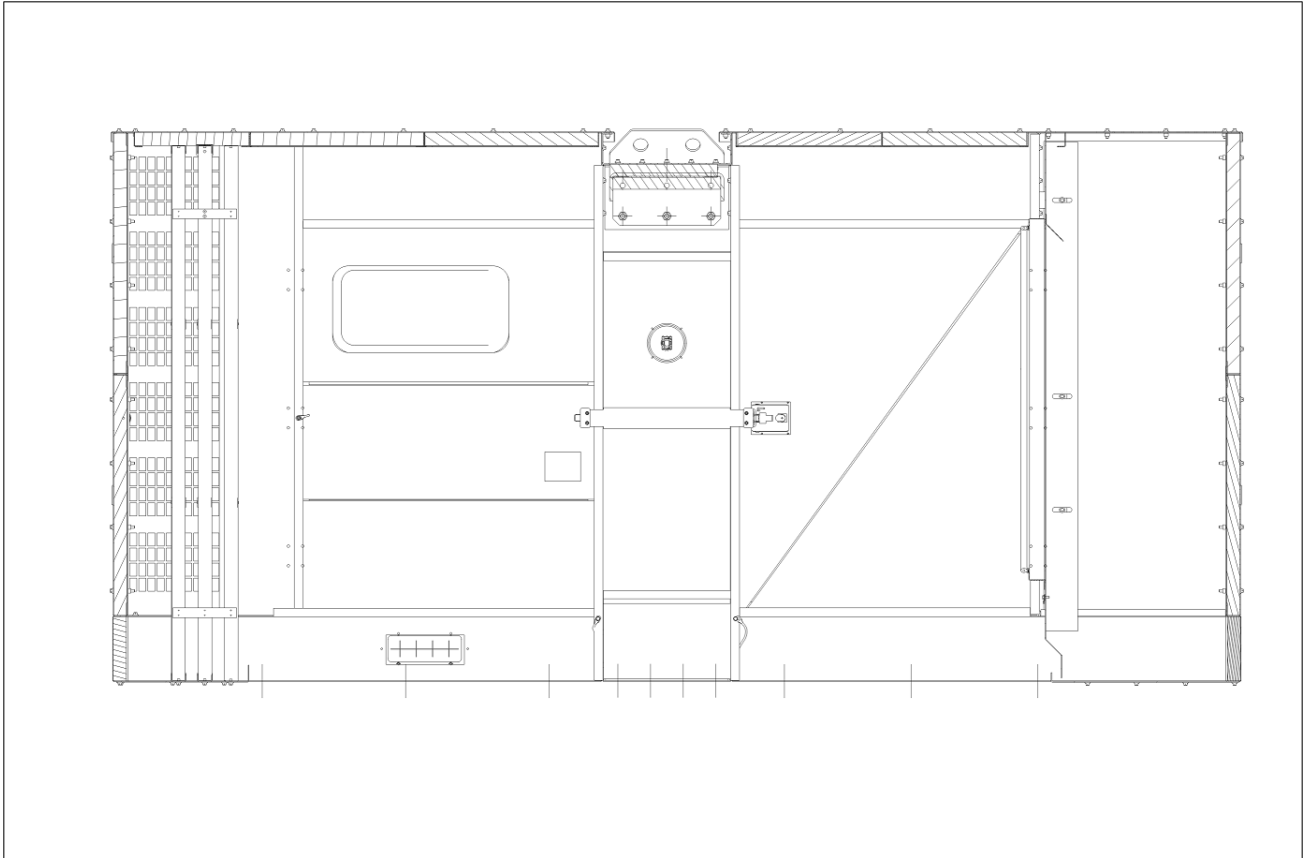


FIGURE 6. ENCLOSURE ASSEMBLY

3.7.4 Circuit Breaker

A circuit breaker is used to prevent the generator from being overloaded.

A line circuit breaker is mounted in the generator output box. If the load exceeds the circuit breaker current rating, the line circuit breaker will open, preventing the generator from being overloaded. If the circuit breaker trips, locate the source of the overload and correct as necessary. Manually reset the breaker to reconnect the load to the generator.

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4 Control System - PowerCommand 1.2

4.1 Control System Description

The control system is used to start and stop the generator set, and provides full generator set monitoring capability and protection in a stand-alone situation (non paralleling) from the display screen. It monitors the engine for temperature, oil pressure and speed, and provides voltage and current metering. In the event of a fault, the unit indicates the fault type and on critical faults automatically shuts down the generator set.

All indicators, control buttons, and the display screen are on the face of the operator panel, as illustrated in the figure below.

There are two fault level signals generated by the control system:

- Warning: signals an imminent or non-critical fault for the engine. The control provides an indication only for this condition.
- Shutdown: signals a potentially critical fault for the engine. The control immediately takes the engine off-load and automatically shuts down.

The standard control system operates on 12 or 24 VDC battery power. The auxiliary equipment operates on LV AC power. The history data is stored in non-volatile memory and is not deleted if battery power is lost.

4.1.1 Control System Panel

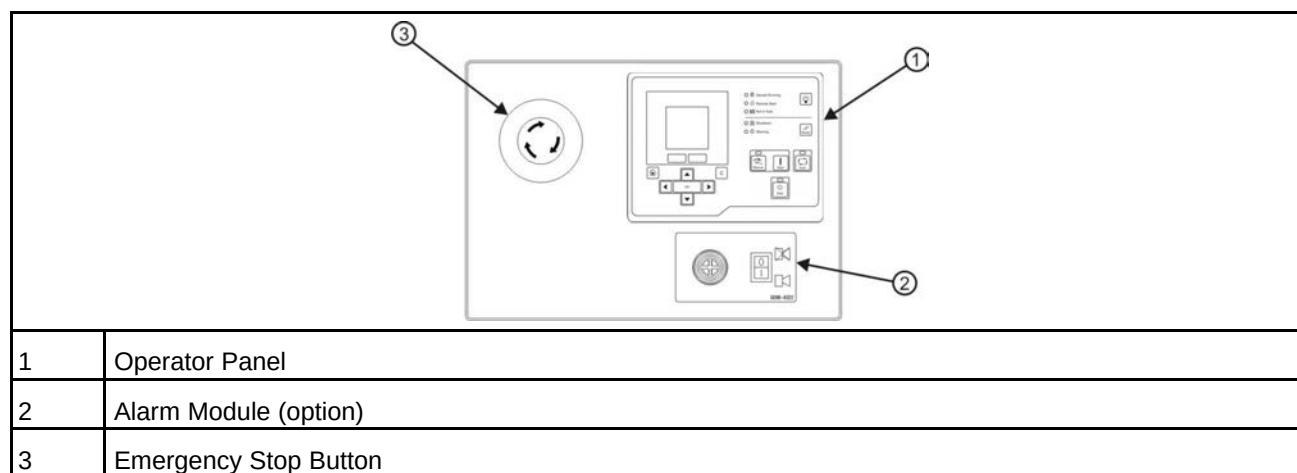


FIGURE 7. TYPICAL CONTROL SYSTEM PANEL

4.1.2 Operating Modes

The PowerCommand® 1.2 control is operated by the **Start/Stop/Manual/Auto** buttons on the Operator Panel. Refer to [Figure 8 on page 27](#).

NOTICE

If the Mode Change access feature is enabled, a password is required to use these buttons to change the mode of operation. Contact your authorized distributor for options.

4.1.2.1 Stop Button



Press this button to put the generator set into the Off mode. This disables Auto and Manual modes. The green lamp above this button lights when the generator set is in the Off mode.

If the generator set is running, in either Manual or Auto mode, and the **Stop** button is pressed, the engine shuts down.

Refer to the Selecting Operating Modes section for more information on stopping in Auto or Manual mode.

NOTICE

If possible, hot shutdown under load should be avoided to help prolong the reliability of the generator set.

4.1.2.2 Manual Button



Press this button to put the generator set into the Manual mode. The **Start** button must then be pressed within ten seconds. Failure to do this results in the control mode defaulting, putting the generator set into the Off mode.

The green lamp above this button is lit when the generator set is in Manual mode.

NOTICE

If the Mode Change access password feature is enabled, the password must be entered before pressing the Start button. See the Passwords and Mode Change section.

4.1.2.3 Start Button



When the **Manual** button is pressed, this **Start** button must be pressed within ten seconds to start the generator set. The generator set starts up normally but without the Time Delay to Start.

In other modes, this button has no effect.

NOTICE

If the Start button is not pressed within the ten seconds of pressing the Manual button, the generator set mode changes to the Off mode automatically.

4.1.2.4 Auto Button



Press this button to put the generator set into the Auto mode. In this mode, the generator set is controlled by a remote switch or device (e.g. transfer switch).

The green lamp above this button lights when the generator set is in Auto mode.

4.1.2.5 Battle Short Mode

WARNING

Automated Machinery

Battle Short mode overrides some parameters of generator set control. Unmonitored generator sets can cause a fire or electrical hazard, resulting in severe personal injury or death.

Make sure that the operation of the set is supervised during Battle Short operation.

Battle Short mode is not a distinct mode of operation. The PowerCommand® control is still in the Off, Manual, or Auto mode while Battle Short mode is active. The PowerCommand® control still follows the appropriate sequence of operation to start and stop the generator set. Battle Short mode is a generator set mode of operation that prevents the generator set from being shut down by all but a few, select, critical shutdown faults.

The purpose of Battle Short mode is to satisfy local code requirements, where necessary. To use this feature, the necessary software must be installed at the factory when the PowerCommand® control is purchased. Only authorized service personnel can enable this feature. When shipped from the factory, this feature is disabled.

NOTICE

The Battle Short feature must be enabled or disabled using the InPower service tool.

This feature must only be used during supervised, temporary operation of the generator set. The faults that are overridden when in Battle Short mode can affect generator set performance, or cause permanent engine, alternator or connected equipment damage.

NOTICE

If this mode of operation is selected, the protection of load devices will be disabled. Cummins will not be responsible for any claim resulting from the use of this mode.

NOTICE

All shutdown faults, including those overridden by Battle Short, must be acted upon immediately to ensure the safety and well-being of the operator and the generator set.

Battle Short is turned on or off with an external switch connected to one of the two customer configured inputs or a soft switch on the operator panel.

When enabled, **Battle Short** switch input can be set using a Setup menu. To turn Battle Short mode on using the soft switch in the operator panel, **Battle Short** must be set to "Operator Panel" and enabled using the InPower service tool (default is Inactive).

When Battle Short mode is enabled, the Warning status indicator lights and code "1131 – Battle Short Active" is displayed.

When Battle Short mode is enabled and an overridden shutdown fault occurs, the shutdown lamp remains lit even though the set continues to run. "Fault code 1416 – Fail to Shutdown" is displayed. If the fault is acknowledge, the fault message is cleared from the display but remains in the Fault History file as long as Battle Short mode is enabled.

Battle Short is suspended and a shutdown occurs immediately if any of the following critical shutdown faults occur:

- Speed Signal Lost (Loss of Speed Sense) - Fault code 121
- Overspeed - Fault code 234
- Local Emergency Stop - Fault code 1433
- Remote Emergency Stop - Fault code 1434
- Excitation Fault (Loss of Voltage Sense) - Fault code 2335

Or

The Battle Short feature is disabled after an overridden shutdown fault occurred while in Battle Short mode. Fault code "1123 – Shutdown After Battle Short" is then displayed.

4.1.3 Power On and Sleep Modes

The operating modes of the control panel and operating software are Power On and Sleep.

Power On Mode

In this mode, power is continuously supplied to the control panel. The control's operating software and control panel lamps/graphical display remain active until the Sleep mode is activated.

Sleep Mode

Sleep mode is used to reduce battery power consumption when the control is not being used and it is in the Off or Auto mode. In this mode, the control's operating software is inactive and the lamps and graphical display on the control panel are all off.

When all conditions are met (i.e. no unacknowledged faults and the control is in the Off/Auto mode), the sleep mode activates after five minutes of keypad inactivity. This length of time is configurable.

To activate the control and view the menu display without starting the generator set, press any control button.

NOTICE

Sleep mode can be enabled/disabled, contact your authorized distributor for options.

4.2 Operator Panel

The figure below shows the features of the front panel. It includes five lamp indicators; the graphical display with two menu select and seven menu navigation buttons; and four control mode buttons. This display panel enables the operator to look at the status, adjust the settings, and start and stop the generator set

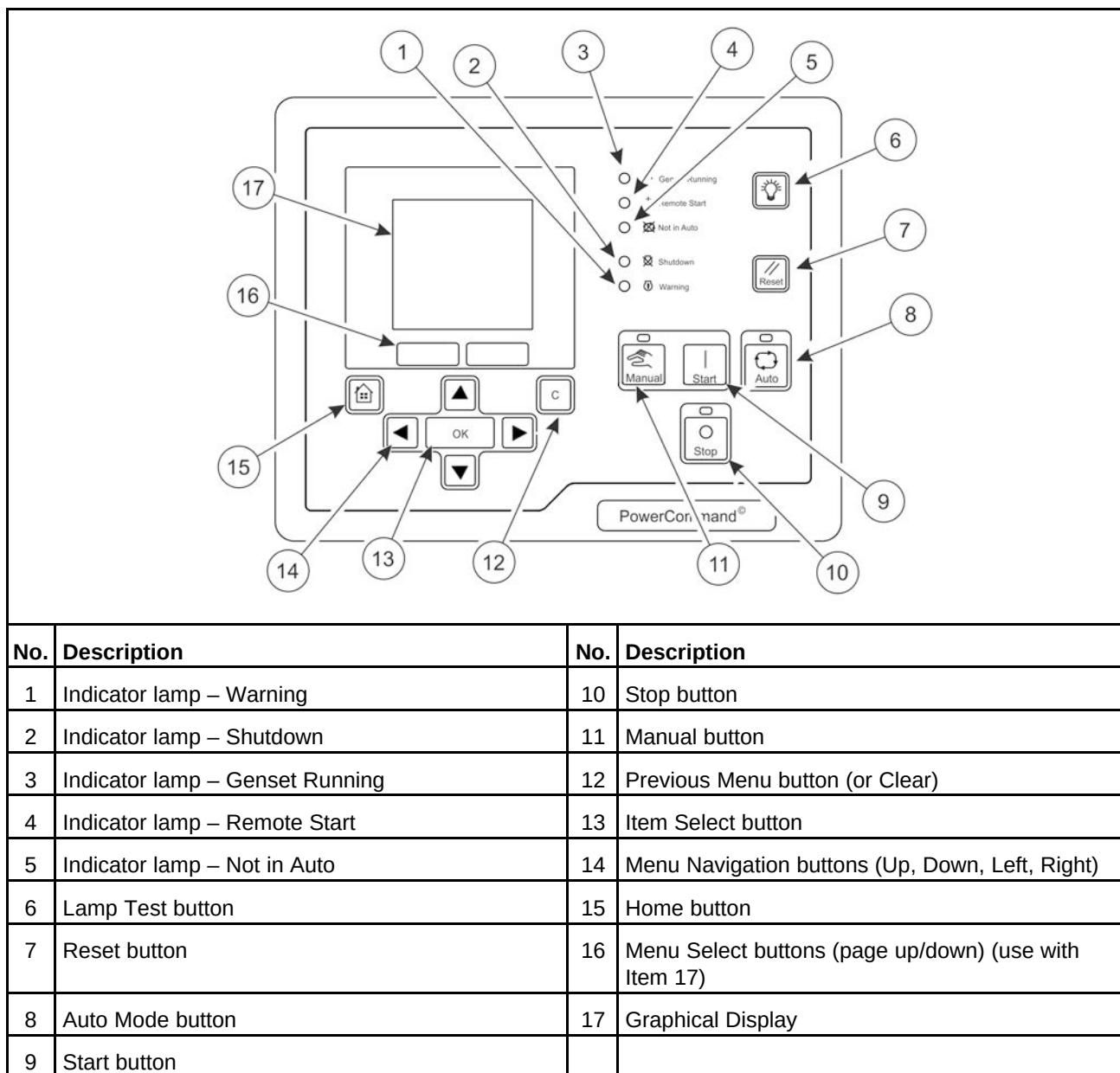


FIGURE 8. OPERATOR PANEL (HMI 220)

4.2.1 Lamp Indicators

Front panel of the Operator Panel shows the five lamp indicators.

4.2.1.1 Warning

This amber lamp is lit whenever the control detects a Warning condition. This lamp is automatically shut off when the Warning condition no longer exists.

4.2.1.2 Shutdown Status

This red lamp is lit when the control detects a Shutdown condition. The generator set cannot be started when this lamp is on. After the condition has been corrected, the lamp can be reset by first pressing the **Stop** button and then the **Reset** button.

4.2.1.3 Not in Auto

This red lamp is lit when the control is not in Auto.

4.2.1.4 Remote Start

This green lamp indicates the control is receiving a **Remote Run** signal. The **Remote Run** signal has no effect unless the generator set is in Auto.

4.2.1.5 Generator Set Running Lamp

The green lamp is lit when the generator set is running at, or near, rated speed and voltage. This is not lit while the generator set is warming up or cooling down.

4.2.2 Lamp (LED) Test Button

Press this button to test the lamps (LEDs). All of the lamps should turn on for five seconds.

Press and hold this for three seconds to turn on or off (to toggle) an external panel lamp.

4.2.3 Reset Button

Press this to reset any active faults.

If the condition(s) that caused an existing shutdown fault still exists, the generator set generates the fault again.

If the condition(s) that caused an existing warning fault still exists, the generator set generates the fault again, but the operator panel stops displaying it in the graphical display.

4.2.4 Graphical Display and Buttons

[Figure 9 on page 29](#) shows the graphical display and the relevant menu selection buttons.

The graphical display is used to view menus of the menu-driven operating system. System messages (communication, event, and fault) are also shown on the display.

Two momentary soft-key buttons (item 5) are used to change pages within each screen. These selection buttons are “active” when the up and down triangles (▲ and ▼) are displayed in the graphical display. Some sub-menus do not include any active buttons.

Use the graphical display to view event/fault information, status, screens, and parameters.

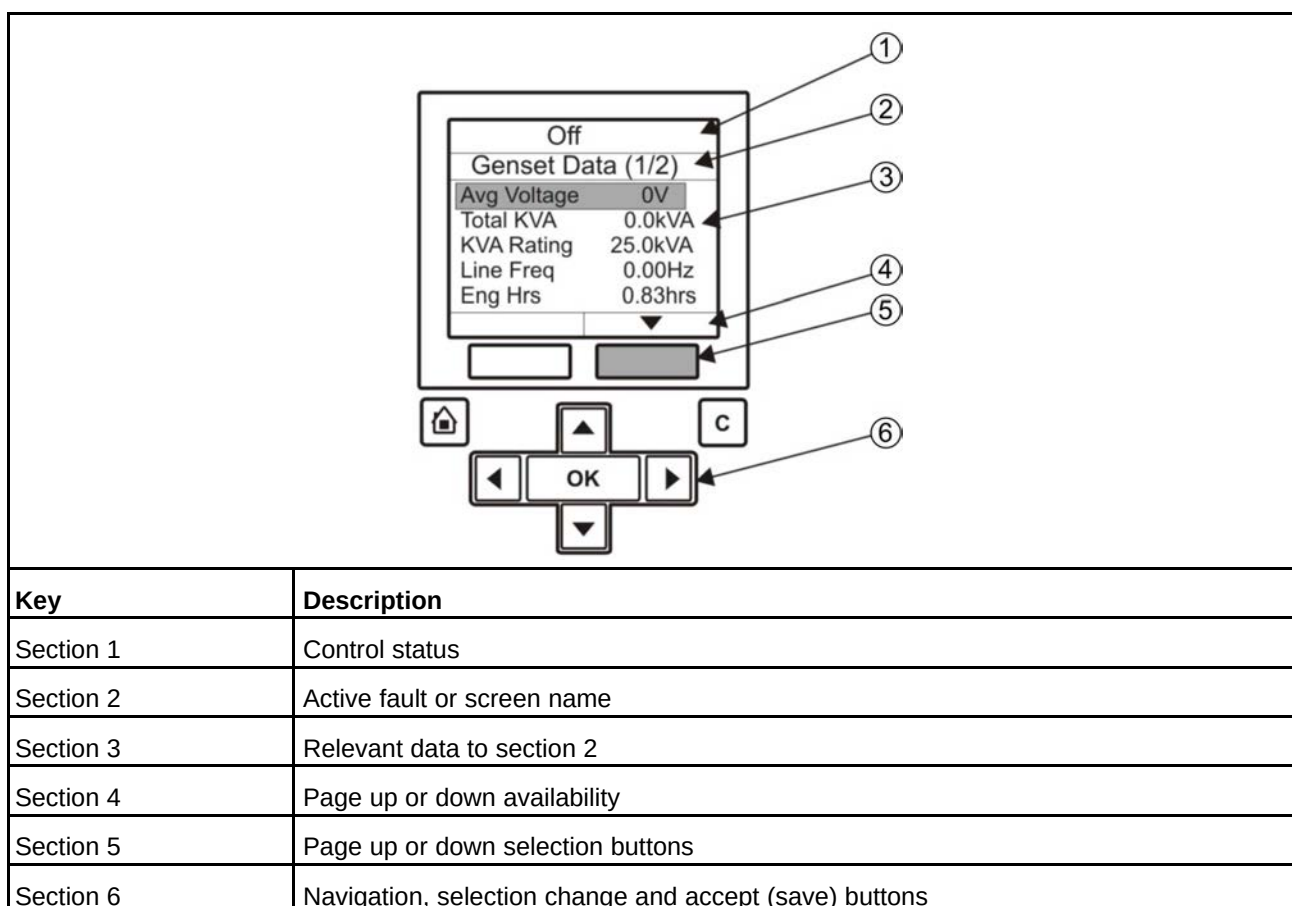


FIGURE 9. GRAPHICAL DISPLAY WITH TYPICAL SCREENSHOT

4.2.4.1 Section 1 - Control Status

Section one displays the status of the controller.

Status	Description
Ready	This is the default state. The controller is ready to start the generator set, or it has started one of the start sequences but has not started the engine yet.
Starting	The controller is starting the engine in one of the start sequences. The generator set has not reached idle speed (if applicable) or rated speed and voltage, and the controller is not raising the engine speed to idle or rated speed.
Idle Warmup	The controller is raising the engine speed to idle speed, or the engine is running at idle speed in one of the start sequences.
Rated Freq and Voltage	The controller is raising the engine speed to rated speed; the generator set is running at rated speed and voltage; or the controller has started one of the stop sequences but has not started reducing the engine speed yet.
Idle Cooldown	The controller is reducing the engine speed to idle speed, or the engine is running at idle speed in one of the stop sequences.
Stopping	The controller is stopping the engine.
Emergency Stop	There is an active shutdown fault.
Setup Mode	The controller is in Setup mode.

Wait to Powerdown	The controller is ready to enter Powerdown mode, but another device is sending a System Wakeup signal.
Demo Mode	The controller is running a demonstration. Every screen is available in the demonstration, and any changes you make in the demonstration have no effect on the controller. To end the demonstration, the Operator Panel must be turned off.

4.2.4.2 Section 2 - Active Fault or Screen Name

Section two displays information about the last active shutdown fault. If there are no active shutdown faults, it displays the last active warning fault. If there are no active faults, the Operator Panel displays the screen name.

If there is an active fault, the Operator Panel displays the following information about it:

- Fault type.
- Fault code number.
- Name of the controller that detected the fault e.g. the engine ECM unit. This is blank if the controller detected the fault.
- Fault name.

