



# Operator Manual

## QSB5-G5, QSB5-G6, and QSB5-G13 Engines with PowerCommand® 2.3 Control

C50D6C (Spec A-B)

C60D6C (Spec A-B)

C80D6C (Spec A-B)

C100D6C (Spec A-B)

C125D6C (Spec A)

**CALIFORNIA**  
**Proposition 65 Warning**

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

# Table of Contents

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1. IMPORTANT SAFETY INSTRUCTIONS .....	1
1.1 Warning, Caution, and Note Styles Used in This Manual .....	1
1.2 General Information .....	1
1.3 Generator Set Safety Code .....	4
1.4 Moving Parts Can Cause Severe Personal Injury or Death .....	4
1.5 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death.....	5
1.6 Fuel and Fumes Are Flammable .....	5
1.7 Batteries Can Explode .....	6
1.8 Exhaust Gases Are Deadly.....	7
1.9 The Hazards of Carbon Monoxide.....	9
1.10 Earth Ground Connection .....	9
2. INTRODUCTION.....	11
2.1 Safety.....	11
2.2 About This Manual.....	11
2.3 Schedule of Abbreviations .....	12
2.4 Related Literature .....	14
2.5 Model Specifications .....	15
2.6 After Sales Services.....	22
3. CONTROL SYSTEM.....	27
3.1 Control System Description .....	27
3.2 Operator Panel.....	32
3.3 Fault Messages - PowerCommand 2.3 .....	38
3.4 Operator Panel - Initial Operator Menu .....	38
3.5 Operator Panel - Generator Set Data Operator Menu.....	40
3.6 Operator Panel - Engine Data Operator Menu .....	43
3.7 Operator Panel - Alternator Data Operator Menu.....	46
3.8 Operator Panel - Faults and Warnings Menus .....	48
3.9 Operator Panel - Adjust Menu .....	53
3.10 Operator Panel - Genset Setup Data Operator Menu .....	56
3.11 Selecting Operating Modes.....	58
4. OPERATION - POWERCOMMAND 2.3 .....	63
4.1 Safety.....	63
4.2 Introduction to Generator Set Operation.....	64
4.3 Maintenance .....	64
4.4 Operating Recommendations .....	64
4.5 Generator Set Operation.....	68
4.6 Before Starting.....	69
4.7 Stopping.....	75
4.8 Frequency Changing.....	77

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5. MAINTENANCE .....	79
5.1 Maintenance Safety .....	79
5.2 Periodic Maintenance .....	82
5.3 Cooling System.....	87
5.4 Engine Oil .....	88
5.5 Diesel Fuel System Safety and Requirements .....	93
5.6 Air Intake System.....	99
5.7 Exhaust System Maintenance .....	103
5.8 Generator Set Output - AC Electric System Checks .....	104
5.9 DC Electrical System .....	105
5.10 Batteries.....	105
5.11 Cleaning the Generator Set Housing.....	109
5.12 Complete System Test .....	109
6. TROUBLESHOOTING .....	111
6.1 Avoiding Generator Set Shutdowns .....	111
6.2 Control System .....	111
6.3 Safety Considerations.....	111
6.4 Fault Codes - PowerCommand 2.3 .....	112
6.5 Line Circuit Breaker .....	119

# 1 IMPORTANT SAFETY INSTRUCTIONS

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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

*Indicates a hazardous situation that, if not avoided, will result in death or serious injury.*

### WARNING

*Indicates a hazardous situation that, if not avoided, could result in death or serious injury.*

### CAUTION

*Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.*

### 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 Inc. with specific generator sets. If this manual has been supplied in isolation, please contact your authorized dealer.

### NOTICE

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

## General Safety Precautions

### 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.***

### 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 and maintenance can result in severe personal injury or death.***

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

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

### 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

#### ***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****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 store fuel, cleaners, oil, etc., near the generator set. Do not use combustible liquids like ether.**

**⚠ WARNING****Combustible Gases**

**Generator sets in operation have combustible gases under pressure, which if ignited can cause eye and ear damage.**

**Wear appropriate eye and ear protection at all times.**

**⚠ WARNING****Combustible Gases**

**Generator sets in operation have combustible gases under pressure, which if ignited can cause severe injury.**

**Do not operate the generator set with any doors open.**

**⚠ WARNING****Fire Hazard**

**Materials drawn into the generator set, as well as 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. Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.**

**⚠ 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).***

**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.***

## 1.4 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.

## **1.5 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death**

- Only qualified service personnel certified and authorized to work on power circuits should work on exposed energized power circuits.
- All relevant service material must be available for any electrical work performed by certified service personnel.
- Exposure to energized power circuits with potentials of 50 VAC or 75 VDC or higher poses a significant risk of 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 safety requirements.

## **1.6 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.

## 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.

## Spillage

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

## Spillage

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

## 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.

## 1.7 Batteries Can Explode

Batteries can explode, causing severe skin and eye burns and can release toxic electrolytes.