If you press the **Reset** button the Operator Panel stops displaying active warning faults, even if the condition(s) that caused the fault(s) has not been corrected. The Warning LED remains on, however.

The Operator Panel always displays any active shutdown faults, even if the **Reset** button is pressed.

Fault Type	Description
Warning	This is a warning fault. (See Chapter 7 on page 89)
Derate	This is a derate fault. (See Chapter 7 on page 89)
Shutdown	This is a shutdown fault that initiates a Shutdown Without Cooldown sequence. (See Chapter 7 on page 89)

4.2.4.3 Section 3 - Interactive Screen or Menu

Section 3 shows information relevant to Section 2. You can view the operating values for the generator set, navigate through screen and adjust parameters (if permitted).

The default screen is the Genset Data screen.

The following table explains how the operator panel displays when the value of a specific parameter is missing, unexpected, or outside the range allowed for the parameter.

TABLE 5. PARAMETER VALUES THAT ARE MISSING, UNEXPECTED, OR OUTSIDE THE RANGE ALLOWED

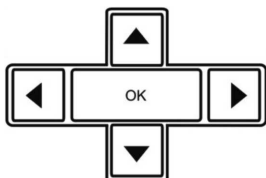
Operator Panel	Description
NWF	Network Failure - There is a PCCNet network failure or a CAN (ECM) failure
OORL	Out Of Range Low - The value is less than the lowest allowed value for this parameter
OORH	Out Of Range High - This value is greater than the highest allowed value for this parameter
-- --	This value is not applicable

4.2.4.4 Section 4 - Additional Functions Indicators

Section 4 indicates if additional information or further sub-menus are available by up or down arrows (▲ and ▼). If that particular page or menu has no additional information, then no arrow will be visible at this time.

For example if the graphical display is not big enough to display the screen at one time an up and/or down arrow (▲ and ▼) will be visible. Press the appropriate selection button beneath the graphical display to look at the previous or next page of information in that screen.

4.2.4.5 Menu Navigation Buttons



Four momentary buttons are used to navigate and change the selection in the graphical display.

Press the **OK** button to select the item that is currently highlighted in the graphical display:

- If the selected item is a menu item, this opens the sub-menu or screen.
- If the selected item is a parameter, this lets you adjust the parameter (if possible) or prompts you for a password.
- If the selected item is a value you have just adjusted, this saves the change.
- If the selected item is an action, the graphical display runs the action or prompts you for a password.

4.2.5 Selection Buttons

Four momentary buttons are used to navigate and change the selection in the graphical display:

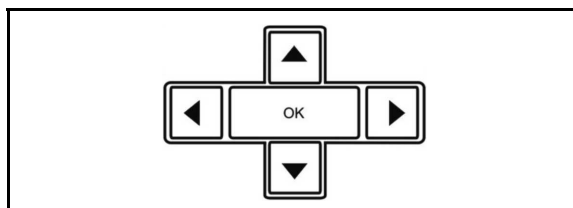


FIGURE 10. SELECTION BUTTONS

Press the **OK** button to select the item that is currently highlighted in the graphical display:

Item	Results of Pressing OK
Menu	Opens the sub-menu or screen
Parameter	Allows adjustment of the parameter (if possible) or prompts for a password
Adjusted Value	Saves the change
Action	The graphical display runs the action or prompts for a password

4.2.6 Default Settings

The operator panel can display SAE or Metric units of measurement and should be set during the initial setup of the generator set. Only trained and experienced personnel are allowed to change the default setting. Contact your authorized distributor.

4.3 Fault Messages



FIGURE 11. FAULT MESSAGE DISPLAY

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault type (Warning or Shutdown), fault number, and a short description. It also includes where the fault occurred if the generator set control did not detect the fault and is simply reporting the fault. [Section 7.5.1 on page 91](#) provides a list of the fault codes, types, messages displayed, and descriptions of the faults.

Active and acknowledged faults may be viewed in the Faults menu.

4.3.1 Fault Acknowledgement

Shutdown faults must be acknowledged after the fault has been corrected. If in Auto or Manual mode, the control must be set to Stop mode (Off).

Faults are also acknowledged when in Auto mode and the remote start command is removed.

Faults are re-announced if they are detected again after being acknowledged.

4.4 Operator Panel - Initial Operator Menu

[Figure 12](#) shows the initial menu and subsequent menu shown when the Home button  is pressed.

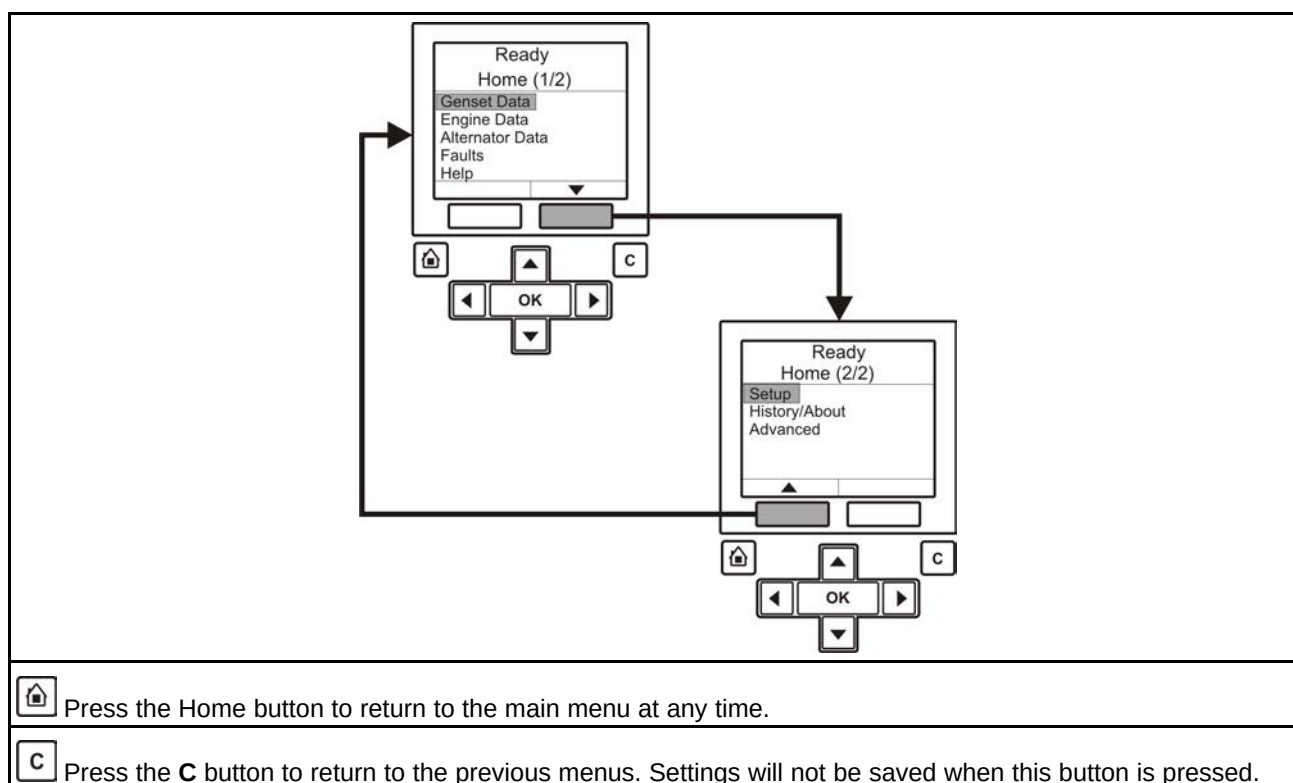


FIGURE 12. INITIAL OPERATOR MENU

4.5 Operator Panel - Generator Set Data Operator Menu

[Figure 13 on page 34](#) shows a block representation of a typical **Genset Data** menu.

To navigate from the Home menu, make sure that the Genset Data line of text is highlighted, and

press the **OK** button.

The **Genset Data** menu is displayed on two pages. Use the buttons below the up and down arrows [▲ and ▼]) in the menu to toggle between the screens.

4.5.1 Generator Set Data

Use this screen to look at the status of the generator set.

Name	Description
Avg Voltage	Generator set line-to-line average voltage
Total kVA	Total kVA output. Allowed values: 0–2000 kVA
kVA Rating	kVA Rating for the specified application. Allowed values: 0–2000 kVA
Line Freq	Measured frequency of L1-L2 frequency signal
Eng Hrs	Engine running hours in tenths of hours. Allowed values: 0–6553.5 hours.
Coolant Temp	Measured sensor value
Oil Pressure	Allowed values: 0–145 psi (0–999.7 kPa)
Fuel Rate	Fuel consumption in gallons per hour

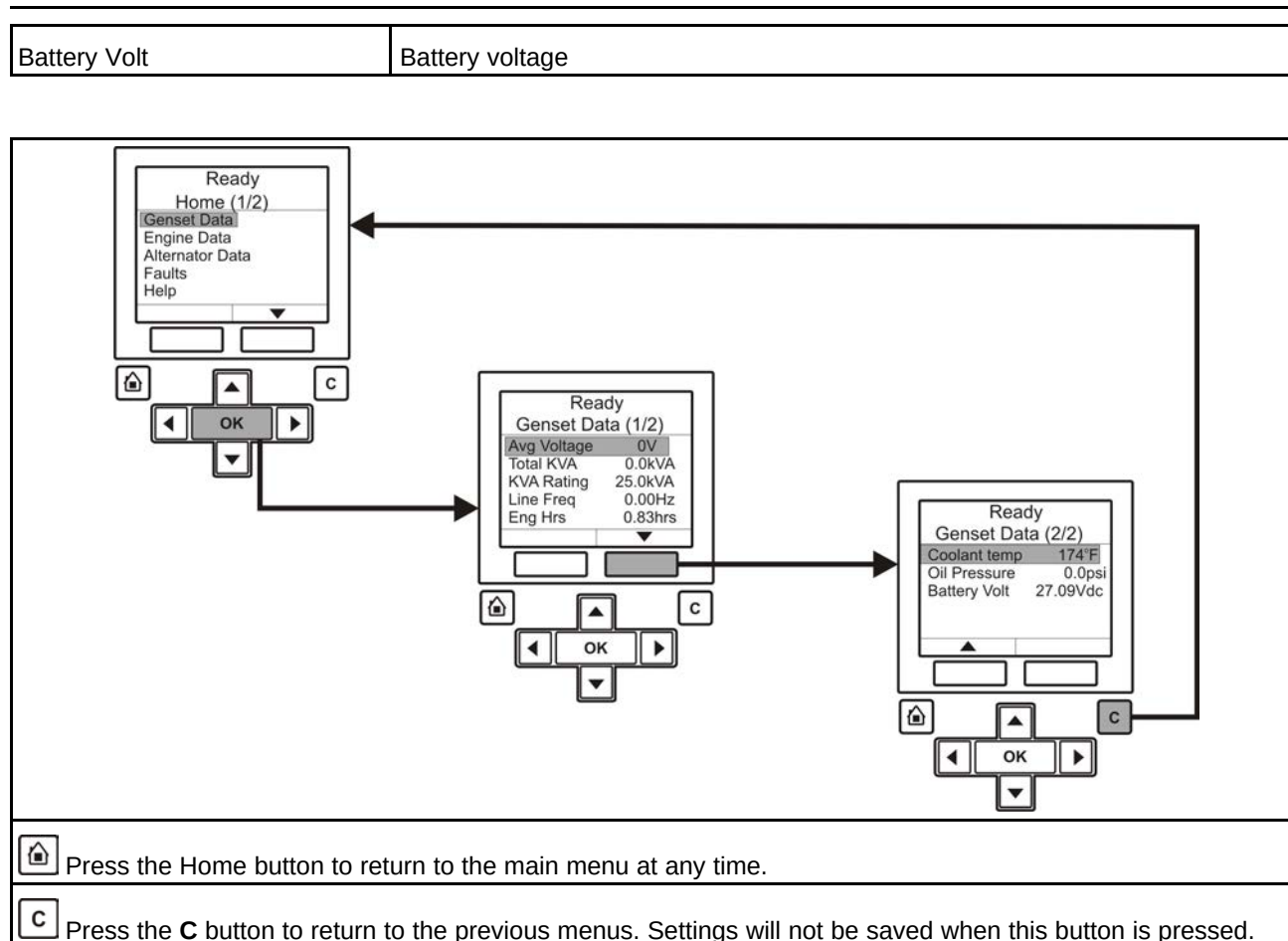
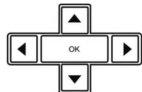


FIGURE 13. GENSET DATA MENU - TYPICAL DATA

4.6 Operator Panel - Engine Data Operator Menu

[Figure 14 on page 35](#) shows a block representation of a typical **Engine Data** menu. This menu displays the engine starting battery voltage, coolant temperature, engine oil pressure, and hours of engine operation.

To navigate from the Home menu, toggle down until the Engine Data line of text is highlighted, and



press the **OK** button.

The **Engine Data** menu is displayed on two pages. Use the buttons below the up and down arrows (▲ and ▼) in the menu to toggle between the two screens.

4.6.1 Engine Data

Use this screen to look at the status of the engine.

Name	Description
Engine Hours	Engine running hours in tenths of hours. (Password level 2) Allowed values: 0–6553.5 hours
Coolant Temp	Measured sensor value
Engine Speed	Sensed Instantaneous Engine speed after the Output Enabled process
Battery Volt	Points to the function the analog input signal feeds. Allowed values: 0–35 VDC
Oil pressure*	Allowed values: 0–145 psi (0–999.7 kPa)
Oil Temp	Allowed values: –40–63 °C (–40–145 °F)
Manf Temp	Intake Manifold Temperature
Fuel Supply Press	Allowed values: 0–145 psi (0–999.7 kPa)
* Oil pressure is not available for all models	

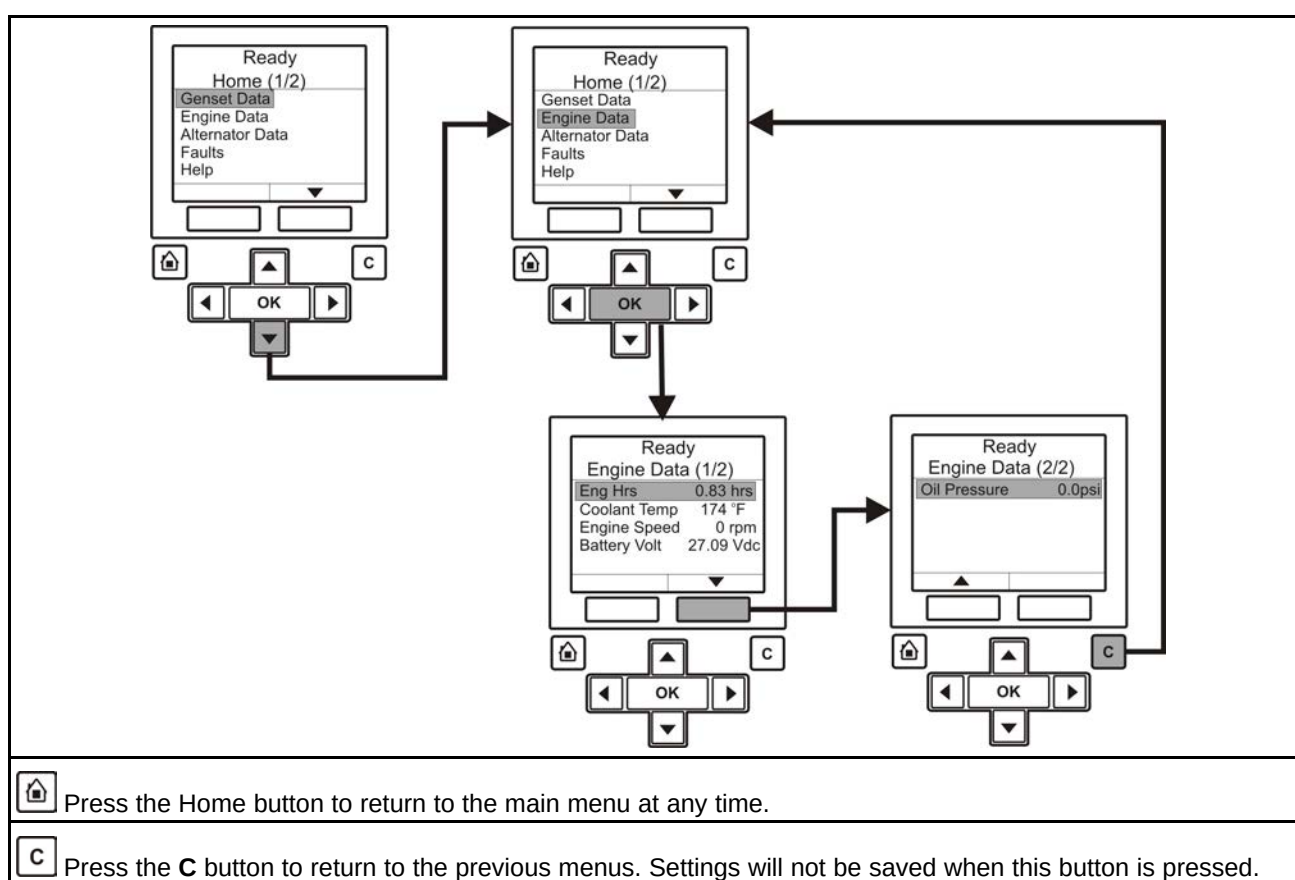


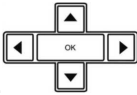
FIGURE 14. ENGINE DATA MENU - TYPICAL DATA

4.7 Operator Panel - Alternator Data Operator Menu

[Figure 15 on page 37](#) shows a block representation of a typical **Alternator Data** menu. Use this screen to look at the status of the alternator. This menu displays line-to-line voltage, line-to-neutral voltage, current, and generator set power (kVA). Some values are not available, dependent on the number of phases (one or three) and whether or not the application has current transformers.

To navigate from the Home menu, toggle down until the Alternator Data line of text is highlighted, and

press the **OK** button.



The **Alternator Data** menu is displayed on three pages. Use the buttons below the up and down arrows (▲ and ▼) in the menu to toggle between the screens.

4.7.1 Alternator Data

Use this screen to look at the status of the alternator. This menu displays line-to-line voltage, line-to-neutral voltage, current, and generator set power (in kVA). Some values are not available, dependent on the number of phases (one or three) and whether or not the application has current transformers.

Name	Description
L1 L2 L3	Alternator terminals
LL(Vac)	Measured line-to-line voltage. Allowed values: 0–750 V
LN(Vac)	Measured L1-N voltage. Measured L2-N voltage. Measured L-N voltage. Allowed values: 0–450 V
Amps	Measured line current. Allowed values: 0~1000 amps
kVA	kVA provided through phase 1. kVA provided through phase 2. kVA provided through phase 3. Allowed values: 0–700 kVA
Alt Voltage	The alternator line-to-line voltage
Total kVA	Total kVA output. Allowed values: 0–2000 kVA
AVR Reg % Out	Output command to Voltage Regulator PWM
Line Freq	Measured frequency of L1-L2 frequency signal

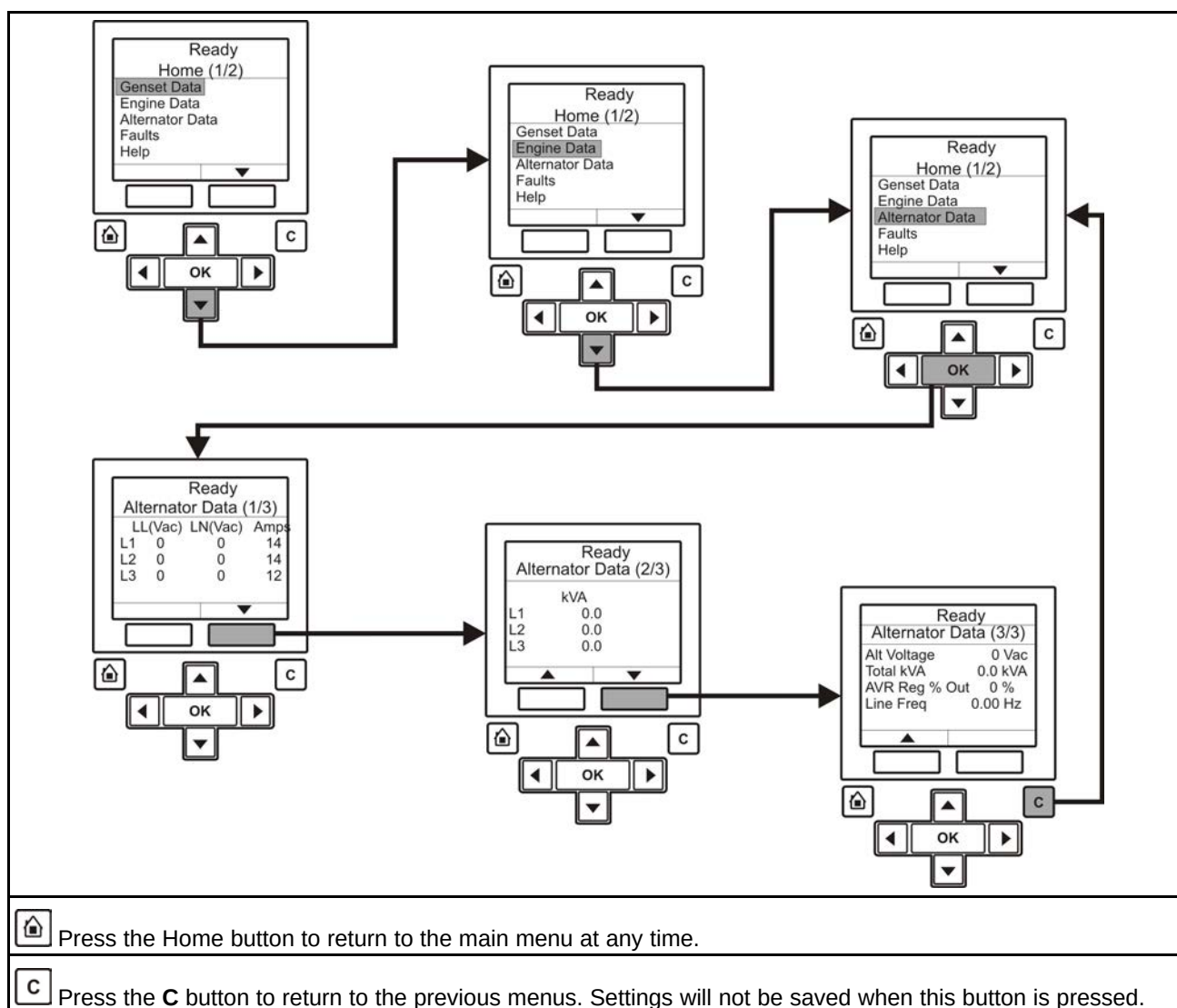
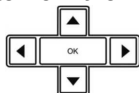


FIGURE 15. ALTERNATOR DATA MENU - TYPICAL DATA

4.8 Operator Panel - Current Fault Data Operator Menu

[Figure 16 on page 38](#) shows a block representation of a typical **Current Fault** menu.

To navigate from the Home menu, toggle down until the **Faults** line of text is highlighted and press the



OK button.

The **Faults** menu is divided into two main subsections; Current Fault covers the latest active fault, and Faults History ([Figure 17 on page 40](#)) shows faults that have been cleared.

With the Current Fault line of text highlighted, press the **OK** button. This will display information regarding the current fault.

4.8.1 Current Fault Data

Use this screen to look at the current fault code and description.

Name	Description
Fault #	Fault code
SA	Controller that identified the fault
Gen Response	Type of fault (Shutdown or Warning)

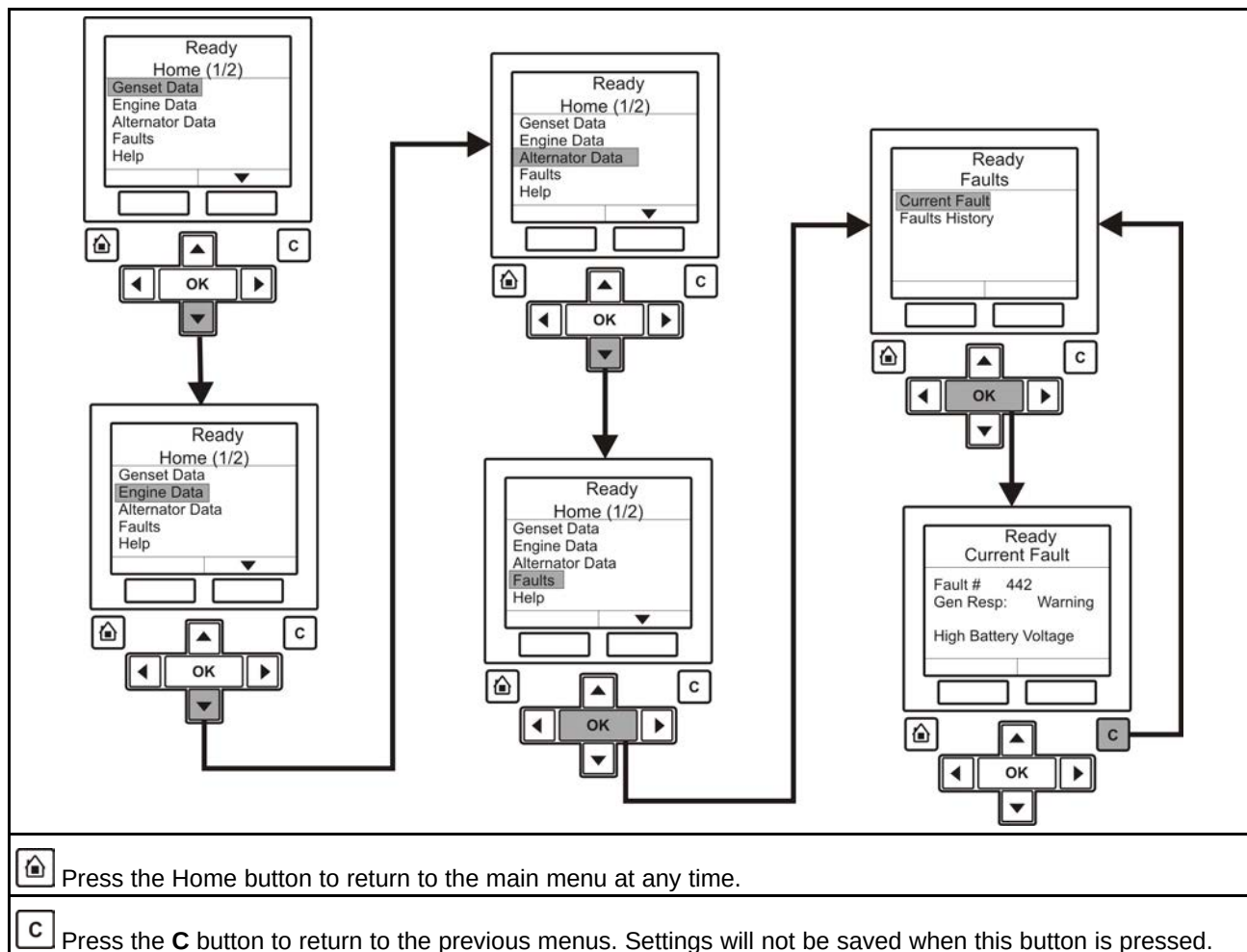
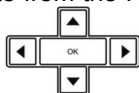


FIGURE 16. CURRENT FAULT MENU - TYPICAL DATA

4.9 Operator Panel - Faults History Data Operator Menus

[Figure 17 on page 40](#) shows a block representation of a typical **Faults History** menu.

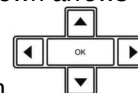
To navigate from the Home menu, toggle down until the **Faults** line of text is highlighted and press the



OK button.

The **Faults** menu is divided into two main subsections; Current Fault covers the latest active fault, and Faults History shows faults that have been cleared.

Toggle down to the **Faults History** menu using the buttons below the up and down arrows (▲ and ▼)



in the menu. With the **Faults History** line of text highlighted, press the **OK** button.

This will display information regarding the previous faults.

The **Faults History** menu contains up to ten screens. Use the buttons below the up and down arrows (▲ and ▼) in the menu to toggle between the screens.

4.9.1 Faults History

This screen displays up to ten faults.

Name	Description
Index #	Number of the fault in the fault history. It is not the fault code
Fault #	Fault code
SA	Controller that identified the fault. It is blank if the PowerCommand Controller identified the fault
Gen Response	Type of fault (Shutdown or Warning)
Cntl Time	Number of hours that the engine has run (not necessarily continuously) when the fault was generated

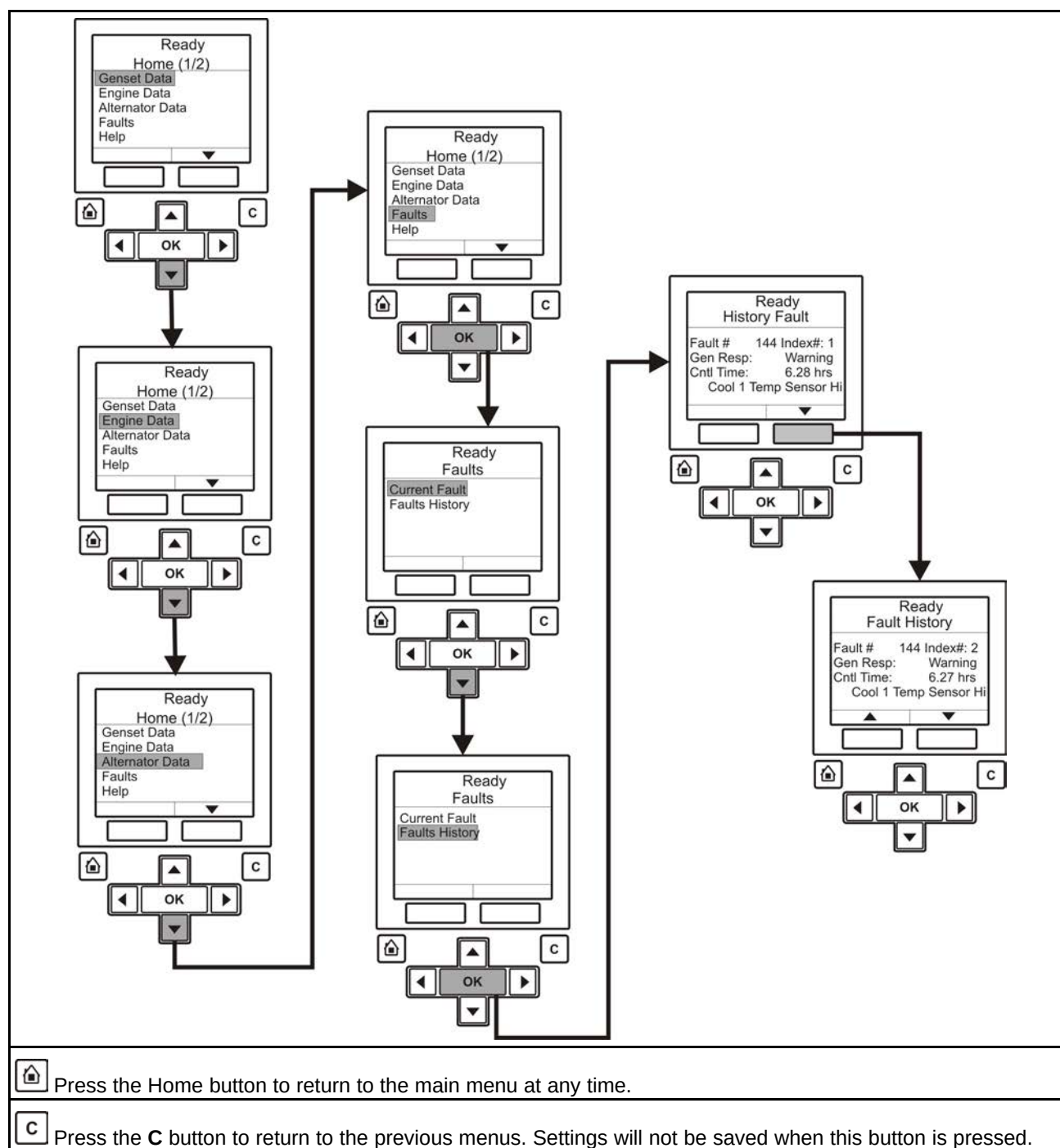


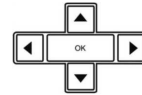
FIGURE 17. HISTORY FAULT MENU - TYPICAL DATA

4.10 Operator Panel - Generator Set Setup Data Operator Menu

[Figure 18 on page 41](#) shows a block representation of the **Setup/Genset Data Menu**.

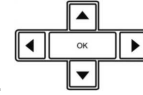
Page down to the second page of the Home menu (using the buttons below the up and down arrows [▲ and ▼]) in the menu. See [Section 4.4 on page 32](#).

With the Setup line of text highlighted, press the **OK** button.



This displays the **Setup Menu (1/2)**.

Page down to the second page of the Setup Menu (using the buttons below the up and down arrows [▲ and ▼]) in the menu.



With the Genset Setup line of text highlighted, press the **OK** button.

This displays the **Setup/Genset Data (1/5)** menu.

Page down to the fifth page of the **Setup/Genset Data** menu (using the buttons below the up and down arrows [▲ and ▼]) in the menu to review the generator set data.

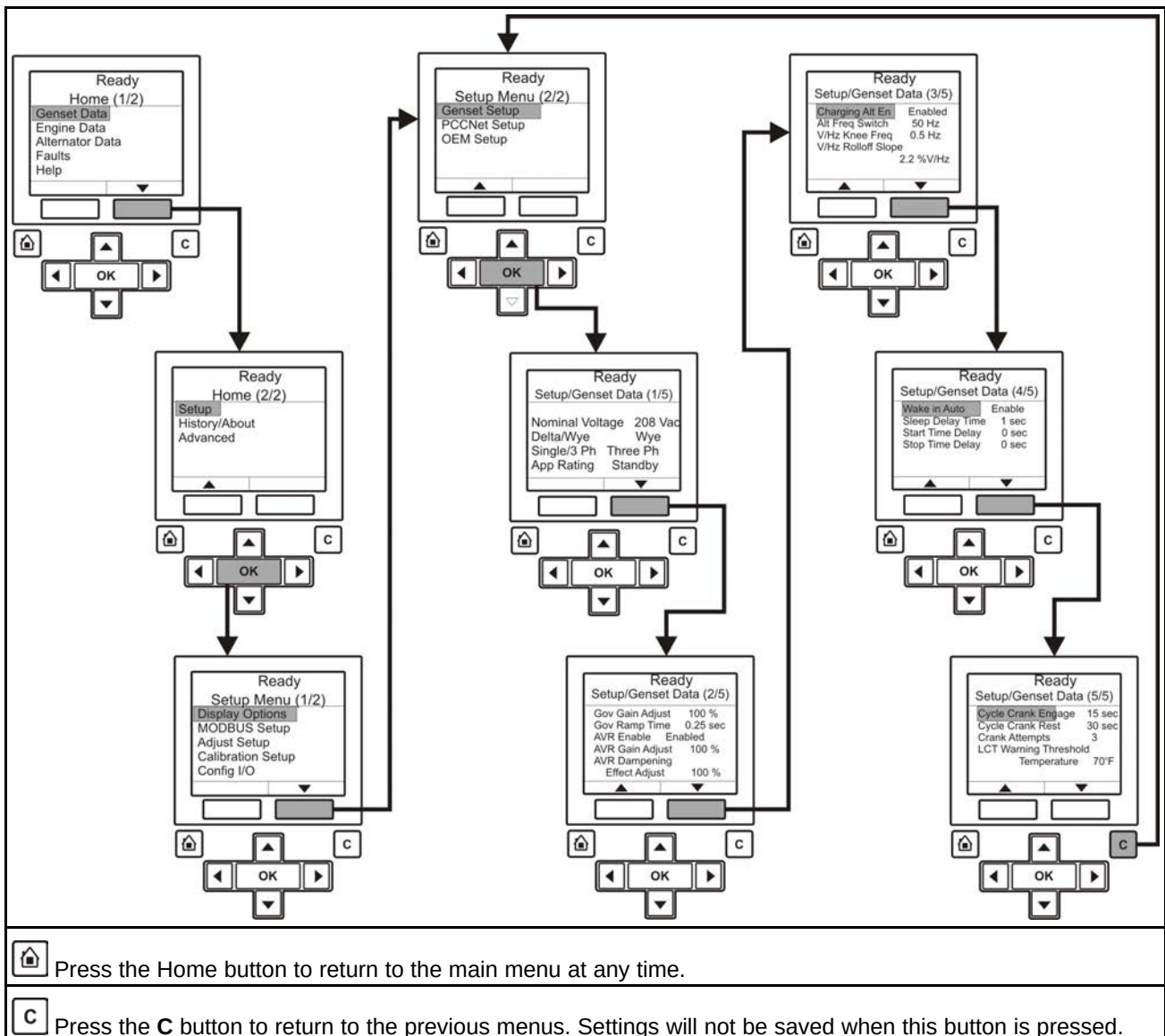


FIGURE 18. SETUP DATA MENU - TYPICAL DATA

4.11 Selecting Operating Modes

4.11.1 Passwords and Mode Change Access

4.11.1.1 Entering the Mode Change Access Code

The Mode Change submenus are intended for trained and experienced service personnel and site personnel only, and by default will require an Access password. If a password is required, the Mode Change – Access Code menu appears when the Auto, Manual Run, or Stop mode is selected.

To enter the mode access code:

1. With the first character highlighted, press the up and down arrow buttons until the required value is displayed.
2. Press the left arrow button to move to the next numeric character.
3. Repeat steps 1 and 2 until all characters of the Access Code are correct.
4. After you have completed entering the password, press the **OK** button.



FIGURE 19. MODE CHANGE ACCESS CODE DISPLAY SCREEN

NOTICE

If an incorrect password is entered, the operator menu that was displayed before Auto, Manual Run, or Stop mode was selected is redisplayed.

4.11.1.1.1 Passwords

It is possible for the operator to view every parameter in the graphical display; however, a password may be required before adjustment of a parameter is permitted. The generator set will prompt you if a password is required and inform you of the level of password required.

TABLE 6. PASSWORDS

Level	Description	Comment
0	No password	None required
1	Operator password	Restricted
2	Service password	Restricted
3	Engineering password	Restricted

4.11.2 Selecting Manual Run Mode

NOTICE

When changing modes, the generator set may start or stop without warning. Make sure there is no danger to personnel or equipment should the generator set unexpectedly start or stop.



Press the **Manual** button and then (within ten seconds) the **Start** button. This bypasses the "Time Delay to Start" function and activates the engine control system and the starting system.



If the engine does not start, the starter disengages after a specified period of time and the controller indicates a "Fail to Start" shutdown.

The generator set can be configured for 1–7 starting cycles with set times for crank and rest periods for all starting modes (manual/remote). The default setting is 3 start cycles, composed of 15 seconds of cranking and 30 seconds of rest.

NOTICE

The InPower service tool or access to the setup menu is required to change the cycle number, and crank and rest times. Contact your authorized distributor for assistance.



To clear a Fail to Start shutdown, press the **Stop** button and then press the **Reset** button.



Before attempting to restart, wait 2 minutes for the starter motor to cool and repeat the starting procedure. If the engine does not run after a second attempt, refer to the Troubleshooting section.

4.11.3 Selecting Auto Mode

NOTICE

When changing modes, the generator set can start or stop without warning. Make sure there is no danger to personnel or equipment should the generator set start or stop.

NOTICE

Make sure that it is safe to do so before proceeding to change the mode.



Press the **Auto** button. This allows the generator set to be started from a remote switch or device (e.g. transfer switch).

In response to the **Remote Start**, the control lights the Remote Start indicator and initiates the starting sequence. This start incorporates a Time Delay to Start function.

NOTICE

The InPower service tool or access to the setup menu is required to change the cycle number, and crank and rest times. Contact your authorized distributor for assistance.

NOTICE

Should a remote start signal be received, the generator set starts automatically. Make sure there is no danger to personnel or equipment should the generator set start without warning.

The starting/stopping sequence for a remote start is as follows:

1. A **remote start** signal is received at the customer connection on the generator set. This input signal is received from a transfer switch, a remote start switch, etc.
2. The Time Delay to Start (0–300 seconds) begins.
3. When the Time Delay to Start has expired, the engine starts. Once it has reached its rated speed and voltage, the generator set is available for use.
4. When the **remote start** signal is removed, a Time Delay to Stop (0–600 seconds) begins. This time delay is used to transfer the load (if connected to another power source) and let the engine cool down.
5. When the Time Delay to Stop has expired, the engine stops.

NOTICE

If the emergency stop or control off button is pressed at any time during the starting/stopping sequence, the engine immediately stops, bypassing the cooldown sequence.

4.11.4 Selecting Off Mode

NOTICE

When changing modes, the generator set can stop without warning. Make sure there is no danger to personnel or equipment should the generator set stop.



Press the **Stop** button to put the generator set into the Off mode. This disables Auto and Manual modes.

If the generator set is running in either Manual or Auto mode, and the **Stop** button is pressed, the engine will shut down. This action may include a cool down run.

NOTICE

Do not perform a hot shutdown under load; a hot shutdown may result in engine damage.

5 Operation - PowerCommand 1.2

5.1 Safety

WARNING

Toxic Gases

Inhalation of exhaust gases can cause asphyxiation and 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. Do not use exhaust heat to warm a room, compartment, or storage area.

WARNING

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Do not open the generator set output box while the generator set is running. Read and observe all warnings and cautions in the generator set manuals.

CAUTION

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service. Even with the power removed, improper handling of components can cause electrostatic discharge.

Only trained and experienced personnel should carry out generator set operations. Before operating the system, the operator should become familiar with all health and safety procedures, warnings, cautions, precautions, and the other documentation supplied with the generator set. (See [Chapter 1 on page 1](#)). Observe all of the warnings and cautions at all times.

NOTICE

Before operating the generator set become familiar with the equipment and how it is operated (including all controls, manually operated valves, and alarm devices). Safe and efficient operation can only be achieved if the generator set is operated correctly.

5.2 Introduction

This section describes the operation of the generator set. The text should be read in conjunction with the System Overview and the Control System Sections of this manual.

All indicators, control switches/buttons, and graphical display are located on the face of the Operator Panel.

5.3 Maintenance

To ensure maximum performance and reliability from your generator set, it is essential that certain components are inspected periodically and, where necessary, maintenance procedures are carried out, as detailed in the Maintenance chapter.

5.4 Operating Recommendations

5.4.1 Running-in

Refer to the Maintenance chapter of this manual. Special "running-in" oils are not recommended for new or rebuilt Cummins engines. Use the same type of oil during "running-in" as is used in normal operation.

The engine should be run at varying loads during the first few hours of operation to allow the components to "bed in." Avoid long periods of light load or full load running particularly during the early life of the engine.

5.4.2 No Load Operation

Periods of no load operation should be held to no longer than 15 minutes. Long periods of no load operation can result in engine and (if fitted) diesel particulate filter damage.

If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a load of at least 30% rated load, but not to exceed rated load. Such a load could consist of a heater element or load bank.

5.4.3 Exercise Period

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts.

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts, and in general helps provide reliable engine starting.

Exercise the set for a minimum of ten minutes off-load at least once a week and for a minimum of 30 minutes with load at least once each month so that the engine reaches normal operating temperatures.

5.4.4 Low Operating Temperatures

NOTICE

Operating engines at idle (650 to 1000 rpm) in cold ambient temperatures wastes fuel, accelerates wear, and can result in serious engine damage. Under low temperature conditions, incomplete combustion will occur, allowing deposits of unburned tars and carbon to buildup on the valve guide and valves, and eventually cause valve sticking.

In cold climates it is critical that the following items be appropriately maintained and selected based on ambient operating temperatures. Check to be sure:

- The battery is properly sized.
- An appropriate mixture of antifreeze is used in the cooling system.
- The proper grade of fuel is being used.
- The correct weight of engine oil is being used.

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins will help provide reliable starting under adverse weather conditions. Make sure the voltage of the separate power source is correct for the heater element rating.

5.4.5 High Operating Temperatures

In high ambient temperatures, when operating at full load, it is normal for the high temperature warning to be given. This indicates that the engine is operating near to its maximum capacity and is normal. If operation in high temperature environments is anticipated, increase the frequency of checks for coolant level, obstructions of cooling air inlets and outlets, and debris at the radiator.

Refer to the generator set nameplate for the maximum operating temperature, if applicable.

5.4.6 Operating Conditions

NOTICE

All generator sets supplied by Cummins must be run under the following operating conditions, and in accordance with the operating information contained within the literature package supplied with each generator set.

5.4.6.1 Continuous Power Rating (COP) for Constant Load Applications

The Continuous Power Rating (COP) is applicable to utility parallel and other non-variable load applications for supplying power continuously to a load of up to 100% of the continuous rating for an unlimited number of hours per year between the stated maintenance intervals and under stated ambient conditions. All maintenance must be carried out as prescribed in Cummins manuals. No overload capability is available at this rating. This rating is applicable for utility base load operation. In these applications, generator sets are operated in parallel with a utility source and run under constant loads for extended periods of time.

5.4.6.2 Prime Power Rating (PRP) for Variable Load Applications

The Prime Power Rating (PRP) is the maximum power available during a variable load sequence which may be run for an unlimited number of hours per year, between the stated maintenance intervals and under the stated ambient conditions. All maintenance must be carried out as prescribed in Cummins manuals. Prime power applications fall into one of the following two categories:

- Unlimited time prime power (for variable load applications)

Prime power is available for an unlimited number of annual operating hours in variable load applications. The permissible average power output under variable load shall not exceed a 70% average of the prime power rating during any operation of 250 hours. The total operating time at 100% prime power shall not exceed 500 hours per year. A 10% overload capability is available for a period of 1 hour within a 12-hour period of operation, in accordance with ISO 8528-1 2005. Total operating time at the 10% overload power shall not exceed 25 hours per year.

- Limited running time prime power (for constant load applications) (LTP)

Prime power is available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as utility power curtailment. Generator sets may be operated in parallel with the public utility up to 750 hours per year at power levels never to exceed the prime power rating. No sustained overload capability is available at this rating. The customer should be aware, however, that the life of any generator set will be reduced by constant high load operation. Any operation exceeding 750 hours per year at the prime power rating should use the Continuous Power Rating.

5.4.6.3 Emergency Standby Power Rating (ESP) for Variable Load Applications

The Emergency Standby Power Rating (ESP) is applicable for supplying emergency power for the duration of a utility power interruption, between the stated maintenance intervals and under the stated ambient conditions. All maintenance must be carried out as prescribed in Cummins manuals. No overload capability is available for this rating and utility parallel operation is not permitted at the standby power rating. For applications requiring sustained utility parallel operation, the limited time prime power rating or continuous power rating must be utilized as applicable.