### WARNING

#### ***Combustible Gases***

***Batteries can explode, causing severe skin and eye burns, and can release toxic electrolytes.***

***Do not dispose of the battery in a fire, because it is capable of exploding. Do not open or mutilate the battery. Do not charge frozen batteries.***

**⚠ WARNING*****Electric Shock Hazard******Batteries present the risk of high short circuit current.******When servicing the generator set:***

- ***Remove watches, rings, or other metal objects.***
- ***Use tools with insulated handles.***

**NOTICE****Service of batteries must be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.**

- Wear safety glasses.
- Do not smoke.
- Do not charge frozen batteries.
- To prevent arcing when disconnecting the battery:
  1. Press the Off switch from the display and then press the E-Stop button.
  2. Disconnect AC power from any battery chargers.
  3. Remove the negative (-) battery cable to prevent starting.
- To prevent arcing when reconnecting the battery:
  1. Reconnect the positive (+) cable.
  2. Reconnect the negative (-) cable.
  3. Reconnect the battery charger to AC power supply.
- When replacing the generator set battery, always replace it with a battery as specified in this manual.

## 1.8 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.

## 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.

## 1.9 The Hazards of Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless, tasteless and non-irritating gas. You cannot see it or smell it. Red blood cells, however, have a greater affinity for CO than for oxygen. Therefore, exposure even to low levels of CO for a prolonged period can lead to asphyxiation (lack of oxygen) resulting in death. Mild effects of CO poisoning include eye irritation, dizziness, headaches, fatigue and the inability to think clearly. More extreme symptoms include vomiting, seizures and collapse.

Engine-driven generator sets produce harmful levels of carbon monoxide that can injure or kill you.

### Special Risks of CO near the Home

#### WARNING

##### **Toxic Gases**

***Carbon monoxide (CO) gas can cause nausea, fainting, or death. Residents can be exposed to lethal levels of CO when the generator set is running. Depending on air temperature and wind, CO can accumulate in or near the home.***

***To protect yourself and others from the dangers of CO poisoning, it is recommended that reliable, approved, and operable CO detector alarms are installed in proper locations in the home as specified by their manufacturer.***

### Protecting Yourself from CO Poisoning

- Locate the generator set in an area where there are no windows, doors, or other access points into the home.
- Make sure all CO detectors are installed and working properly.
- Pay attention for signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction, and leaks every time you start the generator set and every eight hours when you run it continuously.

## 1.10 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.**

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**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.**

## 2 Introduction

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### 2.1 Safety

 **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.***

### 2.2 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 Inc. 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 Inc. policy of continuous development and improvement, information may change at any time without notice. The users should therefore make sure that they have the latest information available before starting any work. 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 people to carry out any installation work. Consult your authorized dealer for further installation information. It is essential that the utmost care is taken with the application, installation, and operation of any generator set due to their potentially hazardous nature. Careful reference should also be made to other Cummins Inc. literature. You must operate and maintain your generator set properly if you are to expect safe and reliable operation.

For further assistance, contact your authorized Cummins Inc. dealer.

**NOTICE**

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interferences.
- This device must accept any interference received, including interference that may cause undesired operation.

## 2.3 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.

Abbr.	Description	Abbr.	Description
AC	Alternating Current	LED	Light-Emitting Diode
AMP	AMP, Inc. (part of Tyco Electronics)	MFM	Multifunction Monitor
ANSI	American National Standards Institute	Mil Std	Military Standard
ASOV	Automatic Shut Off Valve	MPU	Magnetic Pickup
ASTM	American Society for Testing and Materials (ASTM International)	NC	Normally Closed
ATS	Automatic Transfer Switch	NC	Not Connected
AVR	Automatic Voltage Regulator	NFPA	National Fire Protection Agency
AWG	American Wire Gauge	NO	Normally Open
CAN	Controlled Area Network	NWF	Network Failure
CB	Circuit Breaker	OEM	Original Equipment Manufacturer
CE	Conformité Européenne	OOR	Out Of Range
CCA	Cold Cranking Ampere	OORH/ ORH	Out Of Range High
CFM	Cubic Feet per Minute	OORL/ORL	Out Of Range Low
CGT	Cummins Generator Technologies	PB	Push Button
CMM	Cubic Meters per Minute	PCC	PowerCommand® Control



<b>Abbr.</b>	<b>Description</b>	<b>Abbr.</b>	<b>Description</b>
CT	Current Transformer	PGI	Power Generation Interface
DC	Direct Current	PGN	Parameter Group Number
DEF	Diesel Exhaust Fluid	PI	Proportional/Integral
DPF	Diesel Particulate Filter	PID	Proportional/Integral/ Derivative
EBS	Excitation Boost System	PLC	Programmable Logic Controller
ECM	Engine Control Module	PMG	Permanent Magnet Generator
ECS	Engine Control System	PPE	Personal Protective Equipment
EMI	Electromagnetic Interference	PT	Potential Transformer
EN	European Standard	PTC	Power Transfer Control
EPS	Engine Protection System	PWM	Pulse-Width Modulation
E-Stop	Emergency Stop	RFI	Radio Frequency Interference
FAE	Full Authority Electronic	RH	Relative Humidity
FMI	Failure Mode Identifier	RMS	Remote Monitoring System
FSO	Fuel Shutoff	RMS	Root Mean Square
Genset	Generator Set	RTU	Remote Terminal Unit
GCP	Generator Control Panel	SAE	Society of Automotive Engineers
GND	Ground	scfh	Standard Cubic Feet of gas per Hour
HMI	Human-Machine Interface	SCR	Selective Catalytic Reduction
IC	Integrated Circuit	SPN	Suspect Parameter Number
ISO	International Organization for Standardization	SW_B+	Switched B+
LBNG	Lean-Burn Natural Gas	UL	Underwriters Laboratories

Abbr.	Description	Abbr.	Description
LCD	Liquid Crystal Display	UPS	Uninterruptible Power Supply
LCT	Low Coolant Temperature		

## 2.4 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 familiarize themselves with the warnings and operating procedures.

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 the Operator manual for the safe operation of the generator set.

The following documents are shipped with the generator set:

- Installation Manual for QSB5 Engine with PC 2.3 Control (A055H194)
- Operator Manual for QSB5 Engine with PC 2.3 Control (A055H195)
- Health and Safety Manual (A007W058 [0908-0110-00])
- Warranty Administration Manual (4021290)
- Global Commercial Warranty Statement (A028U870)
- All Engines Worldwide Generator Drive Warranty (EPA warranty statement) (A056N379 [3381307])

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

- Generator Set Service Manual for QSB5 Engine with PC 2.3 Control (A055H196)
- Controller Service Manual for PowerCommand 2.3 Controller (A030F082 [0900-0666])
- Engine Operation and Maintenance Manual (4021531)
- Recommended Spares List (RSL) for each model:
  - C50D6C (A054H261)
  - C60D6C (A054H263)
  - C80D6C (A054H265)
  - C100D6C (A055J379)
  - C125D6C (A055J386)
- Parts Manual for QSB5 Engine with PC 2.3 Control (A055J388)
- InPower User Manual (0901-0108)

- Universal Annunciator Owner Manual (0900-0301)
- Standard Repair Times - AO Family (A055J390)
- Service Tool Manual (A043D529)
- Failure Code Manual (F1115C)
- Engineering Application Manual *T-030: Liquid Cooled Generator Sets* (A040S369)

## 2.5 Model Specifications

TABLE 1. MODEL VARIATIONS (ALL MODELS 60 HZ)

Model	kW	Phase	Amps	Voltage (L-N/L-L) V
C50D6C	50	3	173	120/208
		3	164	127/220
		3	150	120/240
		3	75	277/480
		3	60	347/600
		1	208	120/240
C60D6C	60	3	208	120/208
		3	197	127/220
		3	180	120/240
		3	90	277/480
		3	72	347/600
		1	250	120/240
C80D6C	80	3	278	120/208
		3	262	127/220
		3	241	120/240
		3	120	277/480
		3	96	347/600
		1	333	120/240

Model	kW	Phase	Amps	Voltage (L-N/L-L) V
C100D6C	100	3	347	120/208
		3	328	127/220
		3	301	120/240
		3	150	277/480
		3	120	347/600
		1	417	120/240
C125D6C	125	3	434	120/208
		3	410	127/220
		3	376	120/240
		3	188	277/480
		3	150	347/600
		1	521	120/240

**TABLE 2. COLD WEATHER SPECIFICATIONS (ALL MODELS)**

Temperature	Description	Battery Type	Group
Above 10 °C (50 °F)	No starting aids required.	Standard	34
-17 to 10 °C (0 to 50 °F)	All starting aids (battery heater, 1000 W coolant heater, battery charger) recommended. Factory options available.	2 Standard	34
Below -17 °C (0 °F)	All starting aids (battery heater, 1500 W coolant heater, battery charger) recommended. Factory options available.	2 Standard	34

**NOTICE**

**For NFPA 110 applications, a coolant heater is required. A factory option is available.**

**TABLE 3. FUEL SPECIFICATIONS (PER HOUR)**

Full Load Rating	C50D6C	C60D6C	C80D6C	C100D6C	C125D6C
Standby	20.06 L	23.09 L	27.63 L	33.69 L	38.99 L
	5.30 gal	6.10 gal	7.30 gal	8.90 gal	10.30 gal
Prime	17.79 L	20.82 L	26.87 L	29.15 L	35.20 L
	4.70 gal	5.50 gal	7.10 gal	7.70 gal	9.30 gal