This rating is applicable to installations served by a reliable normal utility source. Generator sets should be sized for a maximum average load factor of 80% of the standby power rating with a maximum of 200 hours of operation per year, which includes less than 25 hours per year at the standby power rating. In installations served by unreliable utility sources (where outages last longer or occur more frequently), where operation is likely to exceed 200 hours per year, the prime power rating should be applied. The standby rating is only applicable for emergency and standby applications where the generator set serves as the back up to the normal utility source. Negotiated power outages are not considered as emergencies.

5.4.6.4 Applicable to All Ratings

The following information applies to all ratings, unless otherwise agreed by the Regional Sales Manager of Cummins in writing:

- When determining the actual average power output of a variable power sequence in any of the ratings above, powers of less than 30% of the emergency standby power are taken as 30% and time at no load shall not be counted.
- Variable load is calculated in accordance with methods and formulas given in ISO 8528-1-2005.
- All three-phase generators are rated for 0.8 power factor lag. Single-phase generators are rated for 1.0 power factor.
- All ratings are based on the following reference conditions:
 - Ambient temperature: 27 °C (81 °F)
 - Altitude above sea level: 150 m (490 ft)
 - Relative humidity: 60%
- If any of the above conditions are exceeded, the output may be subject to de-rate.
- If any of the above conditions are not satisfied, the operational life of the generating set may be reduced.
- Short term parallel operation with the utility for load transfer purposes only is permitted with all ratings.

5.4.7 De-Rating Factors

Engine power and resulting electrical output decrease as ambient temperature or altitude increases. For de-rating factors applicable at specific sites, contact your authorized distributor.

5.5 Generator Set Operation

WARNING

Combustible Vapors

Engine over speeding can cause component failure, fire, or an explosion; which can cause severe personal injury or death.

Do not operate an engine where there are or can be combustible vapors.

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

Numerous safety devices may be available, such as air intake shutoff devices, to minimize the risk of overspeeding in which an engine, because of application, might operate in a combustible environment (from a fuel spill or gas leak, for example). Cummins does not know how the engine will be used. The equipment owner and operator, therefore, is responsible for safe operation in a hostile environment. Consult your authorized distributor for further information.

NOTICE

Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding where an engine will be operated in a combustible environment.

NOTICE

Long periods of idling (more than ten minutes) can damage an engine. Do not idle the engine for excessively long periods.

5.5.1 Sequence of Operation

The generator set is run automatically using a **Remote Start** signal, or manually using the generator set control panel buttons. LEDs are provided on the operator panel to indicate the operating run mode of the generator set. The PowerCommand® control initiates a starter cranking signal and performs an automatically sequenced manual start, under a complete engine protection system combined with full monitoring capability. If a fault is sensed at start-up, the engine is locked out and will not start.

The choice of **Auto** or **Manual Run** mode is decided by authorized personnel during the generator set initial setup. An access code is required to switch between the **Auto**, **Manual Run**, or **Off** modes, and this facility may be permitted or denied by the authorized personnel during the initial setup of the generator set.

5.6 Before Starting

NOTICE

One operator should be in complete charge, or working under the direction of someone who is in charge. Remember that, upon starting the engine, cables and switchgear will become energized, possibly for the first time. Furthermore, equipment that does not form part of the generator set installation may become electrically charged. Only authorized and competent personnel should carry out this work.

NOTICE

Do not use the Emergency Stop button to shut down an engine unless a serious fault develops. The Emergency Stop button must not be used for a normal shut-down as this will prevent a cooling down run in which the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings in a safe manner.

NOTICE

Diesel engines only: Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. The engine must be shut down as soon as possible after the appropriate functions have been checked.

NOTICE

Gaseous engines only: Avoid running the generator set at no-load and light-loads for extended periods.

Before attempting to start the generator set, the operator should read through this entire manual and the specific literature provided as part of the documentation pack supplied with the generator set. It is essential that the operator be completely familiar with the generator set and the PowerCommand® control.

The sub-sections below cover the systems used to start and stop the generator set.

Before starting the generator set, make sure that exhaust and fuel fittings are tight and properly positioned, and that proper maintenance and pre-start checks have been performed.

During starting, automatic checks are carried out for the integrity of various protection systems. The PowerCommand® control will not allow the generator set to continue the starting sequence if the integrity of a sensor is considered to be in doubt.

The generator set can be configured for a number of starting cycles (one to seven) with set times for crank and rest periods for all starting modes (manual/remote). The default setting is for three start cycles, composed of fifteen seconds of cranking and 30 seconds of rest.

NOTICE

The number of starting cycles, and the crank and rest times are set from within the Setup menu. Trained and experienced service personnel are required to change the default setting. Contact your authorized Cummins distributor.

5.6.1 Initial Pre-Start Checks

WARNING

Electric Shock Hazard

Voltages and currents present an electrical shock hazard that can cause severe burns or death.

Make sure that only personnel who are trained and experienced work with distribution voltages. Even after generator set shutdown, an electrical shock hazard may still exist, caused by induced or residual voltage within the alternator or cables. Some interfaces may display zero voltage even when voltages are present.

WARNING

Hot Pressurized Liquid

Contact with hot liquid can cause severe burns.

Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

Before starting, competent personnel must make the following checks to make sure that the unit is ready for operation:

TABLE 7. INITIAL PRE-START CHECKS

Check	Description
Generator Set Grounding	Grounding (earthing) must be checked prior to performing service or inspection procedures that may expose personnel to conductors normally energized with voltages greater than 600 Volts. Contact your authorized Cummins distributor.
Insulation Testing ¹	This must be performed on all generator sets before initial start-up and after the generator set grounding procedure has been completed. Insulation testing for low voltage (less than 600 Volts) generator sets is recommended by Cummins. These tests are used to verify that the windings are dry before the generator set is operated, and to develop a base line for future test comparisons. Contact your authorized Cummins distributor.
Lubrication ²	Check the engine lubrication oil level and ensure that the correct level is always maintained.
Coolant ^{3,4,5}	Check the engine coolant level and ensure that the level is always maintained. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check the level while the engine is hot.

Check	Description
¹	When wire insulation-testing an alternator, failure to protect the voltage regulator, control and diodes could result in permanent damage to one or more of the electronic components.
²	<i>Generator sets shipped dry only:</i> They must be filled with the correct type and quantity of oil before use. Be sure to check the oil level before initial start. Failure to fill to the recommended level can result in equipment damage.
³	<i>Generator sets that require a mix of anti-freeze and DCA inhibitor only:</i> You must comply with Cummins requirements for the correct type and concentration of anti-freeze and DCA inhibitor. Warranty claims for damage will be rejected if the incorrect mix is used. Consult your authorized Cummins distributor for the correct anti-freeze specifications and concentration for your operating conditions.
⁴	<i>Radiators with two fill necks only:</i> Both fill necks must be filled after the cooling system has been drained.
⁵	<i>Generator sets shipped dry only:</i> The engine must be filled with the correct type and quantity of coolant before use. Be sure to check coolant level(s), before the initial start.

5.6.2 Operator's Pre-Start Checks

 WARNING
<p>Arc Flash and Shock Hazard <i>Electric arc flash can cause electrical shock, severe burns, or death. Make sure the alternator is dry before the generator set is operated.</i></p>
 WARNING
<p>Hot Pressurized Liquid <i>Contact with hot liquid can cause severe burns. Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.</i></p>
NOTICE
<p><i>Radiators with two fill necks only:</i> Both fill necks must be filled when the cooling system has been drained.</p>

TABLE 8. OPERATOR'S PRE-START CHECKS

Check	Description
Fuel Supply (<i>Diesel Only</i>)	<p>Make sure that:</p> <ul style="list-style-type: none"> The fuel tank is filled to the normal level with clean water-free fuel and that the fuel system is primed; All the valves required for operation are open; and There are no leaks and that all fittings are tight.
Lubrication	With the engine stationary, check the engine lubrication oil level and make sure that the correct level is always maintained.
Coolant	Check the engine coolant level and make sure that the level is always maintained at the coolant expansion tank. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check while the engine is hot.
Cooling Air Inlet/Outlets	Make sure that the cooling air inlets/outlets are unobstructed.

Check	Description
Exhaust Outlet	Make sure that: <ul style="list-style-type: none"> Exhaust components are secured and not warped; The exhaust outlet is unobstructed; No combustible materials are near the system; Gases are discharged away from building openings; and There are no leaks and that all fittings are tight.
Batteries	Make sure that the batteries are charged, and that all connections are clean, correct and tight (if applicable).
Auxiliary Powered AC Supplies	Make sure that all auxiliary equipment is receiving power from the customer's supply.
Emergency Stop	Make sure that the emergency stop button is fully operational.

5.6.3 Starting at Operator Panel (Manual Run Mode)

NOTICE

Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity of both the generator set and connected load equipment that the generator set is about to start.

Make sure the main circuit breaker is in the open position.

To start the generator set in the **Manual Run** mode, press the **Manual** button  on the Operator

Panel, and then press the **Start** button  within ten seconds. Failure to press the **Start** button within this time will result in the generator set changing to the **Off** mode. (Refer also to [Section 4.11.2 on page 43](#))

NOTICE

If the mode change access code feature has been enabled, enter the access code when prompted. (See [Mode Change Access](#)).

The PowerCommand® control will initiate a starter cranking signal and will perform an automatically sequenced manual start, under a complete engine protection system combined with full monitoring capability. This will activate the engine control system and the starting procedure. The starter will begin cranking, and after a few seconds the engine will start and the starter will disconnect.

Should the engine fail to start, the starter will disengage after a specified period of time and the control will indicate a Fail to Start shutdown.

To clear a Fail to Start shutdown, press the **Stop** button  and then press the **Reset** button.  Before attempting to re-start wait a minimum of two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to [Chapter 7 on page 89](#).

To disable **Manual** mode, change to **Auto** or **Off** mode. If the generator set is running when it leaves **Manual** mode, it will continue to run if **Auto** mode has been selected and the remote start signal is active. If there is no active remote start signal, the generator set will stop.

5.6.4 Starting from Remote Location (Auto Mode)

NOTICE

Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity that the generator set is about to start.



To start the generator set in the **Auto Run** mode, select the **Auto** button from the operator panel. (Refer also to [Section 4.11.3 on page 43](#)).

Only on receipt of a remote start signal, and after a Time Delay to Start, will the PowerCommand® control initiate the starting sequence as above.

The **Remote Start LED** will be lit.

NOTICE

If the mode change access code feature has been enabled, enter the access code when prompted. (See [Section 4.11.1 on page 42](#)).

To disable **Auto** mode, change to **Manual** or **Off** mode.

5.6.5 Cold Starting with Loads

NOTICE

Make sure that all pre-start checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity that the generator set is about to start.

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

Cummins recommends equipping standby generator sets (life safety systems) with engine water jacket coolant heaters to maintain the coolant at a minimum of 32 °C (90 °F) and, for most applications, accept the emergency load in ten seconds or less. Although most Cummins generator sets will start in temperatures down to -32 °C (-25 °F) when equipped with engine water jacket coolant heaters, it might take more than ten seconds to warm the engine up before a load can be applied when ambient temperatures are below 4 °C (40 °F).

The **Low Coolant Temp** (Code 1435) message along with the lighting of the **Warning** LED are provided to alert the operator of a possible delay in accepting the load. The engine cold sensing logic initiates a warning when the engine water jacket coolant temperature falls below 21 °C (70 °F). In applications where the ambient temperature falls below 4 °C (40 °F), a cold engine may be indicated even though the coolant heaters are connected and functioning correctly. Under these conditions, although the generator set may start, it may not be able to accept load within ten seconds. When this condition occurs, check the coolant heaters for correct operation. If the coolant heaters are operating correctly, other precautions may be necessary to warm the engine before applying a load.

5.6.5.1 Checking Coolant Heater Operation

⚠ WARNING

Hot Surfaces

Contact with the hot surfaces can cause severe burns.

Avoid contact with hot parts. Allow hot parts to completely cool.

Do not touch the cooling system outlet hose. The coolant heater is operating if radiant heat can be felt with your hand held close to the outlet hose and the engine is not running.

5.7 Stopping

NOTICE

The access code may be required before initiating the Off button sequence. See the Passwords and Mode Change Access section.

NOTICE

Run the generator set at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

5.7.1 Stopping at Operator Panel (Manual Mode)

If the generator set was started at the Operator Panel in **Manual** mode, remove the load, open the

main circuit breaker and press the **Stop** button  once to stop the generator set immediately.

NOTICE

If possible, hot shutdown under load should be avoided to help prolong the reliability of the generator set.

5.7.2 Stopping from the Operator Panel (Auto Mode)

If the generator set was started in **Auto** mode, press the **Stop** button  once to stop the generator set immediately.

NOTICE

If possible, hot shutdown under load should be avoided to help prolong the reliability of the generator set.

5.7.3 Stopping from Remote Location (Auto Mode)

If the control receives a remote stop signal, the generator set completes its normal shutdown sequence (Refer to [Section 4.11.3](#)). (The remote stop signal is actually the removal of the remote start signal to the control).

The generator set stops after completing the Time Delay to Stop function (zero to 600 seconds).

NOTICE

The InPower service tool or access to the Setup menus is required to enable and change the time delay start/stop settings. Contact your authorized distributor for assistance.

5.7.4 Code 1433 or 1434 - Emergency Stop

The local **Emergency Stop** button is situated on the front of the operator panel. This is a mechanically latched switch that will unconditionally stop the engine when pressed, bypassing any time delay to stop. Push this button for emergency shutdown of the engine.

NOTICE

If the engine is not running, pushing the button will prevent the starting of the engine, regardless of the start signal source (Manual or Auto - Remote).

When the **Stop** button is pressed, the display will indicate the shutdown condition by illuminating the red **Shutdown** status LED  and displaying the following message on the graphical LCD display:

- Fault Number: 1433 LOCAL EMERGENCY STOP

A remote **Emergency Stop** button may be incorporated within the installation. If this remote **Emergency Stop** button is activated, the following message will be displayed:

- Fault Number: 1434 REMOTE EMERGENCY STOP

To reset:

1. Pull, or twist and pull the button out.
2. Press the **Stop** button on the operator panel to acknowledge this action.
3. Press the **Reset** button.
4. Press the **Auto** or **Manual Run** button, as previously determined. See the Selecting Operating Modes section.

NOTICE

Do not use an Emergency Stop button to shut down an engine unless a serious fault develops. The Emergency Stop button must not be used for a normal shut-down because this will prevent a cooling down run in which the lubricating oil and engine coolant safely carry away heat from the engine combustion chamber and bearings.

NOTICE

Make sure that the cause of the Emergency Stop is fully investigated and remedied before a fault Reset and generator set Start are attempted.

NOTICE

An Emergency Stop button is situated in close proximity to the operator panel viewing window.

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6 Maintenance

WARNING

Automated Machinery

Accidental or remote starting of the generator set can cause severe personal injury or death. Make sure that the generator set cannot be started accidentally or remotely before starting work on the generator.

WARNING

Fall Hazard

Falls can result in severe personal injury or death. Make sure that suitable equipment for performing tasks at height are used in accordance with local guidelines and legislation.

WARNING

Mechanical Hazard

Failed components may be ejected or operate incorrectly which can cause severe personal injury or death. Do not climb the generator set; this may damage critical parts.

WARNING

Combustible Gases

Ignition of battery gases is a fire and explosion hazard which can cause severe personal injury or death. Do not smoke, or switch the trouble light ON or OFF near a battery. Touch a grounded metal surface first before touching batteries to discharge static electricity. Stop the generator set and disconnect the battery charger before disconnecting battery cables. Using an insulated wrench, disconnect the negative (-) cable first and reconnect it last.

WARNING

Electric Shock Hazard

Voltages and currents present an electrical shock hazard that can cause severe burns or death. Make sure that only personnel who are trained and experienced work with distribution voltages. Even after generator set shutdown, an electrical shock hazard may still exist, caused by induced or residual voltage within the alternator or cables. Some interfaces may display zero voltage even when voltages are present.

WARNING

Electrical Generating Equipment

Incorrect operation and maintenance can result in severe personal injury or death. Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

NOTICE

Only authorized and qualified maintenance technicians, who are familiar with the equipment and its operation, should carry out maintenance.

NOTICE

Dependent upon the control system fitted, this unit may operate automatically and could start without warning.

NOTICE

Before carrying out any maintenance work, become familiar with [Section 1.3 on page 4](#), together with all the documentation supplied with the generator set.

NOTICE

Always disconnect a battery charger from its AC source before disconnecting the battery cables. Failure to do so can result in voltage spikes high enough to damage the DC control circuits of the generator set.

All maintenance tasks must be assessed for health and safety risks, the preventative measures identified must be actioned. Accompaniment is required for tasks where the presence of someone else will add significantly to the safety of the task.

Read, understand, and comply with all Caution and Warning notes in this section, those contained within [Chapter 1 on page 1](#), and those contained within the documentation supplied with the generator set.

Ensure adequate lighting and staging (where required) are installed.

NOTICE

Before carrying out any maintenance work, lock the generator set out of service for safe working.

6.1 Locking the Generator Set Out of Service

Before any work is carried out for maintenance, etc., the generator set must be immobilized. Even if the generator set is put out of service by pressing the **Off** switch on the operator panel, the generator set cannot be considered safe to work on until the engine is properly immobilized, as detailed in the following procedures.

NOTICE

Refer also to the engine specific Operator Manual. This manual contains specific equipment instructions that may differ from the standard generator set.

6.1.1 Immobilizing for Safe Working

To immobilize the generator set:

1. Press the **Off** mode switch on the operator panel to shut down the generator set.
2. Press the **Emergency Stop button**. This prevents the generator set starting, regardless of the Start signal source and provides an additional safety step for immobilizing the generator set.

NOTICE

When the Emergency Stop button is pressed, the operator panel indicates a Shutdown condition. The red Shutdown status LED  illuminates and a message is displayed.

NOTICE

This condition is stored in the Fault History.

3. As an additional precaution, thoroughly ventilate the plant room before disconnecting any leads.
4. Isolate and lock off the supply to the heater, where fitted.
5. Isolate and lock off the supply to the battery charger, where fitted.
6. Isolate the fuel supply to the engine.
7. Using an insulated wrench, disconnect the negative (–) cable first on the starting batteries and control system batteries (if separate).
8. Fit warning notices at each of the above points to indicate Maintenance in Progress – Plant Immobilized for Safe Working.

6.2 Periodic Maintenance

The periodic maintenance procedures should be performed at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

The tabular data that follows gives the recommended service intervals for a generator set on Standby service. If the generator set will be subjected to Prime usage or extreme operating conditions, the service intervals should be reduced accordingly.

Some of the factors that can affect the maintenance schedule are:

- Use for continuous duty (prime power)
- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand

Consult with an authorized distributor if the generator set will be subjected to any extreme operating conditions and determine if extra protection or a reduction in service intervals is needed. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated, or after the number of operating hours indicated, whichever comes first.

TABLE 9. AIR INTAKE MAINTENANCE

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 250 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task		Service Technician Task				
Check air cleaner restriction indicator (where fitted): If the service indicator shows red, replace air cleaner elements and reset the air cleaner service indicator.	■						
Check air intake system for leaks: Visually inspect the air intake system for signs of wear or damage. Check audibly when the generator set is running. To replace, contact your authorized distributor.	■						
Clean air cleaner housing.				■			

TABLE 10. CONTROL MAINTENANCE

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 250 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task		Service Technician Task				
Check operation of Control Panel: Check display (the system will perform a control panel test on initial activation). To replace, contact your authorized distributor.	■						
Check operation of Emergency Stop Button: With the generator set running, press the Emergency Stop button. Check all systems, before resetting the fault.		■					

TABLE 11. COOLING MAINTENANCE

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 250 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task		Service Technician Task				
Check coolant level of radiator(s) (water jacket & LTA): If low, top up to coolant system specifications level, with Cummins recommended coolant mix.	■						
Check cooling fan blades: Visually inspect the fan blades through the guarding for signs of wear or damage. To replace, contact your authorized distributor.	■						
Check drive belt, condition and tension: Visually check belt for evidence of wear or slippage. To replace, contact your authorized distributor.	■						
Check coolant lines and radiator hoses for leaks, wear, and cracks: Visually check for leaks, worn or damages hoses. To replace, contact your authorized distributor.	■		■				
Check radiator air flow: Visually inspect the radiator through the guarding for blockage, build up of debris, signs of wear or damage. To clean or replace, contact your authorized distributor.	■						
Clean radiator matrix.			■ ¹				
Check aftercooler core.						■	
Check water pump.						■	
Check belt driven fan hub.							■
Change coolant filter.			■				
Check coolant heater.					■		
Fan drive idler arm and fan belt tensioner check.					■		
Replace cooling system coolant.							■
■ ¹ – Cleaning schedule may be reduced depending on operating conditions/environment. Contact your authorized distributor.							

TABLE 12. ENGINE MAINTENANCE C90 D5, C110 D5, C80 D6, C100 D6 - (6BTA5.9-G5/G6)

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 500 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task		Service Technician Task				
Check fuel lines and hoses: Visually check for leaks, worn or damages hoses. To replace, contact your authorized distributor.	■ ¹						
Check engine oil level: If low, top up to engine specifications level, with recommended oil.	■						
Drain water from fuel system primary filter/water separator: Drain one cup, or more, of fuel to remove water and sediment. See procedure in this chapter.	■						
Crankcase breather tube/collector. Check for condensed oil. Drain and dispose of in accordance with local legislation.	■						
Check charge alternator: Check visually and audibly when the generator set is running. To replace, contact your authorized distributor.	■						
Check engine oil make-up system: If low, top up to to indicated level, with Cummins recommended oil.	■						
Check engine coolant heater: Check coolant heater has power and is running. To replace, contact your authorized distributor.	■						
Replace lubricating oil and filters.			■				
Check engine ground. Clean as necessary.				■			
Replace water separator element.			■				
Replace fuel system secondary filter.			■				
Check engine mounts.			■				
Check starting motor.					■		
Check turbocharger.					■		
Engine oil heater check.					■		
Engine steam clean.					■		
Air compressor discharge lines check.					■		
Check air compressor unloader and valve assembly.							■
■ ¹ – Check before starting and again with the generator set running.							

TABLE 13. ENGINE MAINTENANCE C150 D5, C170 D5, C135 D6 - (6BTAA5.9-G6/G7)

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 500 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task	Service Technician Task					
Check fuel lines and hoses: Visually check for leaks, worn or damages hoses. To replace, contact your authorized distributor.	■ ¹						
Check engine oil level: If low, top up to engine specifications level, with recommended oil.	■						
Drain water from fuel system primary filter/water separator: Drain one cup, or more, of fuel to remove water and sediment. See procedure in this chapter.	■						
Crankcase breather tube/collector. Check for condensed oil. Drain and dispose of in accordance with local legislation.	■						
Check charge alternator: Check visually and audibly when the generator set is running. To replace, contact your authorized distributor.	■						
Check engine oil make-up system: If low, top up to to indicated level, with Cummins recommended oil.	■						
Check engine coolant heater: Check coolant heater has power and is running. To replace, contact your authorized distributor.	■						
Replace lubricating oil and filters.				■			
Check engine ground. Clean as necessary.				■			
Replace water separator element.				■			
Replace fuel system secondary filter.				■			
Check engine mounts.			■				
Check starting motor.					■		
Check turbocharger.					■		
Engine oil heater check.					■		
Engine steam clean.					■		
Air compressor discharge lines check.					■		
Check air compressor unloader and valve assembly.							■
■ ¹ – Check before starting and again with the generator set running.							