**TABLE 4. FUEL TANK PART NUMBERS**

Option	Tank Type	Capacity Min. (Hr)	C50 D6	C60 D6	C80 D6	C100 D6	C125 D6
C301-2	Regional	24	A053L909	A053L909	A053L909	A053L909	A053L909
C303-2	Regional	48	A053L911	A053L911	A053L911	A053L911	A053L912
C305-2	Regional	72	A053L911	A053L912	A053L912	A053L912	-
C307-2	Regional	96	A053L912	A053L912	-	-	-
C319-2	Basic	24	A053H409	A053H409	A053H409	A053H409	A053H409
C320-2	Basic	48	A053H409	A053H411	A053H411	A053H412	A053H412

**TABLE 5. ENGINE SPECIFICATIONS (ALL MODELS)**

Type	Specification
Engine	4 Cylinder-in-line, liquid-cooled, 4-stroke <ul style="list-style-type: none"> <li>• QSB5-G5: C50D6C (Spec A), C60D6C (Spec A), C80D6C (Spec A), and C100D6C (Spec A)</li> <li>• QSB5-G6: C125D6C only</li> <li>• QSB5-G13: C50D6C (Spec B), C60D6C (Spec B), C80D6C (Spec B), and C100D6C (Spec B)</li> </ul>
Aspiration	Turbocharged and charge air cooled
Displacement	4500 cc (272 in <sup>3</sup> )
Compression Ratio	17.3:1
Fuel	ASTM number 2D fuel (refer to the engine operator and maintenance manual)
Coolant	50/50 coolant solution (50% pure water and 50% anti-freeze)
Coolant Fill Rate	Maximum 3 GPM

Type	Specification
Fuel Flow	Maximum fuel flow: <ul style="list-style-type: none"> <li>• C50D6C, C60D6C, C80D6C, and C100D6C: 133 L/hr (35 gal/hr)</li> <li>• C125D6C only: 95 L/hr (25 gal/hr)</li> </ul>
	Maximum fuel inlet restriction with clean filter: 17 kPa (5 in. Hg)
	Maximum return restriction: 20 kPa (6 in. Hg)

**TABLE 6. LUBRICATING OIL SYSTEM SPECIFICATIONS (ALL MODELS)**

Type	Value
Lubricating Oil Pressure at Rated Speed (Minimum)	G5 engine: 310 kPa (45 psi) G6 engine: 344.7 kPa (50 psi) G13 engine: 276 kPa (40 psi)
Oil Recommendation	15W40 (refer to the engine operator and maintenance manual)
<b>Lubricating Oil Capacity:</b>	
--Full at High Mark on Dipstick	11.0 L (11.6 qt)
--Low Mark on Dipstick	9 L (9.5 qt)

**TABLE 7. GENERATOR SET SIZE (ALL MODELS) (L X W X H)**

Enclosure Type	in	mm
Open/Weather (Short) (does not include exhaust discharge elbow)	98 x 40 x 58	2489 x 1016 x 1473
Sound Level 1 (Long)	119 x 40 x 58	3023 x 1016 x 1473
Sound Level 2 (Long)	136 x 40 x 58	3454 x 1016 x 1473

**TABLE 8. GENERATOR SET WET WEIGHT (INCLUDING BATTERY)**

Model	kg	lb
C50D6C, C60D6C	998	2200
C80D6C	1044	2300
C100D6C	1089	2400
C125D6C	1180	2600

**TABLE 9. ALTERNATOR SPECIFICATIONS 60 HZ, 1800 RPM**

	<b>C50D6C</b>	<b>C60D6C</b>	<b>C80D6C</b>	<b>C100D6C</b>	<b>C125D6C</b>
Alternator	Brushless, 4-pole rotating field, single bearing				
Power (kVA) 1Phase/3 Phase - Standby	50/62.5	60/75	80/100	100/125	125/156
Power (kVA) 1Phase/3 Phase - Prime	45/56	55/69	72/90	90/112.5	113/141
Rated Voltages (V) (Line to Neutral/Line to Line)	120/240				
	120/208				
	127/220				
	277/480				
	347/600				

**NOTICE****Maximum I<sub>2</sub> = 8%.**

**TABLE 10. GENERATOR SET DERATING GUIDELINES (STANDBY)**

Model	Spec	Above	Derate At (per 10 °C/18° F)	Above	Derate At (per 300 m/1000 ft)	Until	Derate At (per 300 m/1000 ft)		
C50D6C	A	40 °C	19%	2012 m (6600 ft)	17%	x			
C60D6C	A			1890 m (6200 ft)					
C80D6C	A			1585 m (5200 ft)					
C100D6C	A			1280 m (4200 ft)					
C125D6C	A			1097 m (3600 ft)					
C50D6C	B		16.10%	4648 m (15250 ft)	2.20%				
C60D6C	B			3581 m (11750 ft)					
C80D6C	B			1524 m (5000 ft)	17.50%			1707 m (5600 ft)	2.20%
C100D6C	B			1295 m (4250 ft)					



**TABLE 11. GENERATOR SET DERATING GUIDELINES (PRIME)**

Model	Spec	Above	Derate At (per 10 °C/18° F)	Above	Derate At (per 300 m/1000 ft)	Until	Derate At (per 300 m/1000 ft)
C50D6C	A	40 °C	19%	2073 m (6800 ft)	17%	x	
C60D6C	A			1951 m (6400 ft)			
C80D6C	A			1707 m (5600 ft)			
C100D6C	A			1463 m (4800 ft)			
C125D6C	A			1158 m (3800 ft)			
C50D6C	B	16.10%		5258 m (17250 ft)	2.30%		
C60D6C	B			4343 m (14250 ft)			
C80D6C	B			1753 m (5750 ft)			
C100D6C	B			1448 m (4750 ft)	17.50 %		

**TABLE 12. CONTROL SPECIFICATIONS (ALL MODELS)**

Control
PowerCommand® 2.3 integrated, microprocessor-based engine/alternator/transfer switch controller, including Engine Control Module (ECM) CM850

**TABLE 13. DC SYSTEM SPECIFICATIONS (ALL MODELS)**

Type	Value
Nominal Battery Voltage (VDC)	12
Battery Group	34
Battery Type	Lead acid (wet)
Minimum Cold Crank Amps (CCA)	2 batteries x 850 CCA (per battery) = Total 1700 CCA

## 2.6 After Sales Services

Cummins offers a full range of maintenance and warranty services.

### Maintenance

#### WARNING

##### ***Electrical Generating Equipment***

***Incorrect service or parts replacement can result in severe personal injury, death, and/or equipment damage.***

***Make sure service personnel are qualified to perform electrical and mechanical service.***

For expert generator set service at regular intervals, contact your Cummins Inc. service provider. See [power.cummins.com/sales-service-locator](http://power.cummins.com/sales-service-locator) for service locations that service this application. Maintenance tasks should only be undertaken by trained and experienced technicians provided by your Cummins Inc. service provider.

### Warranty

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

Extended warranty coverage is also available. 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.

For further warranty details, contact your authorized dealer.

#### NOTICE

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

### Warranty Limitations

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

### How to Obtain Service

For parts, service, and product information, contact the nearest authorized Cummins Inc. dealer. To easily locate the nearest certified distributor/dealer for Cummins generator sets in your area, or for more information, contact us at 1-800-CUMMINS™ (1-800-286-6467) or visit [www.cummins.com/support](http://www.cummins.com/support).

## Generator Set Nameplate

### WARNING

#### ***Electrical Generating Equipment***

***Improper service or replacement of parts can lead to severe personal injury or death and to damage to equipment and property.***

***Make sure service personnel are qualified to perform electrical and mechanical service.***

### NOTICE

**Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.**

**Model, Spec, and Serial Numbers:** Be ready to provide the model, spec, and serial numbers on the generator set nameplate when contacting Cummins Inc. for information, parts, and service. The nameplate is located on the inside of the customer access door on enclosed generator sets.

Record these numbers so that they are easy to find when needed. Each character in these numbers is significant for obtaining the right parts listed in the Parts Catalog. Genuine Cummins Inc. replacement parts are recommended for best results.

### My Generator Set Information

Model	
Spec	
Serial Number	

## Manufacturing Facilities

Facility	Address	Phone Numbers
U.S. and CANADA	Cummins Inc. 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Toll Free 1-800-CUMMINS™ (1-800-286-6467) Phone +1 763-574-5000 Fax +1 763-574-5298
EMEA, CIS	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	Phone +44 1843 255000 Fax +44 1843 255902
ASIA PACIFIC	Cummins Inc. 10 Toh Guan Road #07-01 TT International Tradepark Singapore 608838	Phone +65 6417 2388 Fax +65 6417 2399
BRAZIL	Rua Jati, 310, Cumbica Guarulhos, SP 07180-900 Brazil	Phone +55 11 2186 4195 Fax +55 11 2186 4729
CHINA	Cummins Inc. 2 Rongchang East Street, Beijing Economic – Technological Development Area Beijing 100176, P.R. China	Phone 86 10 59023001 Fax +86 10 5902 3199
INDIA	Cummins Inc. Plot No B-2, SEZ Industrial Area, Village-Nandal & Surwadi, Taluka- Phaltan Dist- Satara, Maharashtra 415523 India	Phone +91 021 66305514
LATIN AMERICA	3350 Southwest 148th Ave. Suite 205 Miramar, FL 33027 USA	Phone +1 954 431 551 Fax +1 954 433 5797

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<b>Facility</b>	<b>Address</b>	<b>Phone Numbers</b>
MEXICO	Eje 122 No. 200 Zona Industrial San Luis Potosi, S.L.P. 78395 Mexico	Phone +52 444 870 6700 Fax +52 444 824 0082

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# 3 Control System

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## 3.1 Control System Description

The control system is used to start and stop the generator set from the display screen in either Manual or Auto mode. It is suitable for standalone or paralleling generator sets in both standby and prime-power applications, providing full generator set monitoring capability and protection. 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 automatically shuts down the generator set on critical faults.