TABLE 14. EXHAUST MAINTENANCE

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 250 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task	Service Technician Task					
Check all exhaust components, and hardware (fittings, clamps, fasteners, etc.): Visually inspect the exhaust system for signs of wear or damage. Check audibly when the generator set is running. To replace, contact your authorized distributor.	■						
Check exhaust condensation trap: Drain condensation into a suitable container. Dispose of fluids in accordance with local legislation.	■						

TABLE 15. GENERATOR SET MAINTENANCE

MAINTENANCE ITEMS	Daily 8 Hours	Weekly 50 Hours	6 Months 250 Hours	12 Months 250 Hours	1500 Hours 12 Months	2000 Hours	2 Years 6000 Hours
Perform maintenance tasks as specified using Daily or Hourly periods – whichever occurs first							
Task	Operator Task	Service Technician Task					
Check fuel level in tank: If low, add fuel (A full tank reduces condensation.)	■						
Check bedframe/enclosure fluid containment (where fitted): Drain as necessary. Clean all contaminated areas. Dispose of fluids in accordance with local legislation.	■						
Check generator set enclosure: Visually check enclosure, walk around inspection of generator set. Make sure no inlets/outlets are covered/restricted, service access doors are operational and safety systems are in place and operational. To replace damaged parts, contact your authorized distributor.	■						
Check batteries: Check connections are secure and battery area is free from tools and other items.		■			■		
Check battery electrolyte level.				■			
Check electrical connections (battery, starter motor and alternator connections).				■	■		

6.3 Maintenance Procedures - Daily or When Refueling

Monitor fluid levels, oil pressure, and coolant temperature frequently. During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. The following sections cover several areas that should be frequently inspected for continued safe operation.

NOTICE

Components that have guards against inadvertent touching must be visually inspected only. Do not remove the guards to do the inspection.

6.3.1 General Information

Preventive maintenance begins with day-to-day awareness of the condition of the generator set. Before starting the generator set, check and look for:

- Oil and coolant levels
- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine noise or performance
- Generator set appearance

6.3.2 Engine Operation Report

The engine must be maintained in good mechanical condition if the operator is to obtain optimum satisfaction from its use. Running reports are necessary to enable programmed or emergency servicing to be carried out.

Comparison and intelligent interpretation of the running report, together with a practical follow-up action will eliminate most failures and emergency repairs.

Most engine problems give an early warning. Look and listen for changes in engine performance, sound, or appearance that can indicate service or repair is needed. Some engine changes to look for and report on are:

- Low lubricating oil pressure
- Low power
- Abnormal water or oil temperature
- Unusual engine noise
- Excessive use of coolant, fuel or lubricating oil
- Any coolant, fuel, or lubricating oil leaks
- Misfire
- Unexplained frequency fluctuation
- Significant vibration
- Excessive white and/or black exhaust smoke.

6.4 Cooling System

NOTICE

Loss of coolant can allow the engine to overheat if it does not have the protection of a shutdown device. This can cause severe damage to the engine. Maintain coolant level for proper operation of high engine temperature shutdown system. If applicable, see the Model Specifications section for more information.

6.4.1 Coolant Level - Check

⚠ WARNING

Scalding

Do not remove the radiator cap from a hot engine; Failure to do so can result in personal injury from heated coolant spray or steam.

Wait until the temperature is below 50 °C (122 °F) before removing pressure cap. Remove filler cap slowly to release coolant system pressure.

⚠ CAUTION

Skin Infection

Avoid prolonged or repeated skin contact with antifreeze to prevent skin infections.

Comply with all local health and safety regulations/codes when handling or disposing of antifreeze.

⚠ CAUTION

Cold coolant.

Engine castings can be damaged.

Do not add cold coolant to a hot engine, allow the engine to cool to below 50 °C (122 °F) before adding coolant.

NOTICE

Never use a sealing additive to stop leaks in the coolant system. This can result in a blocked coolant system and inadequate coolant flow causing the engine to overheat.

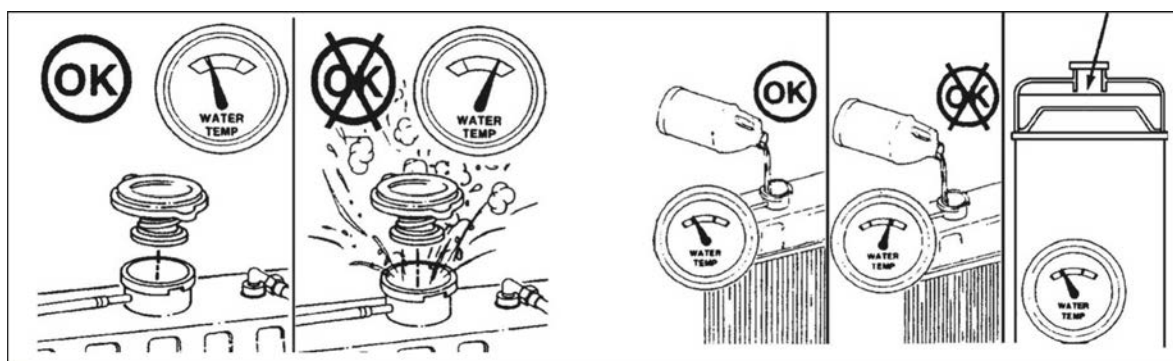


FIGURE 20. COOLANT LEVEL PROCEDURE

Coolant level must be checked daily. The standard coolant concentration is 50% Ethylene Glycol and water, this concentration must be maintained. Warranty claims for damage will be rejected if the incorrect mix of anti-freeze has been used. Consult your authorized distributor for the correct anti-freeze specifications and concentration for your operating conditions. The recommended antifreeze is Fleetguard® Compleat ES which is a low-silicate antifreeze, or its equivalent.

NOTICE

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

Fill the cooling system with coolant to the bottom of the fill neck in the radiator or expansion tank, with the coolant temperature at 50 °C (122 °F) or lower.

NOTICE

Some radiators have two fill necks, both of which must be filled. Refer to the generator set specific drawings supplied with the set.

6.4.2 Cooling Fan - Inspection

** WARNING*****Moving Parts***

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

NOTICE

Never pull or pry on the fan, this can damage the fan blade(s) and cause fan failure.

A visual inspection of the cooling fan is required daily. Check for loose rivets or retaining bolts, for cracks, and bent or loose blades .

Do not operate the generator set with a damaged fan. Contact your authorized distributor for repair or replacement of a damaged fan.

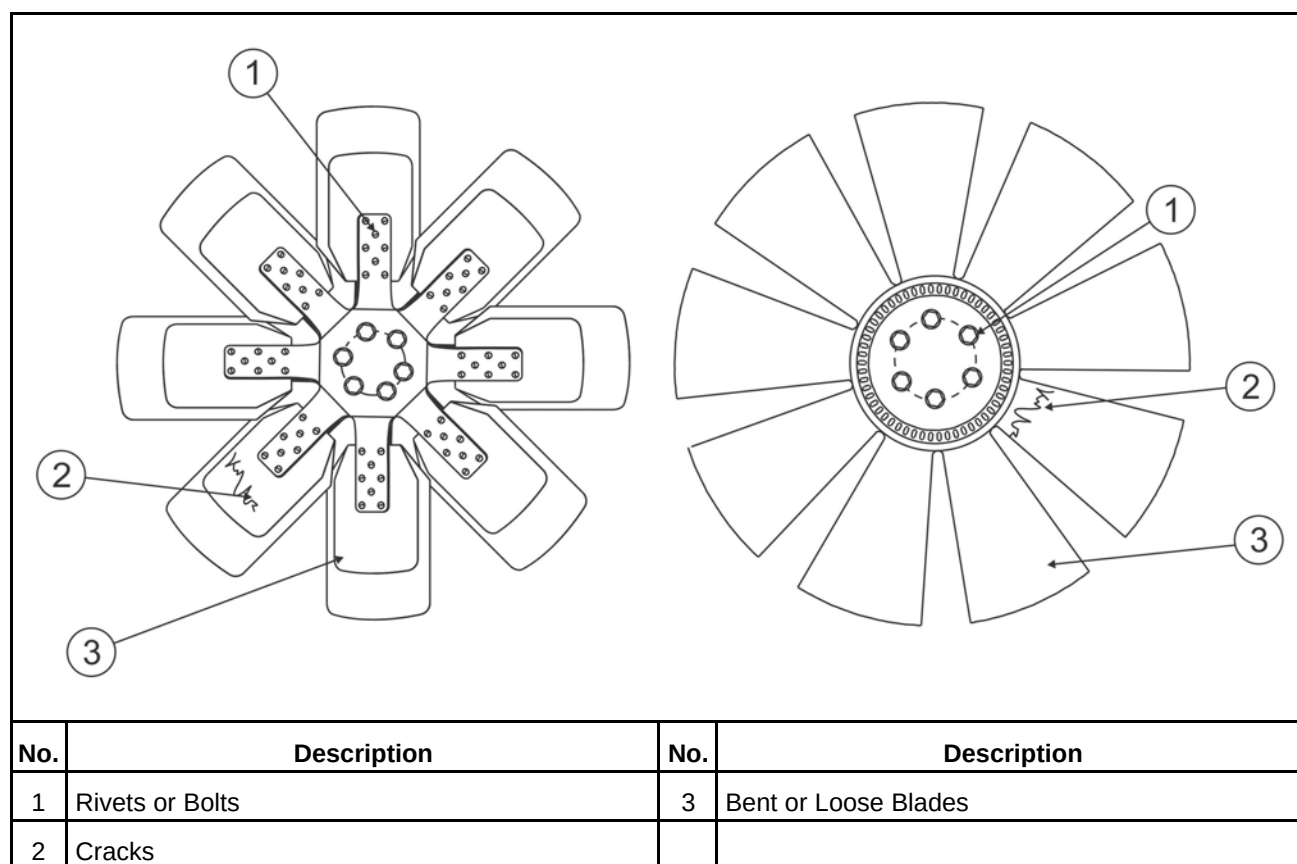


FIGURE 21. COOLING FAN INSPECTION CHECKPOINTS

6.4.3 Drive Belt - Inspection

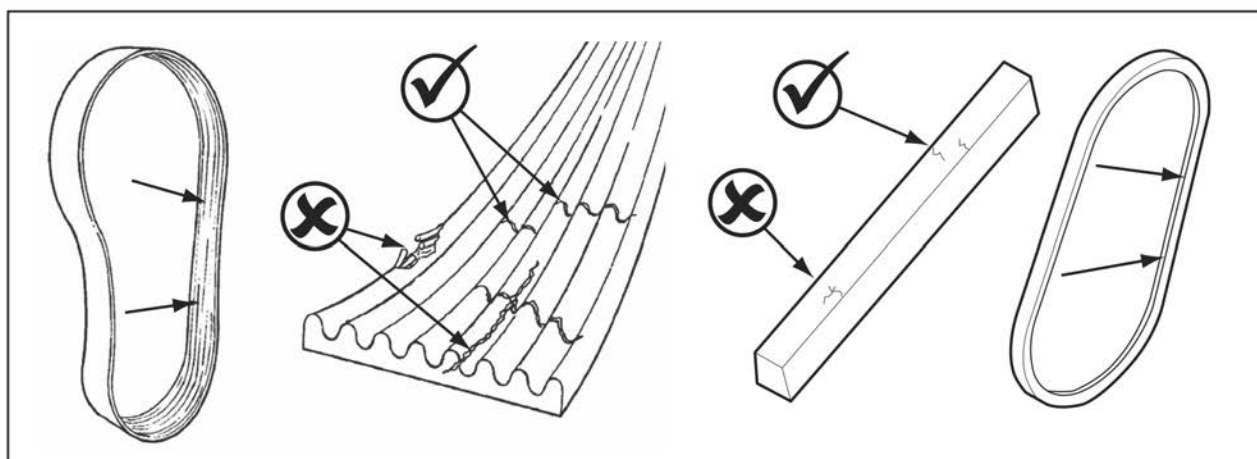


FIGURE 22. DRIVE BELT INSPECTION

Visually inspect the belt through the guarding.

Check for:

- Intersecting cracks. Small transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are NOT acceptable.
- Frays or pieces of material missing.
- Glazed or cracked side walls.
- Uneven wear on sidewalls of belt.

NOTICE

Do not mix old and new V-belts on the same drive.

Contact your authorized distributor to have worn belts replaced.

Visually inspect sheaves through the guarding.

Check for:

- Damaged or worn grooves.
- Breaks on flanges of grooves.
- Frays or pieces of material missing.
- Glazed or cracked side walls.
- Uneven wear on sidewalls of belt.

NOTICE

V-Belts should never ride in the bottom of the groove. Damaged or worn grooves should not be used.

NOTICE

Keep foreign materials away from sheaves and belts as this may cause belt slip.

Contact your authorized distributor to have worn sheaves replaced.

6.4.4 Radiator Check

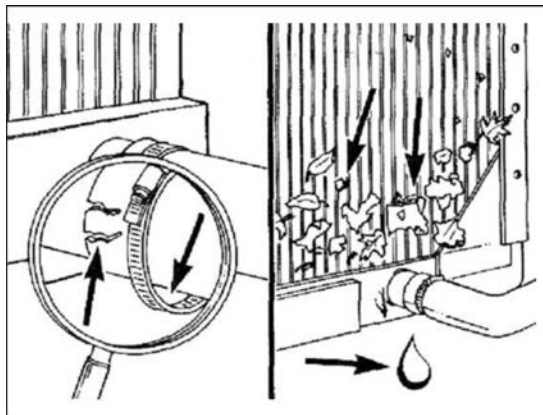


FIGURE 23. RADIATOR CHECK

Check for damaged hoses and loose and damaged hose clamps.

Inspect the exterior of the radiator (through the guarding) for obstructions. During the service life of a radiator a buildup of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To continue the efficiency of the radiator, the core will require cleaning.

Cleaning of the radiator core must only be undertaken by suitably trained and experienced service personnel.

6.5 Level Check

⚠ WARNING

Hot Pressurized Liquid

Contact with hot liquid can cause severe burns.

Crankcase pressure can blow out hot oil. Do not check the oil while the generator set is operating.

⚠ CAUTION

Hazardous Liquid

Prolonged or repeated skin contact can cause severe personal injury.

Avoid prolonged or repeated skin contact. Comply with all local health and safety regulations/codes during handling or disposal.

NOTICE

Do not operate the engine with the oil level below the low mark or above the high mark. Overfilling can cause foaming or aeration of the oil while operation below the low mark may cause loss of oil pressure.

NOTICE

Use high-quality multi-viscosity lubricating oil such as Cummins Premium Blue® or its equivalent. Consult your authorized distributor for the correct lubricating oil specifications for your operating conditions.

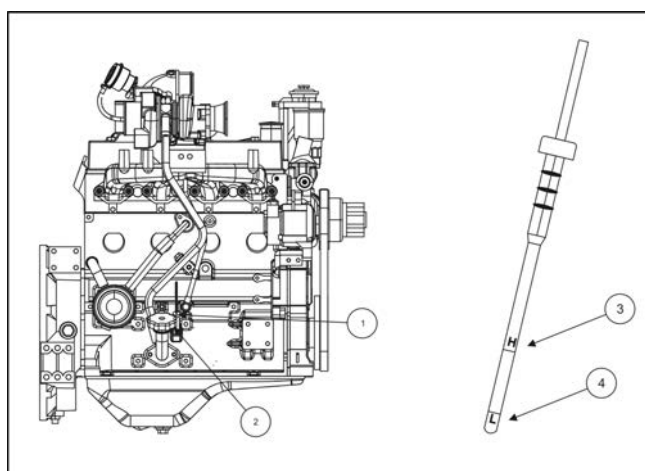


FIGURE 24. OIL LEVEL CHECK

The engine oil level must be checked daily before starting the engine, when the generator set is not running.

Never operate the engine with the oil level below the L (Low) mark (4), or above the H (High) mark (3).

1. Remove the dipstick (1) and with a lint free cloth wipe the dipstick clean.
2. Fully replace the dipstick.
3. Remove the dipstick and check the level of oil against the High and Low marks on the dipstick.
4. Top up to the High mark (3) if necessary with the correct grade of oil for your application.
 - a. Remove the filler cap (2).
 - b. Place a lint free cloth beneath or around the oil filler neck to minimize spillage.

- c. Where possible use a funnel to help pour the new engine oil into the oil filler neck to the correct level.
- d. Using the dipstick check the oil level, do not overfill the system. If more oil is needed then continue to fill with oil until the correct level is reached. If the level is too high then some of the oil will need to be drained off, refer to the engine operator and maintenance manual.
- e. Replace the dipstick and oil filler cap.
- f. Remove the lint free cloth, start the engine and allow to idle for five minutes, switch the engine off wait five minutes to allow the oil to drain back to the oil pan.
- g. Check the oil level. Repeat steps (1-5) if oil needs to be added.

Clean up any spillage and dispose of materials in accordance with local regulations.

6.5.1 Crankcase Breather Oil Drain Cup

Oil must be drained out of the crankcase breather oil drain cup(s) during monthly generator set exercises or whenever necessary. The amount of oil in the drain cup(s) is to be checked daily.

1. When the generator set is not in operation, open the drain valve and drain the oil into a suitable container. The volume of oil is expected to be minimal.
2. When completed, close the drain valve.
3. Clean the area of any spills/residue. Dispose of waste oil and contaminated cloths, in accordance with local legislative requirements, to an authorized waste disposal contractor.

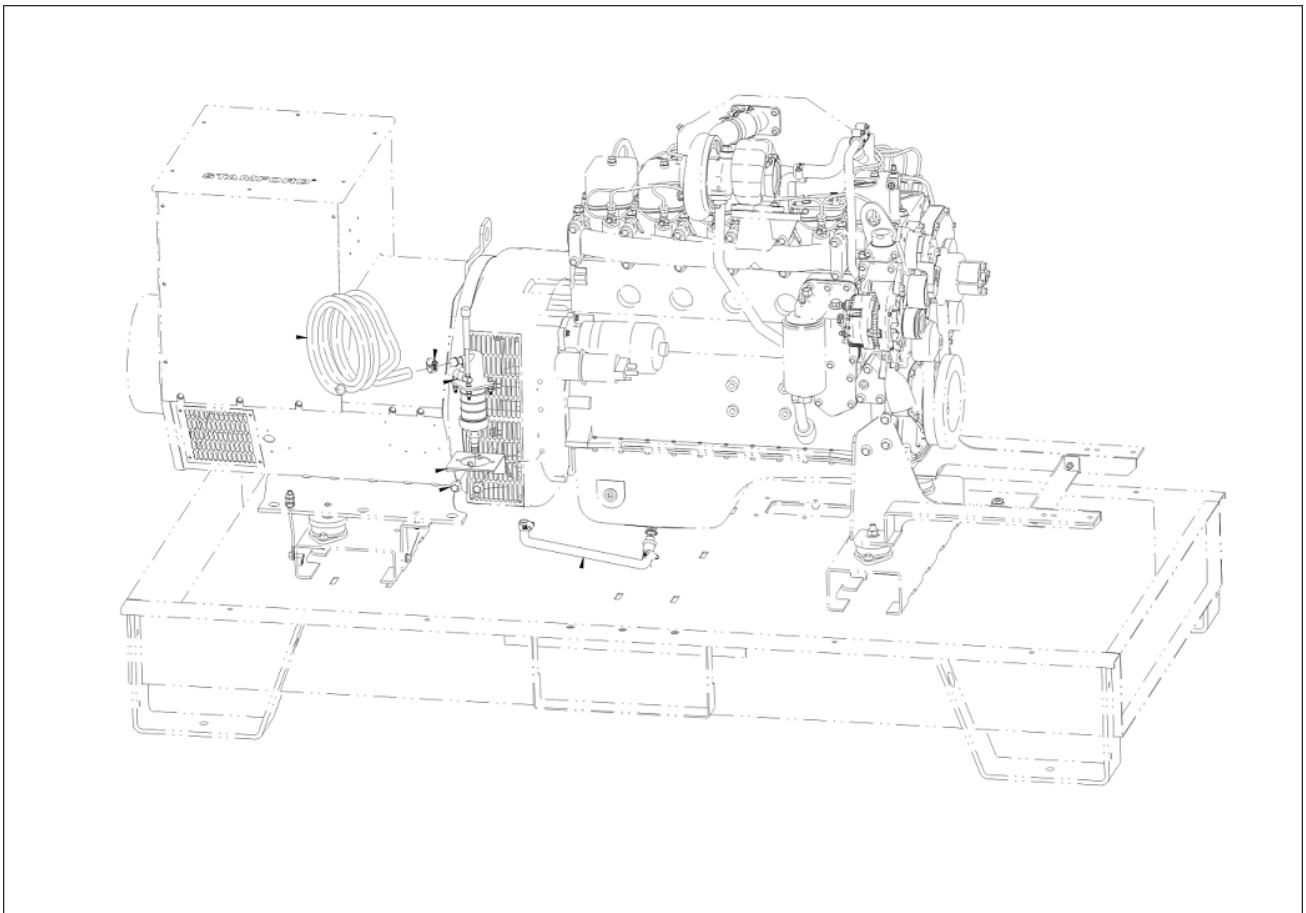


FIGURE 25. OIL DRAIN PUMP INSTALLATION

6.6 Fuel System

WARNING

Combustible Liquid

Diesel fuel is a fire and explosion hazard which can cause severe personal injury or death. Do not permit any open flame, or other igniter near the fuel system, or in areas sharing ventilation.

WARNING

Combustible Liquid

Mixing gasoline or alcohol with diesel fuel is an explosion hazard which can result in severe personal injury or death.

Do not mix gasoline or alcohol with diesel fuels.

NOTICE

Engine fuel actuators can operate at voltages up to 140 volts DC.

NOTICE

Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the injection pump and the injection nozzles.

Use ASTM No. 2D fuel with a minimum Cetane number of 40. No. 2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 40 are often needed in high altitudes, or extremely low ambient temperatures, to prevent misfires and excessive smoke. Contact your authorized distributor for your operating conditions.

NOTICE

A diesel fuel to BS 2869:2010+A1:2011 (Fuel oils for agricultural, domestic, and industrial engine and boilers. Specification), conforming to the requirements and test methods of that specification would be an acceptable alternative to ASTM No. 2D.

6.6.1 Fuel Level

To avoid condensation problems, keep fuel supply tanks as full as possible by filling up each time the engine is used. Condensation (water) can cause clogging of the fuel filters as well as possible freezing problems. In addition, water mixing with the sulfur in the fuel forms acid which can corrode and damage engine parts.

6.6.2 Fuel/Water Separator Drain

Fuel/water separators provide protection for the engine fuel injection system, as water-free fuel supplies cannot be guaranteed.

Drain the water and sediment from the separator daily. The fuel filters can be inspected for collected water by checking the clear bowl at the bottom of each filter.

To drain the water:

1. Shut off the engine.
2. Place a suitable container under the fuel filter.
3. With the fuel supply valve closed, open the vent cap to break the airlock in the filter.

4. Turn the valve counterclockwise until the valve drops down about one inch (25 mm). Accumulated water will drain first. Drain the filter sump of water until clear fuel is visible.
5. When fuel begins to flow out of the drain, push the valve up and turn the valve clockwise to close the drain valve.
6. Before starting the engine, be sure to open the fuel supply valve.
7. If more than 2 oz (60 ml) is drained, refilling of the filter is required to prevent hard starting.

NOTICE

Do not over tighten the valve. Over tightening can damage the threads.

NOTICE

If more than 2 oz (60 ml) is drained, refilling of the filter is required to prevent hard starting.