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

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

- **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 it down.

The standard control system operates on 12 VDC 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.

## Control System Panel

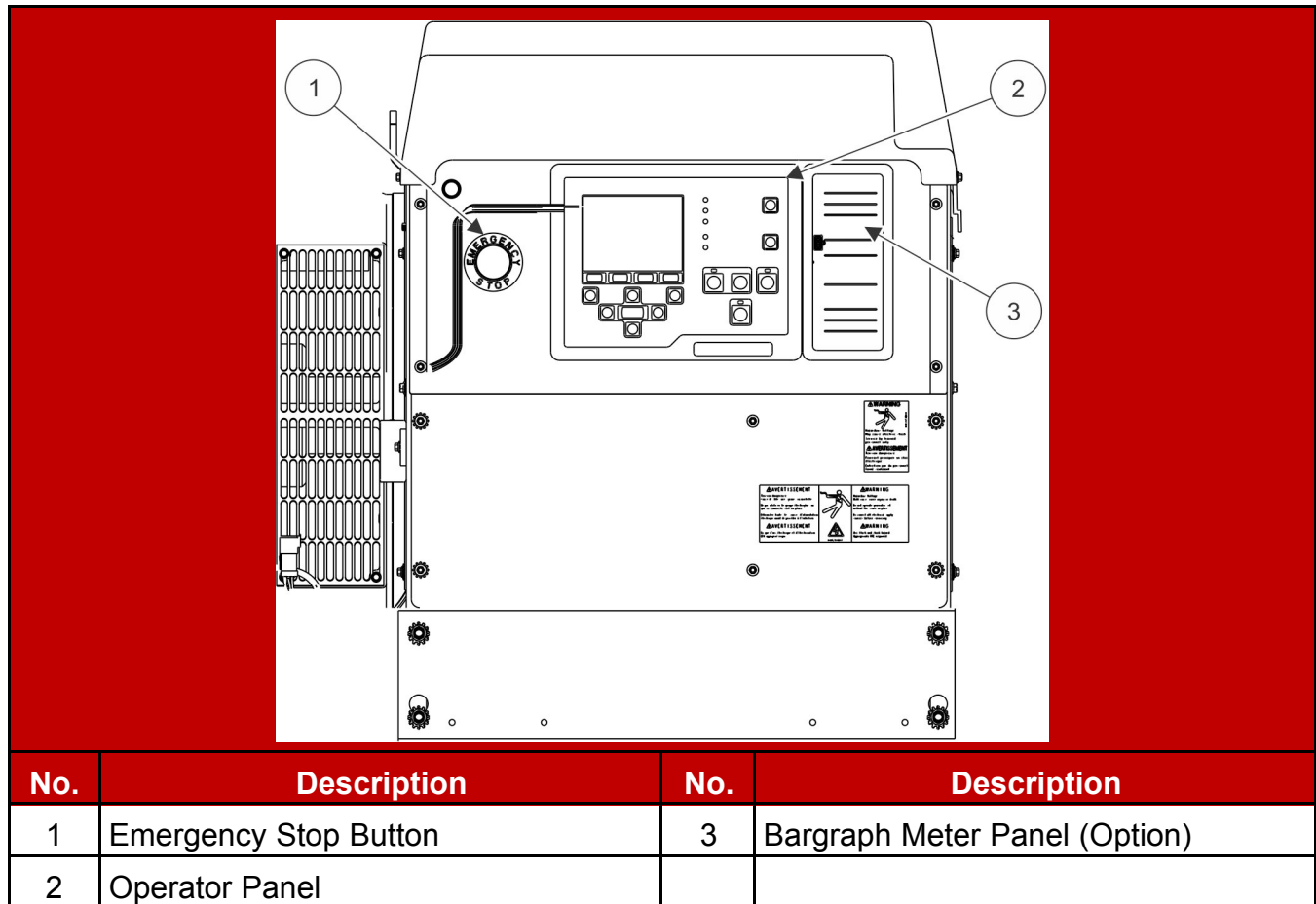


FIGURE 1. CONTROL SYSTEM PANEL

### Operating Modes

The PowerCommand® 2.3 control is operated by the Start/Stop/Manual/Auto buttons on the operator panel. Refer to the Operator Panel section to view these buttons.

**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.

#### 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.***

### 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.**

### 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.***

### 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.

## 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.

## 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.

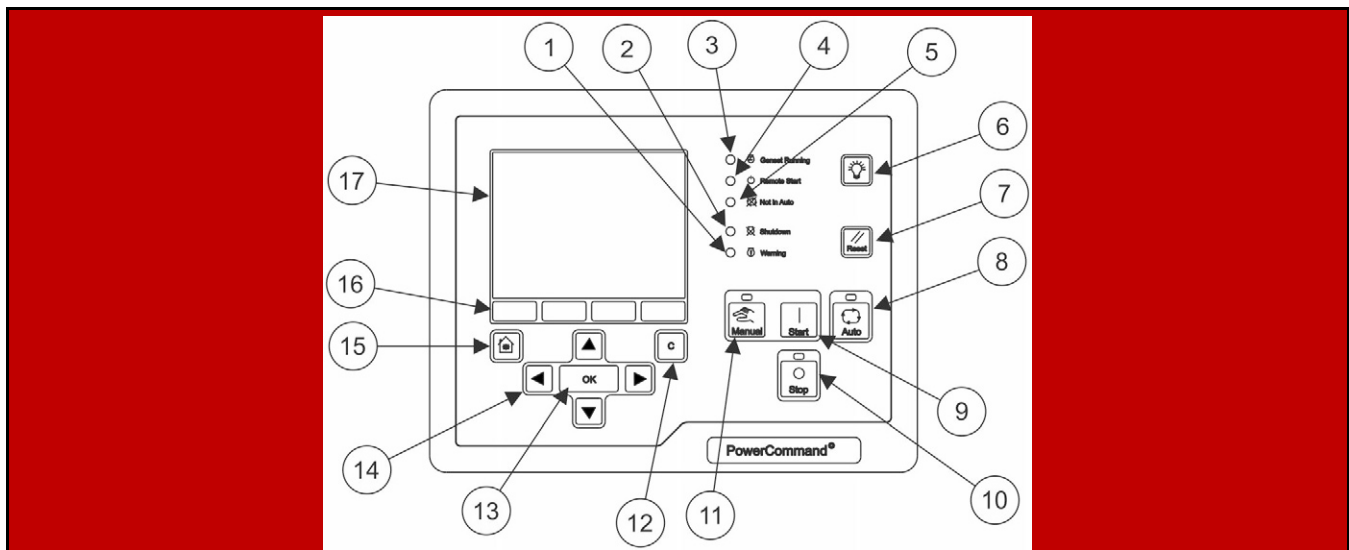
To activate the control and view the menu display without starting the generator set, press any control button.

**NOTICE**

***Sleep mode can be enabled/disabled. Contact your authorized distributor for options.***

## 3.2 Operator Panel

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

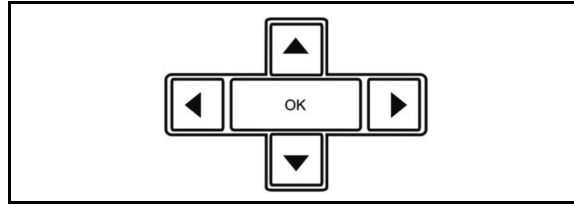


No.	Description	No.	Description
1	Indicator Lamp – Warning	10	Stop Button
2	Indicator Lamp – Shutdown	11	Manual Button
3	Indicator Lamp – Genset Running	12	Previous Menu Button (or Clear)
4	Indicator Lamp – Remote Start	13	Item Select Button (OK)
5	Indicator Lamp – Not in Auto	14	Menu Navigation Buttons (Up, Down, Left, Right)
6	Lamp Test Button/Panel Lamp On-Off	15	Home Button
7	Reset Button	16	Menu Select Buttons (for use with Item 17)
8	Auto Mode Button	17	Graphical Display
9	Start Button		

**FIGURE 2. OPERATOR PANEL**

## Selection Buttons

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



**FIGURE 3. SELECTION BUTTONS**

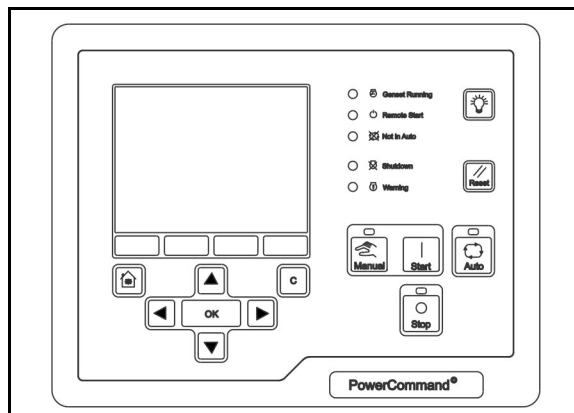
Press the **OK** button to select the item that is currently highlighted in the graphical display:

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

## 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.

## Status Indicators - PowerCommand 2.3



**FIGURE 4. OPERATOR PANEL (HMI 320)**

**Not in Auto** 

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

**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.

**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.

**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 pressing the **Off** button.

**NOTICE**

**When Battle Short mode is enabled and an overridden shutdown fault occurs, the Shutdown lamp lights, even though the generator set continues to run.**