The drained liquids must be disposed of in accordance with local environmental regulations.

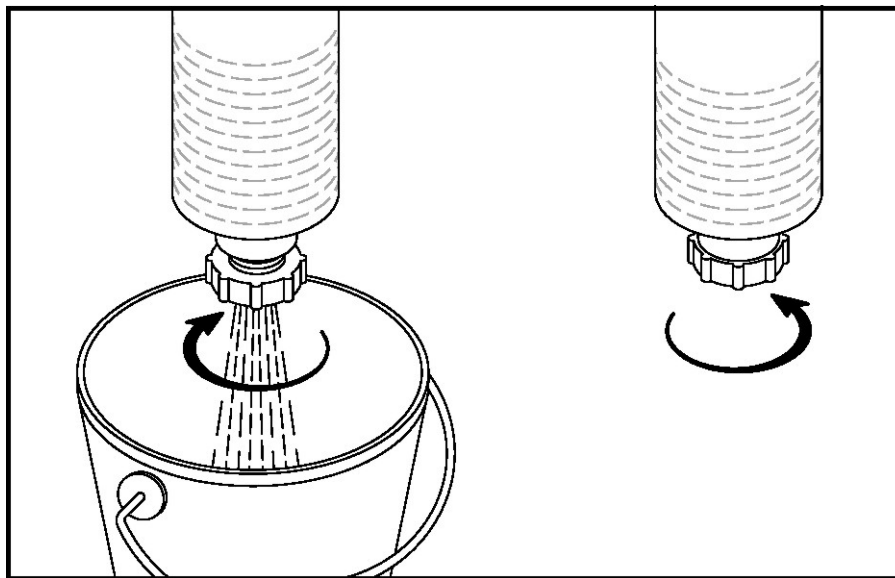


FIGURE 26. DRAINING THE FUEL/WATER SEPARATOR

6.7 Fuel Filter Maintenance

6.7.1 Fuel Filters - Drain

Refer to the engine specific manual for a more detailed procedure for draining the fuel filters.

Drain the water and sediment daily. The fuel 1 filters can be inspected for collected water by checking the clear bowl at the bottom of each filter.

To drain the water:

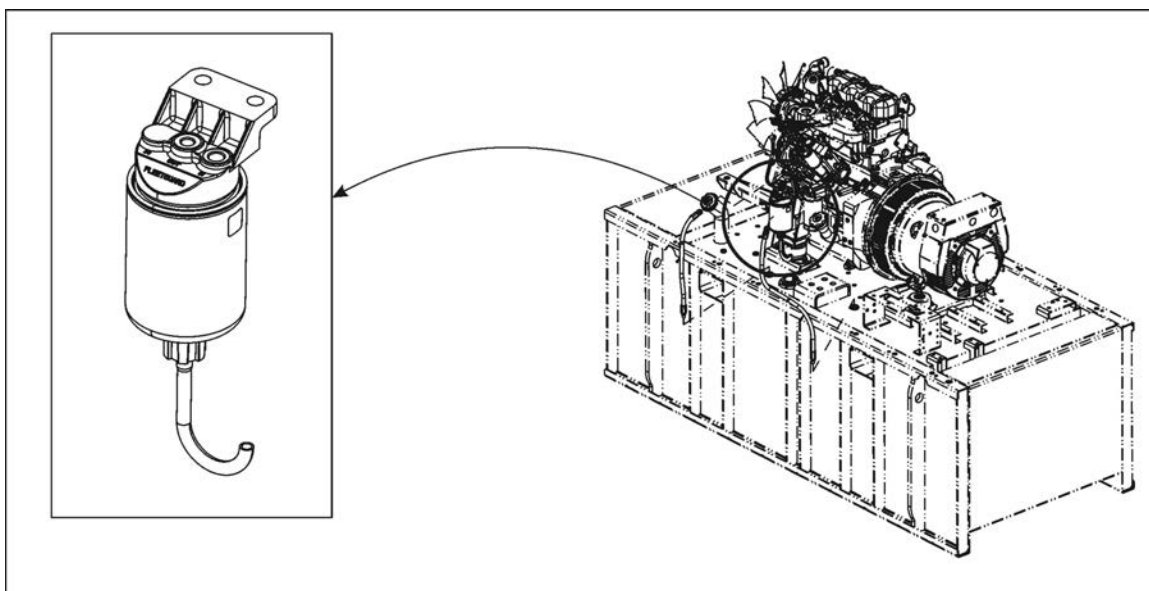
1. Shut off the engine.
2. Place a suitable container under the fuel filter.
3. With the fuel supply valve closed, open the vent cap to break the airlock in the filter.
4. Open the drain valve. Accumulated water will drain first.
5. When fuel begins to flow out of the drain, close the drain valve.

The drained liquids must be disposed of in accordance with local environmental regulations.



FIGURE 27. FUEL FILTER

6.7.2 Fuel Filters - Removal



⚠ WARNING

Depending on the circumstances, fuel is flammable. When inspecting or performing service or repairs on the fuel system, to reduce the possibility of fire and resulting severe personal injury, death, or property damage. Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.

NOTICE

The fuel must be drained from the filter head prior to removing the element. Do not allow fuel to drain onto the ground. Drained fuel must be collected and disposed of in accordance with local environmental regulations.

1. Shutdown the engine.
2. Close the fuel supply shutoff valve.
3. Place a suitable container under the filter to be replaced.
4. Use the collar/vent cap wrench to open the vent cap to break the air lock in the filter.
5. Open the drain valve, and allow the fuel level to drain to a point below the collar.
6. Close the drain valve.
7. Loosen the collar with the collar/vent cap wrench.
8. Remove the clear cover, filter spring, fuel filter element, and o-ring.
9. Remove the sealing grommet.
10. Discard the o-ring and grommet.

6.7.3 Fuel Filter - Element Replacement

** WARNING*****Combustible Liquid***

Diesel fuel is a fire and explosion hazard which can cause severe personal injury or death. Do not permit any open flame, or other igniter near the fuel system, or in areas sharing ventilation.

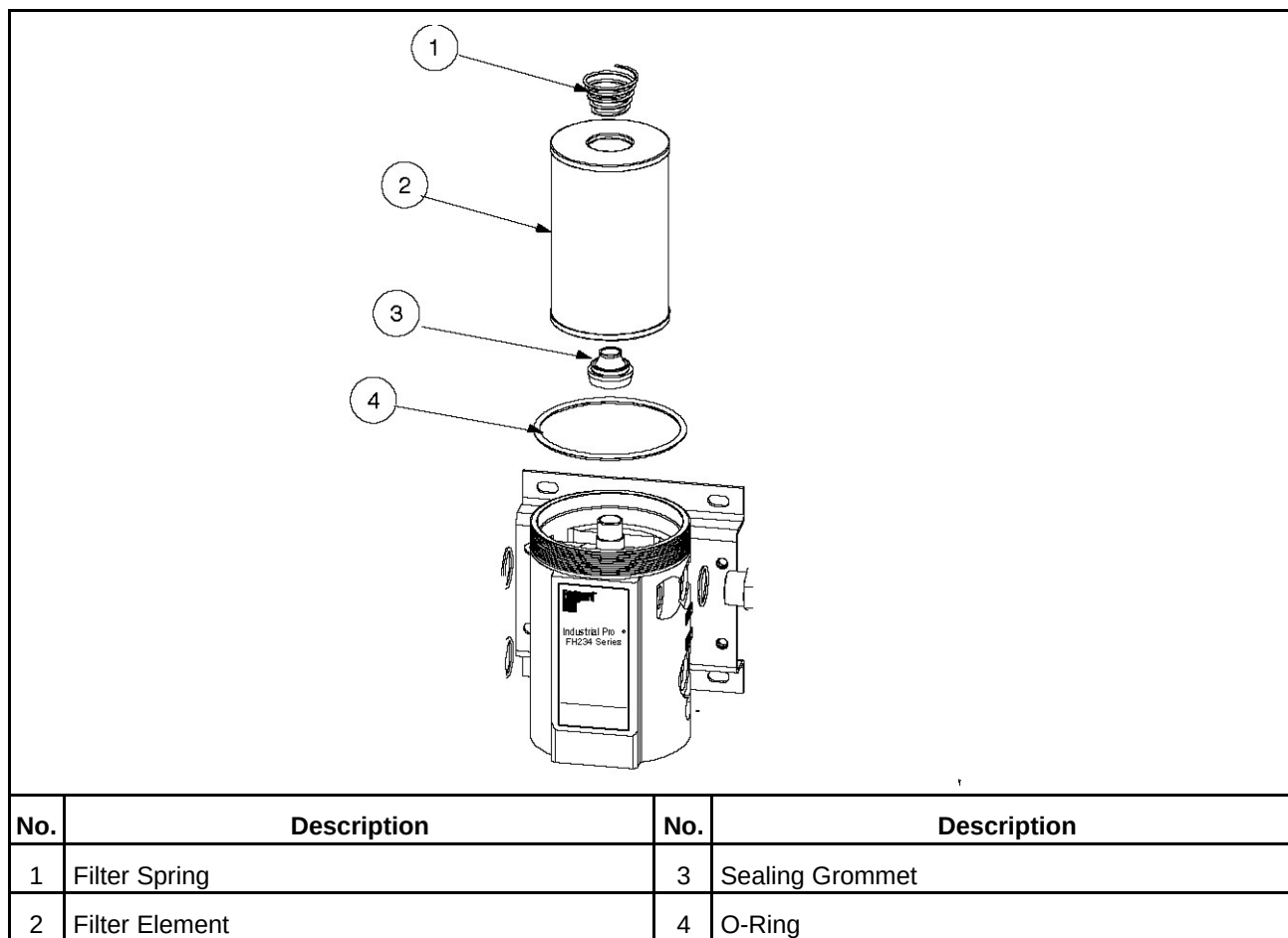


FIGURE 28. FUEL FILTER ELEMENT REPLACEMENT

NOTICE

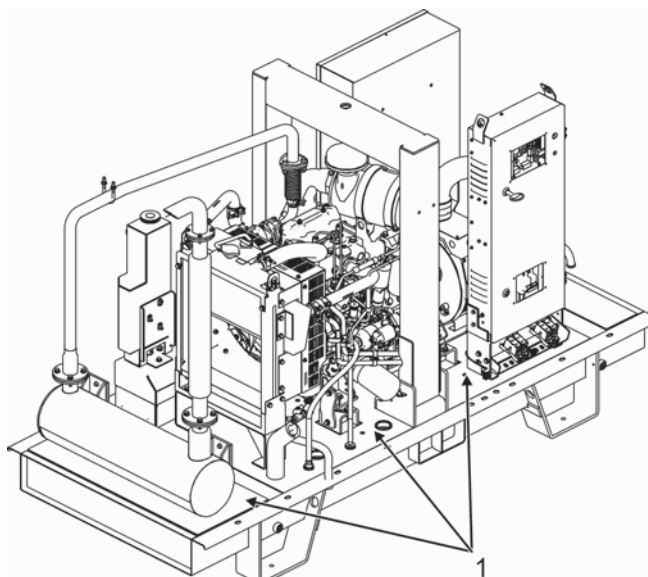
Fuel filter replacement includes the appropriate o-ring and sealing grommet. The o-ring and grommet must be replaced with the filter element to make sure of proper operation.

1. Install a new o-ring, filter element (supplied with a sealing grommet inserted into the filter element), filter spring, and clear cover.
2. Install the vent cap and the collar onto the clear cover.
3. Hand tighten. Do not use tools to tighten the collar.

6.8 Fluid Containment

The bedframe fluid containment area (if applicable) must be inspected at regular intervals and any liquid should be drained off and disposed of in accordance with local health and safety regulations. Failure to perform this action may result in spillage of liquids likely to contaminate the surrounding area.

Any other fluid containment area must also be checked and emptied, as above.



No.	Description
1	Containment Area

FIGURE 29. TYPICAL FLUID CONTAINMENT AREA (ENCLOSURE REMOVED FOR CLARITY)

NOTICE

Generator set shown is not representative of all models.

6.9 Hoses and Fuel Lines - Check

⚠ WARNING

Moving Parts

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

⚠ WARNING

Hot Surfaces

Contact with the hot surfaces can cause severe burns.

Avoid contact with hot parts. Allow hot parts to completely cool.

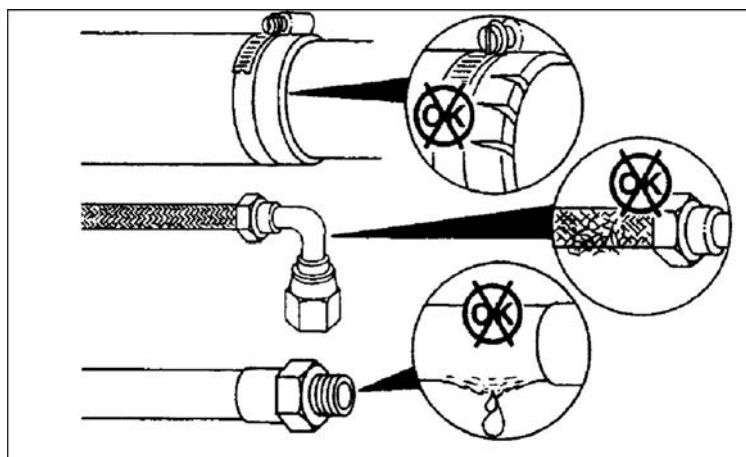


FIGURE 30. HOSES AND FUEL LINE INSPECTION

While the generator set is in operation, visually inspect the fuel lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and make sure they are not rubbing against anything that could cause breakage. If any leaks are detected, shut down the generator set (if possible). Contact your authorized distributor and have the leaks repaired immediately.

6.10 Air Intake System

The direct flow air cleaner consists of a primary filter and a secondary filter within the air cleaner housing. The air cleaner has been designed for a maximum restriction at 25 in water column (6.2 kPa), at which point the filter elements should be changed.

6.10.1 Air Cleaner Service Indicator

⚠ WARNING

Moving Parts

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

⚠ WARNING

Hot Surfaces

Contact with the hot surfaces can cause severe burns.

Avoid contact with hot parts. Allow hot parts to completely cool.

The air cleaner service indicator is located either on the air cleaner assembly or between the assembly and the inlet side of the turbocharger.

Check the air cleaner service indicator. If the gauge has crossed the red mark (1), replace the filter.

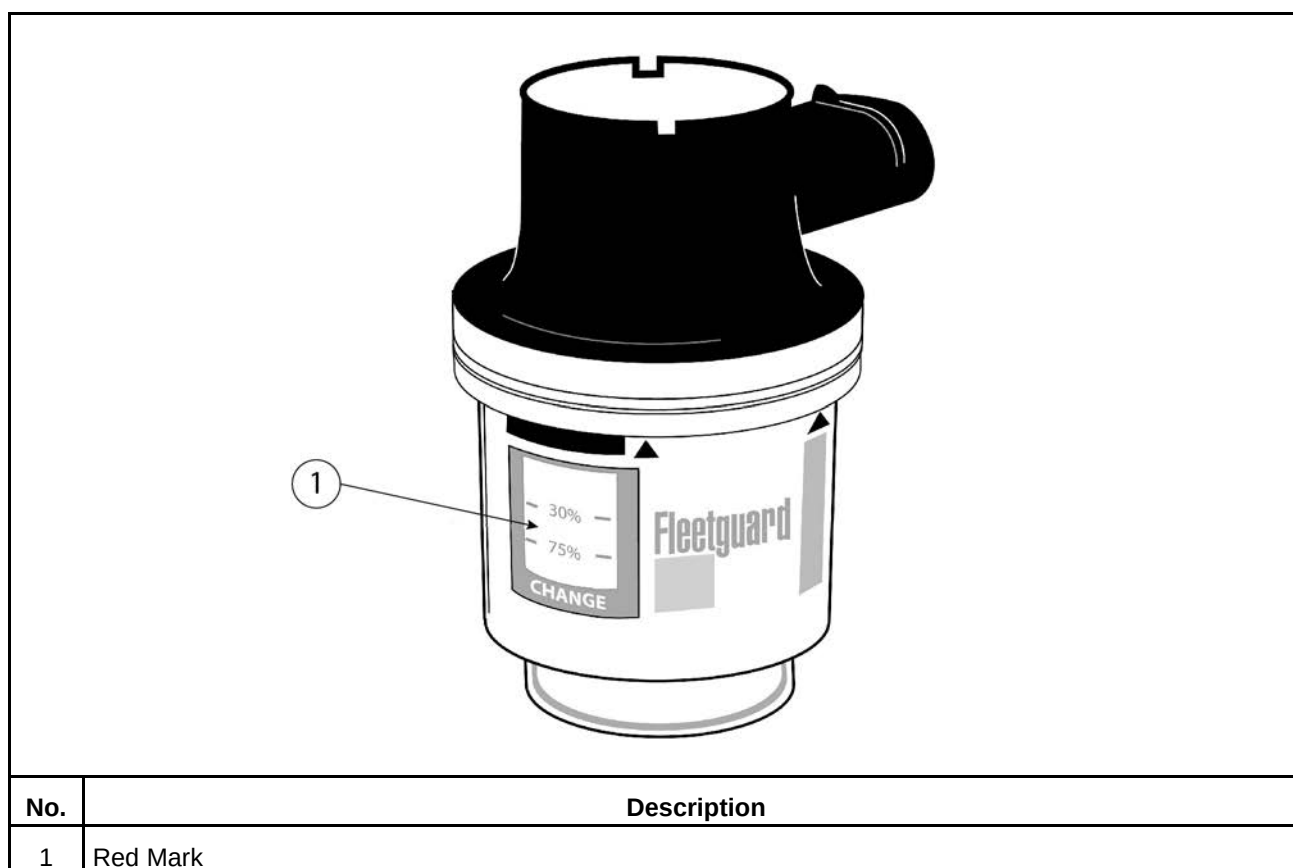


FIGURE 31. AIR CLEANER SERVICE INDICATOR

6.10.2 Heavy Duty Air Cleaner

6.10.2.1 Air Cleaner Element Removal

Heavy duty air cleaners combine centrifuge cleaning with element filtering before air enters the engine.

NOTICE

Cummins does not recommend cleaning paper-type air cleaner elements. Elements that have been cleaned will clog, and airflow to the engine will be restricted.

1. Before disassembly, wipe dirt from the cover and the upper portion of the air cleaner.
2. Loosen the wing bolt (1) and remove the band clamp securing the dust pan (2).
3. Remove the dust shield (4) from the dust pan (2).
4. Clean the dust pan and shield.
5. Loosen the wing bolt (3).
6. Remove the wing nut (5) that secures the air cleaner primary element (6) in the air cleaner housing.
7. Inspect the rubber sealing washer on the wing nut.
8. Remove the dirty cleaner element (6). If the inner safety element (8) is being replaced based upon high intake restriction, remove the wing nut (7) and replace the inner safety element. Dispose of the dirty element in accordance with local environmental agency requirements.

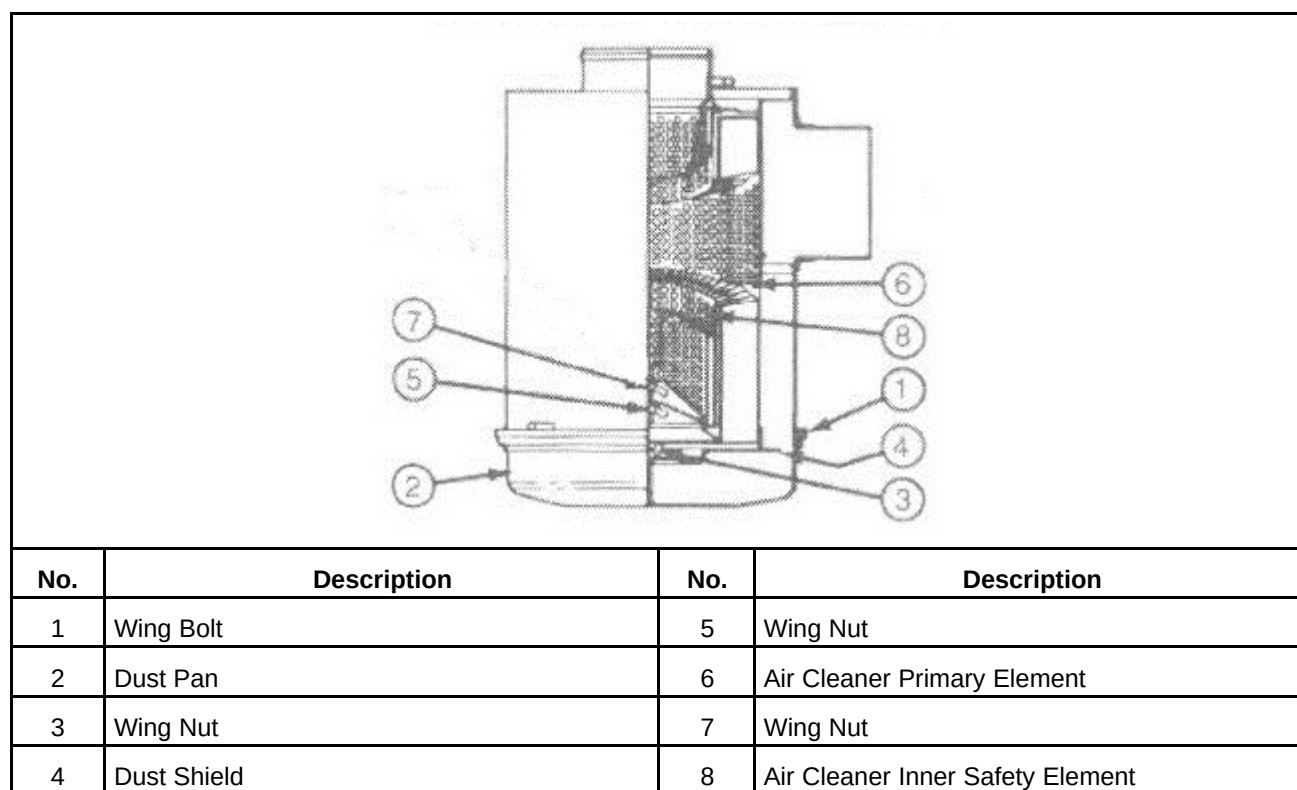
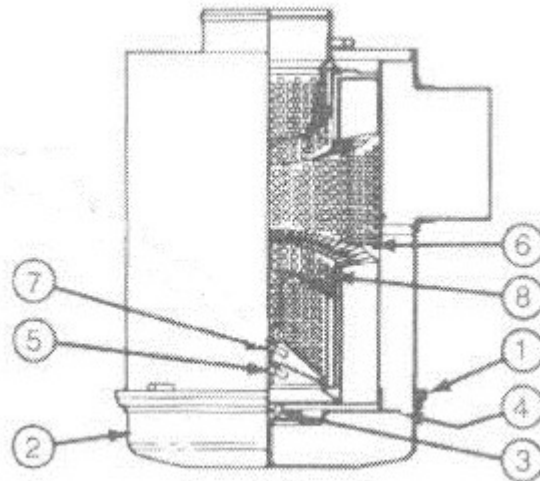


FIGURE 32. HEAVY DUTY AIR CLEANER

6.10.2.2 Air Cleaner Element Installation

1. If the inner safety element (8) is being replaced, install the safety element and secure it with the wing nut (7).
2. Check the seals.
3. Install the air cleaner primary element (6) in the air cleaner housing.
4. Inspect the rubber sealing washer on the wing nut (5).
5. Tighten the wing nut to sure the primary element in the air cleaner housing.
6. Install the dust shield (4) into the dust pan (2).
7. Install the dust shield and dust pan assembly and secure them using the band clamp and tighten the wing bolt (1).
8. Tighten the wing bolt (3).



No.	Description	No.	Description
1	Wing Bolt	5	Wing Nut
2	Dust Pan	6	Air Cleaner Primary Element
3	Wing Nut	7	Wing Nut
4	Dust Shield	8	Air Cleaner Inner Safety Element

FIGURE 33. HEAVY DUTY AIR CLEANER

6.10.2.3 Heavy Duty Air Cleaner Maintenance

⚠ WARNING

Fall Hazard

Falls can result in severe personal injury or death.

Make sure that suitable equipment for performing tasks at height are used in accordance with local guidelines and legislation.

There is a dust ejector valve (DEV) on the bottom of each filter pre-cleaner that should be checked periodically to make sure it is free of dust and dirt.

Each filter pre-cleaner includes a primary and secondary element that is checked periodically to make sure they are clean. Refer to the *Periodic Maintenance Schedule* table for additional information.

6.11 Exhaust System

⚠ WARNING

Hot Surfaces

Contact with the hot surfaces can cause severe burns.

Avoid contact with hot parts. Allow hot parts to completely cool.

⚠ WARNING

Moving Parts

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

 WARNING**Toxic Gases**

Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not breathe in or come into contact with exhaust gases.

While the generator set is in operation, inspect the entire exhaust system visually and audibly including the exhaust manifold, muffler, and exhaust pipe without removing guarding and panels. Check for leaks at all connections, welds, gaskets and joints, and make sure that exhaust pipes are not heating surrounding areas excessively. If any leaks are detected, shut down the generator set (if possible). Contact your authorized distributor and have the leaks repaired immediately.

6.12 Generator Set Output - AC Electric System

Check the following while the generator set is operating:

- Frequency: The generator set frequency should be stable and the reading should be the same as the generator set nameplate rating (50 Hz / 1500 RPM or 60 Hz / 1800 RPM).
- AC Voltage: At no load, the line-to-line voltage, or voltages, should be the same as the generator set nameplate rating.
- AC Ammeter: At no load, the current readings should be zero. With a load applied, each line current should be similar.
- Panel Lamps: When the Operating Panel is first connected to the DC supply, the system runs a check, illuminating each of the indicator lamps in turn.

6.13 Batteries

Batteries are an essential part of any standby generator system. Roughly 90% of all generator failures are due to batteries.

It is important that batteries are stored, commissioned, and maintained as detailed here. Refer also to the Battery Manufacturer's instructions.

Always use correct handling techniques when moving or lifting batteries. Batteries can be heavy and may require more than one person to lift and a suitable trolley for transportation.

Batteries are usually supplied with the generator in 'dry-charged' form. In order to commission dry-charged lead-acid batteries, pre-mixed electrolyte of the correct type and specific gravity must be added to the cells of the battery.

Maintenance free batteries supplied with the generator need no maintenance for commissioning.

6.13.1 Storage

Batteries must be stored in a cool, dry, well-ventilated place, in the upright position, and with the vent caps securely in place.

Batteries must never be stacked on top of each other and must be protected from the floor by a wooden pallet or suitably thick cardboard sheet.

6.13.2 Safety Precautions

Servicing of batteries are to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

6.13.2.1 General Precautions

WARNING

Combustible Gases

Ignition of battery gases is a fire and explosion hazard which can cause severe personal injury or death.

Laying tools or metal objects across the battery can cause arcing. Never lay tools or metal objects across the top of the battery.

CAUTION

Electrical Shock

A battery presents a risk of electrical shock and high short circuit current which can cause minor or moderate injury.

Observe the following precautions when working on batteries.

- Use proper PPE. Remove jewelry such as watches, rings, or other metal objects. Remove any conductive items from pockets. These items can fall into equipment and result in a short circuit, which can cause shock or burning. Refer to local standards for PPE details (in the U.S: see NFPA 70).
- Keep batteries upright to prevent spillage. Electrolyte is a dilute sulphuric acid that is harmful to the skin and eyes.
- Use tools with insulated handles to prevent the risk of electric shock.

6.13.2.2 Fire Hazard

NOTICE

During the charging of a battery, explosive gases are given off. Keep the battery area well ventilated and away from naked flames and sparks. Do not smoke.

- Before disconnecting a battery, isolate the utility powered battery charger (where fitted).
- To disconnect the battery, use an insulated wrench to disconnect the negative cable first.
- To connect the battery, use an insulated wrench to connect the negative cable last.

6.13.2.3 Fluid Hazard

WARNING

Toxic Hazard

Contact with electrolyte can cause severe personal injury.

Wear appropriate PPE when handling electrolyte: acid-proof protective apron, goggles, rubber gloves and boots. If electrolyte is splashed on the skin or in the eyes, flush the affected areas immediately with water and seek medical attention.

WARNING

Hazardous Liquid

Uncontrolled chemical reactions can cause severe chemical burns or death.

Never add undiluted sulfuric acid to a battery.

6.13.3 Battery Maintenance

WARNING

Combustible Gases

Ignition of battery gases is a fire and explosion hazard which can cause severe personal injury or death.

Do not smoke, or switch the trouble light ON or OFF near a battery. Touch a grounded metal surface first before touching batteries to discharge static electricity. Stop the generator set and disconnect the battery charger before disconnecting battery cables. Using an insulated wrench, disconnect the negative (-) cable first and reconnect it last.

NOTICE

To prevent dangerous arcing, always disconnect the negative (-) ground cable from the battery using an insulated wrench before working on any parts of the electrical system or the engine. Before touching batteries, discharge static electricity from body by first touching a grounded metal surface.

NOTICE

Always disconnect a battery charger from its AC source before disconnecting the battery leads. Failure to do so can result in voltage spikes high enough to damage the DC control circuits of the generator set.

NOTICE

Maintenance-free batteries are sealed and do not require the addition of electrolyte. Some manufacturers of maintenance-free batteries provide an 'eye' or some visible means of telling when the battery is discharged or approaching the end of its useful life.

Batteries require attention at all times, even when not working. A battery will not last if it is neglected. Maintenance is carried out as follows:

1. Keep the battery and the battery area clean and dry. If fitted, make sure that the vent caps are securely screwed down, or pushed home.
2. To avoid contamination of the battery, clean it only when the vent plugs (if fitted) are in place.
3. Keep the battery terminals and connections free from corrosion by lightly coating them with petroleum jelly.
4. Secure the battery(s) to prevent movement and internal damage to plates.
5. Check the condition of the starting batteries. Refer to the Generator Set Maintenance table in [Section 6.2 on page 59](#) for the maintenance interval.

6.13.3.1 Cleaning Batteries

WARNING

Toxic Hazard

Contact with electrolyte can cause severe personal injury.

Wear appropriate PPE when handling electrolyte: acid-proof protective apron, goggles, rubber gloves and boots. If electrolyte is splashed on the skin or in the eyes, flush the affected areas immediately with water and seek medical attention.

Prevent a buildup of dirt or corrosion by wiping the batteries with a damp cloth. Use a solution consisting of 0.11 kg (1/4 lb) of baking soda added to 0.96 liters (1 quart) of water to neutralize any possible acid. Be sure the vent plugs (if fitted) are tight to prevent any cleaning solution from entering the cells.

After cleaning, make sure the battery and surrounding areas are dry.

After making connections, coat the terminals with a light application of petroleum jelly to retard corrosion. Keep the battery terminals clean and tight. A loose connection can reduce battery standby time and cause battery fires.

6.13.3.2 Charging

When generator sets are used infrequently, batteries must be re-charged monthly to maintain a fully-charged condition.

NOTICE

Never allow a battery to become completely flat (fully discharged), or to stand in a discharged condition, or damage will result.

1. Do not put a filled battery into storage without first giving the battery a commissioning charge.
2. Batteries must be given a further charge every six months at the normal initial charge rate until the voltage ceases to rise.

6.13.3.3 Trickle/Boost Charging (Option)

The battery will automatically receive a trickle-charge from the battery charger (when switched ON) to prevent the battery from becoming discharged below its optimum charge level.

During trickle-charging, not all cells in the battery receive the same charge. Over a period of several months, this may affect battery performance. It is, therefore, good practice to give batteries a regular charge at their full rate to return all cells to full capacity. This is referred to as boost-charging, or equalize-charging.

If the charger is fitted with a **Boost Charge** switch, the **Boost** position should be selected at intervals detailed by the battery manufacturer (normally around every 6 months).

NOTICE

Batteries should not be left on Boost Charge for extended periods as this results in excessive water consumption and gassing, and may impair battery performance.

A boost charge not exceeding twice the bench charge rate may be used, providing that:

- The electrolyte temperature does not exceed 43 °C (109 °F).
- The battery volts do not reach 15 V (for a 12 V battery).

If either of these situations arises, reduce the charge rate to the normal bench rate. For tropical climates the temperature must not exceed 49 °C (120 °F).

NOTICE

The charge period should be extended:

- **To 8 hours if the battery has been in storage for three months or more at temperatures in excess of 30 °C (86 °F), or if humidity is above 80%.**
- **To 12 hours if the battery has been in storage for twelve months or more.**

At the end of the charging process, the electrolyte levels must be checked and restored if necessary by the addition of electrolyte of the correct SG. The vent caps must then be replaced.

NOTICE

Any further topping-up of the electrolyte must be made using distilled or de-ionized water.

6.13.4 Battery Replacement

WARNING

Combustible Liquid

Burning the battery may cause an explosion. Damage to the casing will release electrolytes which is harmful to the skin and eyes.

When disposing of a battery, do not mutilate or burn it. Comply with all local health and safety regulations/codes during handling or disposal.

Always replace the starting battery with the same number and type (e.g., vented, lead acid, maintenance free) as listed in the specifications section of this document. Properly dispose of battery in accordance with local environment agency requirements.

Always use correct handling techniques to lift and move a battery.

6.13.5 Battery Fault Finding

The following table shows some typical faults, their possible causes and remedies .

TABLE 16. FAULT FINDING

Symptom	Possible Fault	Remedy
Battery completely discharged	Poor battery terminal connection	Clean connections, replace and tighten.
	Charge alternator/ alternator connection fault	Contact your nearest Cummins Power Generation distributor .
	Mains battery charger/ charger connections fault/ mains supply fault	Contact your nearest Cummins Power Generation distributor.
	Blown fuse	Contact your nearest Cummins Power Generation distributor.
	Battery fault	Contact your nearest Cummins Power Generation distributor.
Battery low charge	Poor battery connection	Clean connections, reconnect and tighten securely .
	Charge alternator/ alternator connection fault	Contact your nearest Cummins Power Generation distributor.
	Mains battery charger/ charger connections fault	Contact your nearest Cummins Power Generation distributor.
	Inequality in cell charge	Contact your nearest Cummins Power Generation distributor.
	Battery fault	Contact your nearest Cummins Power Generation distributor.
Battery overcharged	Charge alternator fault	Contact your nearest Cummins Power Generation distributor.
	Mains battery charge fault	Contact your nearest Cummins Power Generation distributor.
	Low battery fluid level	Check the charger; it may not be shutting off when the charge is complete.

Symptom	Possible Fault	Remedy
Battery terminals getting hot	Poor battery connection	Clean connections, reconnect and tighten securely.
		Contact your nearest Cummins Power Generation distributor.

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7 Troubleshooting

Fault code information, together with warning and shutdown information, is provided in this section to assist in locating and identifying the possible causes of faults in the generator set system.

Refer also to the Operator's engine specific manual. The engine manual contains additional information regarding the running and care of the generator set as well as specific equipment instructions that may differ from the standard generator set.

7.1 Control System

The generator set control system continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the control will light a yellow Warning lamp or a red Shutdown lamp and will display a message on the graphical display panel. In the event of an engine shutdown fault (red Shutdown LED), the control will stop the engine immediately.

7.2 Safety Considerations

WARNING

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Make sure that only personnel who are trained and qualified to work on this equipment are allowed to operate the generator set and perform maintenance on it.

WARNING

Automated Machinery

Accidental or remote starting of the generator set can cause severe personal injury or death.

Make sure that the generator set cannot be started accidentally or remotely before starting work on the generator.

WARNING

Combustible Gases

Ignition of battery gases is a fire and explosion hazard which can cause severe personal injury or death.

Do not smoke, or switch the trouble light ON or OFF near a battery. Touch a grounded metal surface first before touching batteries to discharge static electricity. Stop the generator set and disconnect the battery charger before disconnecting battery cables. Using an insulated wrench, disconnect the negative (–) cable first and reconnect it last.

CAUTION

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Isolate all external electrical supplies prior to access of the control panel. Internal components have live exposed terminations even when the generator set is not running.

NOTICE

Isolator switch only: Do not open the output box while the generator set is running as the isolator switch will cause the generator set to shut down. Keep the output box covers in place during troubleshooting.

NOTICE

Always disconnect a battery charger from its AC source before disconnecting the battery cables. Failure to do so can result in voltage spikes high enough to damage the DC control circuits of the generator set.

NOTICE

Ventilate the battery area before working on or near the battery. Wear goggles. Stop the generator set and disconnect the battery charger before disconnecting the battery cables using an insulated wrench. Disconnect the negative (–) cable first and reconnect it last.

All maintenance tasks must be assessed for health and safety risks; the preventive measures identified must be performed. An additional person is required for any task where doing so significantly adds to the safety of the task.

The installation of a generator set can be designed for remote starting. When troubleshooting a generator set that is shut down, make sure that the generator set cannot be accidentally re-started. Refer to the Locking the Generator Set Out of Service section.

7.3 Fault Finding

⚠ WARNING***Electrical Generating Equipment***

Incorrect operation and maintenance can result in severe personal injury or death

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

NOTICE

Review safety precautions listed within [Chapter 1 on page 1](#) of this manual together with the documentation supplied with the generator set.

Should a fault condition occur during operation, follow the procedures in the following tables to locate and correct the problem. For any symptom not listed, contact your authorized distributor for assistance.

Before starting any fault finding, ensure that the following basic checks are carried out:

- All switches and controls are in their correct positions
- Fuel system is connected and fuel is available
- The lubricating oil level is correct
- The coolant level is correct
- The radiator matrix is free from obstruction
- The battery charge condition is satisfactory and the connections are secure
- The generator set electrics and alternator connections are secure
- The panel connections are secure
- The protection circuits have been reset
- Blown fuses have been replaced
- Tripped contactors or circuit breakers have been reset

7.4 Status Indicators - PowerCommand 1.2

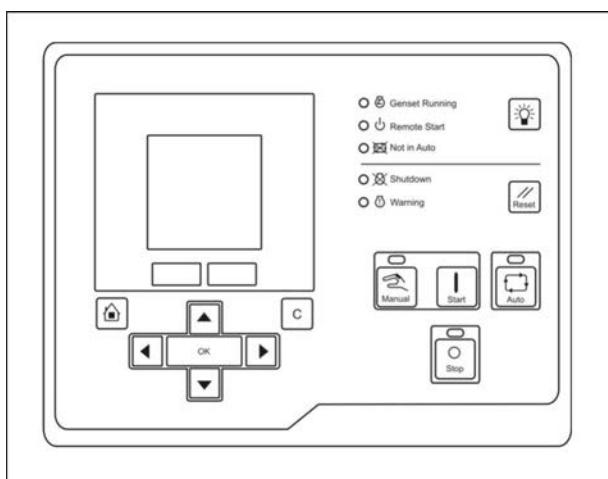


FIGURE 34. OPERATOR PANEL (HMI 220)

7.4.1 Not in Auto

This red lamp is lit when the control is not in Auto.

7.4.2 Remote Start

This green lamp indicates the control is receiving a **Remote Run** signal. The **Remote Run** signal has no effect unless the generator set is in Auto.

7.4.3 Warning

This amber lamp is lit whenever the control detects a Warning condition. This lamp is automatically shut off when the Warning condition no longer exists.

7.4.4 Shutdown Status

This red lamp is lit when the control detects a Shutdown condition. The generator set cannot be started when this lamp is on. After the condition has been corrected, the lamp can be reset by first pressing the **Stop** button and then the **Reset** button.

7.4.5 Generator Set Running Lamp

The green lamp is lit when the generator set is running at, or near, rated speed and voltage. This is not lit while the generator set is warming up or cooling down.

7.5 Fault/Status Codes - PowerCommand 1.2

7.5.1 Fault/Status Codes

WARNING

Electrical Generating Equipment

Incorrect operation and maintenance can result in severe personal injury or death

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

⚠ WARNING**Automated Machinery**

Accidental or remote starting of the generator set can cause severe personal injury or death. Make sure that the generator set cannot be started accidentally or remotely before starting work on the generator.

The fault codes have been divided into five categories to help you determine what corrective action to take for safe operation of the generator set. Use the Fault Codes table to find the category (CTG) and fault description for all codes.

NOTICE

Gaps in the code numbers are for codes that do not apply to this generator set. Some of the codes listed are feature dependent and will not be displayed by this control.

7.5.2 Fault Messages

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault type (Warning or Shutdown), fault number, and a short description. It also includes where the fault occurred if the generator set control did not detect the fault and is simply reporting the fault.

Active and acknowledged faults may be viewed in the Faults menu.

7.5.3 Fault Acknowledgement

Shutdown faults must be acknowledged after the fault has been corrected. If in Auto or Manual mode, the control must be set to Stop mode (Off). Faults are cleared from the control panel display by pressing the **Reset** button.

Faults are re-announced if they are detected again after being acknowledged. See the Reset Button section.

NOTICE

Faults may also be acknowledged when in Auto mode and the Remote Start command is removed. Contact your authorized distributor for this option.

7.5.4 Category A Fault Codes

This category pertains to engine or alternator shutdown faults that require immediate repair by trained and experienced service personnel (generator set non-operational). The control prevents the generator set from being re-started if a shutdown fault has not been corrected.

7.5.5 Category B Fault Codes

This category consists of faults that can affect generator set performance or can cause engine, alternator, or connected equipment damage. Operate the generator set only when it is powering critical loads and cannot be shut down. These faults require repair by trained and experienced service personnel.

7.5.6 Category C Fault Codes

NOTICE

Continued operation may void the generator set warranty if damage occurs that relates to this type of fault condition.

This category consists of faults that do not affect generator set performance, but require repair by trained and experienced service personnel. These codes indicate a defective harness or wiring problem.

These codes can also indicate a defective engine sensor, leaving no engine protection. (Without this protection, engine damage can occur without detection).

7.5.7 Category D Fault Codes

This category consists of faults that are repairable by site personnel. Service will be required by trained and experienced service personnel if site personnel cannot resolve the problem.

7.5.8 Category E Fault Codes

This category indicates non-critical operational status of the generator set, external faults, or customer fault inputs. These faults require repair by trained and experienced service personnel.

7.5.9 Fault Codes - PowerCommand 1.2

TABLE 17. FAULT CODES

CTG	Code	Lamp	Displayed Message	Description
A	121	Shutdown	SPEED SIGNAL LOST	Indicates that no magnetic pickup pulses were sensed for a Loss of Speed delay. If a magnetic pickup is disabled, this fault is not activated.
B	135	Warning	OIL PRESS SENSOR OOR HIGH	Indicates the oil pressure sensor output is out of range (OOR), high.
C	141	Warning	OIL PRESS SENSOR OOR LOW	Indicates the oil pressure sensor output is out of range (OOR), low.
B	143**	Warning	PRE-LOW OIL PRESSURE	Indicates the engine oil pressure is approaching an unacceptable level.
C	144	Warning	COOLANT SENSOR OOR LOW	Indicates the coolant temperature sensor output is out of range (OOR), low.
C	145	Warning	COOLANT SENSOR OOR HIGH	Indicates the coolant temperature sensor output is out of range (OOR), high.
C	146**	Warning	PRE-HIGH COOLANT TEMP	Indicates that the engine is operating near cooling system capacity. Increase in load or higher ambient temperature may cause High Coolant Temp (code 151) shutdown.
D	151**	Shutdown	HIGH COOLANT TEMP	Indicates that the engine coolant temperature is above normal and has reached the Shutdown trip point.
C	153	Warning	INTAKE MANIFOLD TEMP OOR HIGH	Indicates that the intake manifold temperature sensor is out of range (OOR), high.
C	154	Warning	INTAKE MANIFOLD TEMP OOR LOW	Indicates that the intake manifold temperature sensor is out of range (OOR), low.
D	155	Shutdown	INTAKE MANIFOLD TEMP HIGH	Indicates that the intake manifold temperature sensor is above normal and has reached the shutdown trip point.

CTG	Code	Lamp	Displayed Message	Description
C	195	Warning	COOLANT LEVEL OOR HIGH	Indicates that a sensor on the radiator has detected that the coolant level is out of range (OOR), high.
C	196	Warning	COOLANT LEVEL OOR LOW	Indicates that a sensor on the radiator has detected that the coolant level is out of range (OOR), low.
D	197	Warning	COOLANT LEVEL LOW	Indicates that a sensor on the radiator has detected that the coolant level is below normal.
A	234**	Shutdown	OVERSPEED	Indicates that the engine has exceeded normal operating speed. The default thresholds are 1725 RPM (50 Hz) or 2075 RPM (60 Hz).
A	285	Shutdown	ECM PGN TIMEOUT	Datalink failure. PowerCommand® 1.2 control not responding to the engine control module.
A	286	Shutdown	ECM CONFIGURABLE ERROR	Indicates an engine control module configuration error – out of calibration.
D	359	Shutdown	FAIL TO START	The system has failed to start after a set number of crank attempts. This indicates a possible fuel system or air induction problem (engine cranks but fails to start).
A	415**	Shutdown	LOW OIL PRESSURE	Indicates the engine oil pressure has dropped below normal and has reached the shutdown trip point.
C	421^	Shutdown	OIL TEMP HIGH	Indicates the engine oil temperature is above normal and has reached the shutdown trip point. (I/O Module option).
B	425^	Shutdown	OIL TEMP OOR	Indicates the engine oil temperature output is out of range (OOR). High or low. (I/O Module option).
A	426	Shutdown	DATA LINK ERROR	Datalink failure. No communications between the PowerCommand® 1.2 control and the engine control module.
A	427**	Warning	CAN LINK LOST	Datalink fault. Indicates that important data was lost between the PowerCommand® 1.2 control and the engine control module.
D	441**	Warning	LOW BATTERY	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation can occur.
D	442**	Warning	HIGH BATTERY	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur.
D	488^	Shutdown	INTAKE MANIFOLD TEMP HIGH	Indicates that the intake manifold temperature is above normal and has reached the shutdown trip point. (I/O Module option).
A	689	Shutdown	ENGINE SPEED ERRATIC	Indicates a fault condition in the engine crankshaft sensor circuit.
A	781	Shutdown	CAN LINK LOST	Datalink failure. No communications between the PowerCommand® 1.2 control and the engine control module.
D	1117	Warning	ECM POWER LOST	Indicates battery voltage supply to the engine control module was lost.

CTG	Code	Lamp	Displayed Message	Description
B	1123*	Shutdown	SHUTDOWN AFTER BS	A shutdown fault occurred while the Battle Short mode was enabled.
D	1131*	Warning	BATTLE SHORT ACTIVE	Indicates that the control is in Battle Short mode – used to bypass several fault shutdowns for generator set operation during emergencies.
C	1246	Warning	GENERIC ENGINE FAULT	Engine control fault code not recognised by the PowerCommand® 1.2 control.
E	1311	Configurable	Customer Fault Input 1	The nature of the fault is an optional customer selection.
E	1312	Configurable	Customer Fault Input 2	The nature of the fault is an optional customer selection.
E	1317	Configurable	Customer Fault Input 3	The nature of the fault is an optional customer selection.
E	1318	Configurable	Customer Fault Input 4	The nature of the fault is an optional customer selection.
B	1416*	Warning	FAIL TO SHUTDOWN	Indicates that a shutdown fault is active, but is being bypassed by Battle Short.
A	1417	Shutdown	FAILURE TO POWER DOWN	Indicates the control is powered up after attempting to go to sleep.
D	1433	Shutdown	LOCAL EMERGENCY STOP	Indicates a Local Emergency Stop has been activated.
D	1434	Shutdown	REMOTE EMERGENCY STOP	Indicates a Remote Emergency Stop has been activated.
D	1435*	Warning	LOW COOLANT TEMP	Indicates that the engine coolant temperature is below the adjusted setpoint. This may indicate that the coolant heater is not operating or is not circulating coolant.
D	1438	Shutdown	FAIL TO CRANK	The generator set has failed to sense rotation for two start attempts. This indicates a possible fault with the control, speed sensing, or the starting system.
D	1442*	Warning	WEAK BATTERY	Indicates that the generator set battery voltage is below battery thresholds during cranking.
A	1446**	Shutdown	HIGH AC VOLTAGE	Indicates that one or more measured AC output voltages have exceeded the threshold for longer than a specified time limit. The threshold and time limits are 130% of nominal for zero seconds or 110% of nominal for ten seconds.
A	1447**	Shutdown	LOW AC VOLTAGE	Indicates that the measured AC output voltage is below the threshold for longer than a specified time limit. The threshold and time limits are 85% of nominal for ten seconds.
A	1448**	Shutdown	UNDER FREQUENCY	Indicates that the alternator frequency is 6 Hertz under the nominal frequency.
A	1449**	Shutdown	OVER FREQUENCY	Indicates that the alternator frequency is 6 Hertz above the nominal frequency.

CTG	Code	Lamp	Displayed Message	Description
A	1469**	Shutdown	SPEED HZ MATCH	Indicates that measured engine speed and measured alternator AC output frequency do not agree.
B	1471**	Warning	HIGH AC CURRENT	Indicates that the alternator output current (one or more phases) has exceeded safe operating limits.
A	1472**	Shutdown	HIGH AC CURRENT	Indicates that the alternator output current (one or more phases) has exceeded the alternator's current rating.
C	1845	Warning	WATER IN FUEL OOR HIGH	Indicates the water in fuel sensor is out of range (OOR), high.
C	1846	Warning	WATER IN FUEL OOR LOW	Indicates the water in fuel sensor is out of range (OOR), low.
D	1852	Warning	WATER IN FUEL	Indicates that the water in fuel is above normal and has reached the warning trip point.
E	1853	Configurable	Annunciator Fault 2	The nature of the annunciator fault is an optional customer selection.
E	1854	Configurable	Annunciator Fault 3	The nature of the annunciator fault is an optional customer selection.
E	1855	Configurable	Annunciator Fault 1	The nature of the annunciator fault is an optional customer selection.
E	1944	Warning	ANNUNCIATOR OUTPUT CONFIGURATION ERROR	Indicates a mismatch in the configuration of one of the annunciator relay outputs.
D	1965^	Warning	EXHAUST TEMPERATURE OOR	Indicates the exhaust temperature sensor is out of range (OOR), high or low. (Aux 101 I/O option).
B	1992	Warning	ENGINE OVERSPEED	Indicates that the engine has exceeded normal operating speed. The default thresholds are 1725 RPM (50 Hz) or 2075 RPM (60 Hz). (ECM fault code).
C	2224^	Warning	FUEL LEVEL OOR	Indicates the fuel level sensor is out of range (OOR), high or low. (Aux 101 I/O option).
A	2335	Shutdown	EXCITATION FAULT	Indicates that a loss of voltage or frequency sensing from the generator has occurred.
C	2398^	Warning	AMBIENT TEMPERATURE OOR	Indicates the ambient temperature sensor is out of range (OOR), high or low. (Aux 101 I/O option).
C	2542^	Warning	VOLTAGE BIAS OOR	Indicates the voltage bias circuit output is out of range (OOR), high or low. (Aux 101 I/O option).
A	2545	Shutdown	KEYSWITCH RESET REQUIRED	Indicates a datalink failure. Communications are lost between the PowerCommand® 1.2 control and the engine control module.
E	2619^	Diagnostic	AUX 101 ANALOG INPUT 1	The nature of the Base I/O Module event is an optional customer selection. (Aux 101 I/O Module option). Each event function can be programmed (using InPower service tool or access to the Setup menu), as follows: <ol style="list-style-type: none"> 1. Change display name using up to 32 characters. 2. Select active low or high input.

CTG	Code	Lamp	Displayed Message	Description
E	2621^	Diagnostic	AUX 101 ANALOG INPUT 2	See code 2619
E	2622^	Diagnostic	AUX 101 ANALOG INPUT 3	See code 2619
E	2623^	Diagnostic	AUX 101 ANALOG INPUT 4	See code 2619
E	2624^	Diagnostic	AUX 101 ANALOG INPUT 5	See code 2619
E	2625^	Diagnostic	AUX 101 ANALOG INPUT 6	See code 2619
E	2626^	Diagnostic	AUX 101 ANALOG INPUT 7	See code 2619
E	2627^	Diagnostic	AUX 101 ANALOG INPUT 8	See code 2619
E	2628^	Diagnostic	AUX 101 ANALOG INPUT 9	The nature of the Aux I/O Module event is an optional customer selection. (Aux 102 I/O Module option). Each event function can be programmed (using InPower service tool or access to the Setup menu), as follows: <ol style="list-style-type: none"> 1. Change display name using up to 32 characters. 2. Select active low or high input.
E	2629^	Diagnostic	AUX 101 ANALOG INPUT 10	See code 2628
E	2631^	Diagnostic	AUX 101 ANALOG INPUT 11	See code 2628
E	2632^	Diagnostic	AUX 101 ANALOG INPUT 12	See code 2628
A	2676	Shutdown	ALTERNATOR FREQUENCY CONFLICT	Indicates the measured alternator line frequency and measured alternator excitation frequency do not agree.
A	2677	Shutdown	FAIL TO STOP	The generator set continues to run after receiving a stop command from the controller.
B	2678**	Warning	CHARGER FAILURE	Indicates the battery charging alternator has not reached an acceptable voltage range within the selected time period (default is 120 seconds). This warning is also displayed if your alternator is a type that does not support the control's charging alternator logic functionality. If this occurs, this warning can be disabled if the Charging Alt. Enable setting is set to "No".
C	2693^	Warning	SPEED BIAS OOR	Indicates the speed bias circuit output is out of range (OOR), high or low. (Aux 101 I/O Module option).
C	2694^	Warning	ALTERNATOR RTD OOR	Indicates the alternator RTD sensor is out of range (OOR), high or low. (Aux 101 I/O Module option).
A	2696^	Shutdown	ALTERNATOR RTD TEMP HIGH	Indicates the alternator temperature is above normal and has reached the shutdown trip point. (I/O Module option).

CTG	Code	Lamp	Displayed Message	Description
C	2729^	Warning	I/O MODULE LOST	Indicates an intermittent datalink between the I/O module and the control board. (Aux 101 I/O Module option).
A	2731	Shutdown	I/O MODULE LOST	Indicates the datalink between the I/O module and the control board is lost. (Aux 101 I/O Module option).
A	2897	Shutdown	FACTORY BLOCK CORRUPT	Indicates a fatal software error occurred in the PowerCommand® 1.2 control.
A	2998	Warning	PERIODIC/FAULT CORRUPT	Indicates that either the periodic data file or the fault history file has been corrupted. Remove and re-apply power to the control to clear the fault. (Periodic and/or fault history data will be lost after re-setting the control).
A	2899	Shutdown	USER BLOCK CORRUPT	Indicates a fatal software error occurred in the PowerCommand® 1.2 control.
A	2911	Shutdown	TRIM BLOCK CORRUPT	Indicates a fatal software error occurred in the PowerCommand® 1.2 control.
D	2964	Warning	INTAKE MANIFOLD TEMPERATURE HIGH	Indicates engine has begun to overheat (intake manifold temperature has risen to an unacceptable level). Increase in load or higher ambient temperature may cause Intake Manifold Temp High (code 155) shutdown.
A	2972**	Shutdown	FIELD OVERLOAD	Indicates that the Field Voltage has been above 70 V for eight seconds.

* For more information on these events, refer to the Battle Short Mode description in [Chapter 4 on page 23](#).

** Any values listed in the Description column for these faults are default values.

^ These faults are available only if your installation includes the optional I/O Module (Kit 0541-1291).

7.5.10 Customer Input Faults - PowerCommand 1.2

Dependent on Customer Options specified, the Customer Input Faults may indicate the following:

ACTUAL TEXT SHOWN	TRANSLATION
Earth Fault	Earth Fault
Low Fuel	Low Fuel
High Fuel	High Fuel
High Alternator Temperature	High Alternator Temperature

Dependent on the number of Customer Options required, an adjacent display panel may be fitted where these Faults will be displayed.

TABLE 18. TROUBLESHOOTING PROCEDURES FOR FAULT CODES

Fault Code		Corrective Action – *(if in doubt, call your authorized service technician)
CODE:	143	Indicates engine oil pressure has dropped below the warning trip point. If the generator is powering critical loads and cannot be shut down, wait until the next shutdown period and then follow the fault code 415 procedure.
LAMP:	Warning	
MESSAGE:	PRE-LOW OIL PRESSURE	

CODE:	146	Indicates the engine is operating near the cooling system capacity. An increase in load or higher ambient temperature may cause a High Coolant Temp (fault code 151) shutdown. Review fault code 151 correction list for other possible causes.
LAMP:	Warning	
MESSAGE:	PRE-HIGH COOL TEMP	
CODE:	151	Indicates the engine has overheated (coolant temperature has risen above the shutdown trip point). Allow the engine to cool down completely before proceeding with the following checks: <ol style="list-style-type: none"> 1. Look for possible coolant leakage points and repair if necessary. Check coolant level and replenish if low. 2. Check for obstructions to cooling airflow and correct as necessary. 3. Check the fan belt and repair or tighten if necessary. 4. Check the blower fan and circulation pumps on remote radiator installations. 5. Check the blower fan and circulation pumps on remote radiator installations. 6. Reset the control and restart after locating and correcting the problem.
LAMP:	Shutdown	
MESSAGE:	HIGH COOLANT TEMP	
CODE:	155	Indicates the engine has overheated (intake manifold temperature has risen above the shutdown trip point). Large load or high ambient temperature may be the cause. Review fault code 151 correction list for other possible causes.
LAMP:	Shutdown	
MESSAGE:	INTAKE MANIFOLD TEMP HIGH	
CODE:	197	Indicates the engine coolant level has fallen below the trip point. If the generator is powering critical loads and cannot be shut down, wait until the next shutdown period. If the engine can be stopped, allow the engine to cool down completely before proceeding: <ol style="list-style-type: none"> 1. Look for possible coolant leakage points and repair if necessary. Check the coolant level and replenish if low. 2. Reset the control and restart after locating and correcting the problem.
LAMP:	Warning	
MESSAGE:	COOLANT LEVEL LOW	
CODE:	359	Indicates possible fuel system or air induction problem. (Engine cranks but fails to start). Allow engine to cool down completely before proceeding with the following checks: <ol style="list-style-type: none"> 1. Check for empty fuel tank, fuel leaks, or blocked fuel lines and correct as required 2. Check for dirty fuel filter and replace if necessary 3. Check for dirty or blocked air filter and replace if necessary 4. Reset control and restart after correcting the problem.
LAMP:	Shutdown	
MESSAGE:	Fail to Start	
CODE:	415	Indicates the engine oil pressure has dropped below the shutdown trip point. Allow the engine to cool down completely before proceeding with the following checks: <ol style="list-style-type: none"> 1. Check the oil level, lines, and filters. 2. If the oil system is OK but the oil level is low, replenish. 3. Reset the control and restart after locating and correcting the problem.
LAMP:	Shutdown	
MESSAGE:	LOW OIL PRESSURE	

CODE:	441	Indicates the battery voltage supply to the control is approaching a low level at which unpredictable operation will occur. If the engine can be stopped, allow the engine to cool down completely before proceeding: 1. Poor battery cable connections - Clean the battery cable terminals and tighten all connections. 2. Check the battery charge voltage float level if applicable (raise float level). 3. Discharged or defective battery - Check the battery charger fuse. Recharge or replace the battery.
LAMP:	Warning	
MESSAGE:	LOW BAT VOLTAGE	
CODE:	442	Indicates the battery voltage supply to the control is approaching a high level at which damage to the control can occur. If the engine can be stopped, allow the engine to cool down completely before proceeding: 1. Poor battery cable connections - Clean the battery cable terminals and tighten all connections. 2. Check the battery charge float level if applicable (lower float level).
LAMP:	Warning	
MESSAGE:	HIGH BAT VOLTAGE	
CODE:	488	Indicates the engine has overheated (intake manifold temperature has risen above the shutdown trip point). Large load or high ambient temperature may be the cause. Review fault code 151 correction list for other possible causes.
LAMP:	Shutdown	
MESSAGE:	INTAKE MANIFOLD TEMP HIGH	
CODE:	1117	Indicates that the 'Keyswitch' to the ECM was NOT removed for 30 seconds before removing battery power to the ECM (removing battery cable). To reset: 1. Press the Off button and press the Emergency Stop button and wait for 30 seconds. 2. Re-set the Emergency Stop and select an operating mode (manual or remote).
LAMP:	Warning	
MESSAGE:	ECM POWER LOST	
CODE:	1131	Indicates that the control is in Battle Short mode (used to bypass several fault shutdowns; therefore, allowing generator set operation during emergencies).
LAMP:	Warning	
MESSAGE:	BATTLE SHORT ACTIVE	
CODE:	1311, 1312, 1317, 1318	The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using InPower service tool or by accessing the Setup menu), as follows: 1. Event , Warning, or Shutdown level if Function Select = Fault Input. 2. Change the display name using up to 32 characters.
LAMP:	Configurable	
MESSAGE:	CONFIGURABLE INPUT 1, 2, 3, 4	
CODE:	1416	The generator set continues to run after receiving a shutdown command from the controller. The Battle Short feature is enabled (this is used to bypass several critical fault shutdowns; therefore, allowing generator set operation during emergencies).
LAMP:	Warning	
MESSAGE:	FAIL TO SHUTDOWN	

CODE:	1433/1434	Indicates a local or remote Emergency Stop. The Emergency Stop shutdown status can be reset only at the local control panel. After locating and correcting problem, reset the local/remote Emergency Stop button as follows: 1. De-activate (disable) the emergency stop button. 2. Press the O (Off) button. 3. Select the desired operating mode (manual or remote).
LAMP:	Shutdown	
MESSAGE:	E-STOP - LOCAL E-STOP - REMOTE	
CODE:	1435	Indicates the engine coolant heater is not operating or is not circulating coolant. If the engine can be stopped, allow the engine to cool down completely before proceeding with the following checks: 1. The coolant heater is not connected to a power supply. Check for a blown fuse or disconnected heater cable and correct as required. 2. Look for possible coolant leaks and repair as required. Check for low coolant level and replenish if required. Set is not operating. Warning occurs when engine coolant temperature is 21 °C (70 °F) or lower.
LAMP:	Warning	
MESSAGE:	LOW COOLANT TEMP	
		<div style="background-color: #0070C0; color: white; text-align: center; padding: 2px;">NOTICE</div> <div style="border: 1px solid black; padding: 5px;">In applications where the ambient temperature falls below 4 °C (40 °F), Low Coolant Temp may be indicated even though the coolant heaters are operating.</div>
CODE:	1438	Indicates a possible fault with the control, speed sensing, or the starting system. See code 441 for corrective action.
LAMP:	Shutdown	
MESSAGE:	FAIL TO CRANK	
CODE:	1442	Indicates that, during cranking, the battery voltage is at, or below the weak battery warning trip point for a time greater than, or equal to the weak battery set time. See fault code 441 for corrective action
LAMP:	Warning	
MESSAGE:	WEAK BATTERY	
CODE:	1448	Indicates that the generator set frequency has dropped below 90% of nominal for approximately ten seconds. Allow the engine to cool down completely before proceeding with the following checks: 1. Check the fuel supply. 2. Check the air intake supply. 3. Check the load and correct any overload.
LAMP:	Shutdown	
MESSAGE:	UNDER FREQUENCY	
CODE:	1852	Indicates that the water in the fuel is above normal and has reached the warning trip point. If the engine can be stopped, allow the engine to cool down completely before proceeding with the following checks: 1. Check fuel in tank (local or remote). 2. Drain and re-fill if necessary. Be aware of all Health and Safety, and environmental issues if draining tank.
LAMP:	Warning	
MESSAGE:	WATER IN FUEL	
CODE:	2964	Indicates the engine is operating near system capacity. Increase in load or high ambient temperature may cause a High Intake Manifold Temperature (fault code 155) shutdown. If the engine can be stopped, allow the engine to cool down completely before proceeding with the following checks: 1. Review fault code 151 correction list for possible causes.
LAMP:	Warning	
MESSAGE:	HIGH INTAKE MANIFOLD TEMP	

7.6 Line Circuit Breaker

A line circuit breaker is mounted in the generator output box. If the load exceeds the circuit breaker current rating, the line circuit breaker will open, preventing the generator from being overloaded. If the circuit breaker trips, locate the source of the overload or short circuit, and correct as necessary. Manually reset the breaker to reconnect the load to the generator.

8 Battery Charger

8.1 Battery Charger - 6 Amp/12 Volt

The battery charger includes 4 KLED indicators.

- Mains On
- Float Mode
- Boost Mode
- Battery Reverse Polarity

The charger includes 2 connectors.

- Input - 3-Pin Connector
- Output - 4-Pin Connector

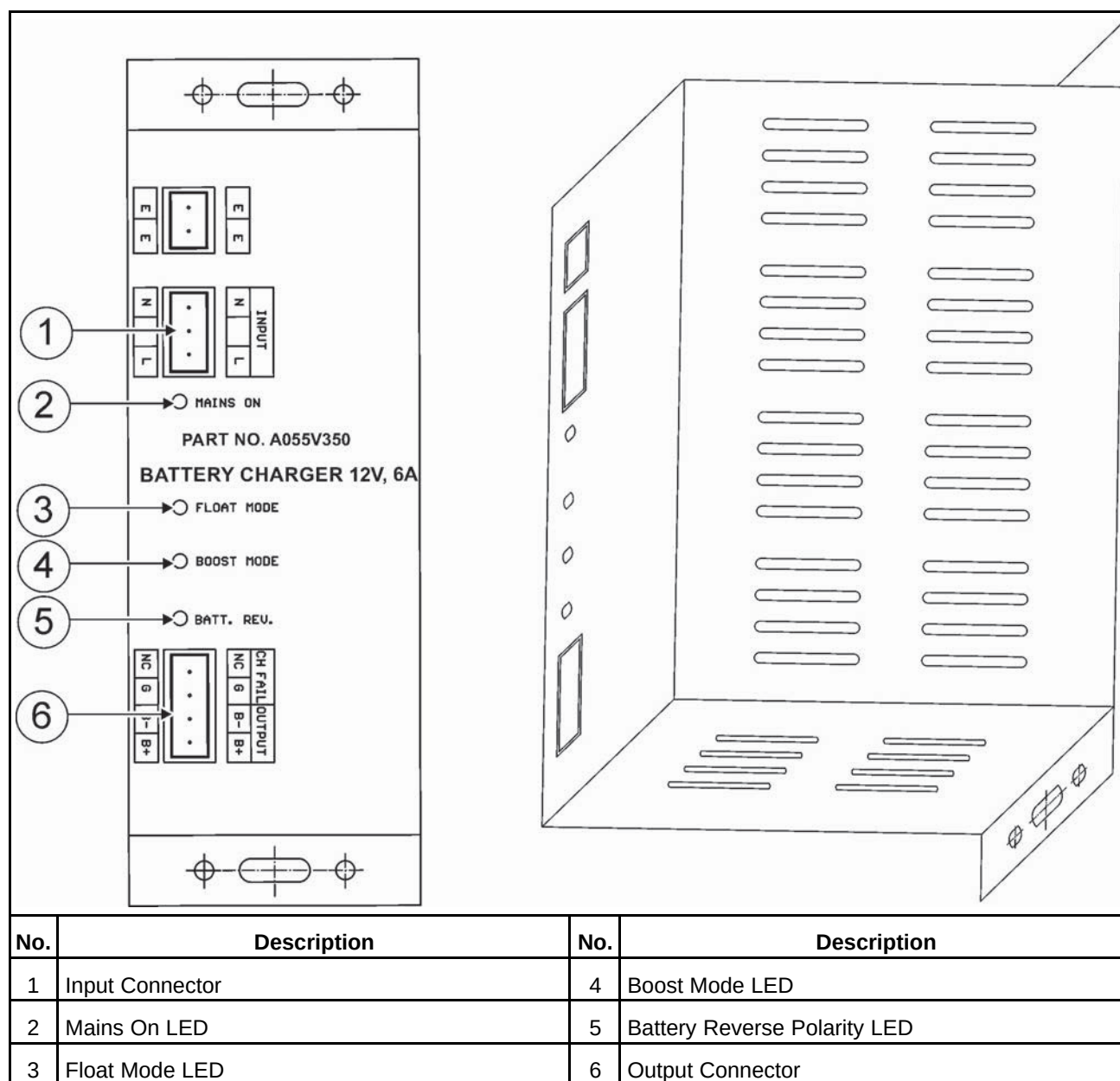


FIGURE 35. 6 AMP, 12 VOLT BATTERY CHARGER

8.1.1 Specifications

TABLE 19. 12 VOLT, 6 AMP BATTERY CHARGER SPECIFICATIONS

Output	
Float Voltage	13.5V
Float Current	2.5A–3.0 Amps
Boost Voltage	14.2V
Rated Power	10 Amps
Ripple and Noise (Maximum)	142 Watts
Voltage Tolerance	< 1% of Output Voltage

Line Regulation	$\pm 1\%$ of Rated Voltage
	$\pm 0.5\%$
Load Regulation	$< \pm 1\%$
Hold-Up Time	>20 mSec Typical
Input	
Voltage Range	90–300 VAC
Frequency Range	45–65 Hz
Efficiency (Typical)	$>80\%$
AC Current	1.2 Amps/230 VAC
Inrush Current (Maximum)	Cold Start 30A (Max)/230 VAC
Leakage Current	<0.5 mA/230 VAC
Protections	
Overload	Protection Type: Constant Current. Recovers automatically after fault condition is removed.
Battery Reverse	Protection Type: O/P Disconnected. Recovers automatically after fault condition is removed.
General	
Operating Temperature	-5°C to 70°C (23°F to 158°F)

8.2 Circuits

For generator set specific information, refer to the drawings and circuit diagrams provided with your generator set.

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9 Manufacturing Facilities

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Cummins Inc. 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Cummins Inc. Columbus Avenue Manston Park Manston, Ramsgate Kent CT12 5BF United Kingdom	Cummins Inc. Royal Oak Way South Daventry Northamptonshire NN11 8NU United Kingdom
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9.1 How to Obtain Service

When a product requires servicing, contact the nearest Cummins distributor. To locate the distributor, refer to www.cummins.com/support and select Distributor Locator. When contacting the distributor, always supply the complete model, specification, and serial number as shown on the nameplate.

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