**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.

**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.

**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.

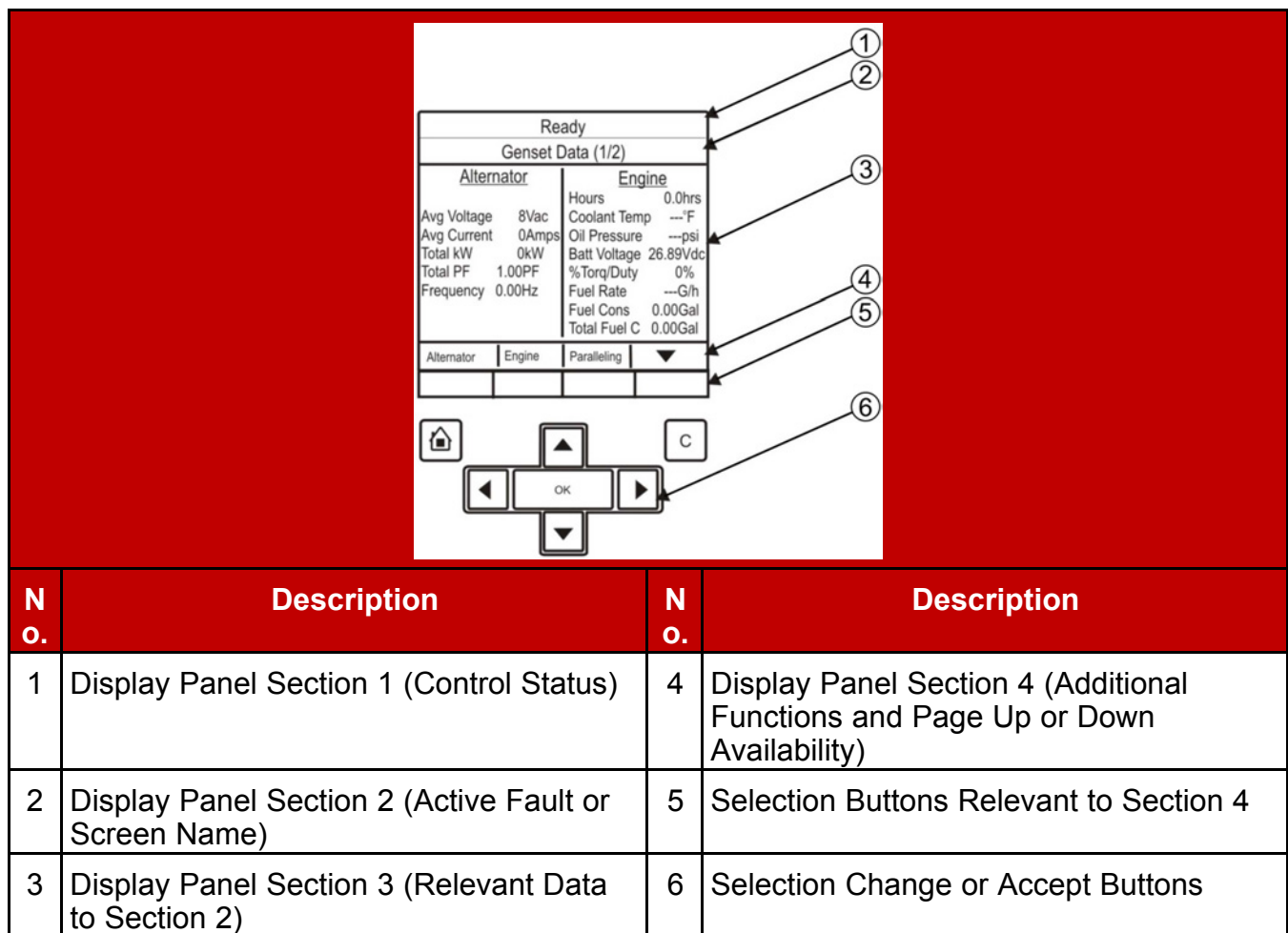
## Graphical Display and Buttons

**Figure 5 on page 35** 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.

Four momentary soft-key buttons (item 5) are used to change menus, or pages within each screen. These selection buttons are “active” when any text or the up and down triangles (▲ and ▼ in Section 4) 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 5. GRAPHICAL DISPLAY WITH TYPICAL SCREENSHOT**

### Section 1 - Control Status

Section 1 displays the status of the controller.

**TABLE 14. CONTROL STATUS**

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, and the engine speed is greater than zero.
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, and the engine speed is still greater than zero.
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.
Off	The controller is in the process of entering power-down mode. The controller is performing some last-second checks.
Demo Mode	The controller is running a demonstration. Every screen is available in the demonstration, and any changes you make in the demonstration will have no effect on the controller. To end the demonstration, the operator panel must be turned off.

## Section 2 - Active Fault or Screen Name

Section 2 displays the screen name and information about the last active shutdown fault. If there are no active shutdown faults, it displays the last active warning fault.

If there is an active fault, the operator panel displays the following information about it:

- Fault type
- Event/fault code
- 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. However, the Warning LED remains on.

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

**TABLE 15. ACTIVE FAULT TYPES**

Fault Type	Description
Warning	This is a warning fault. (See the Troubleshooting section.)
Derate	This is a derate fault. (See the Troubleshooting section.)
Shutdown	This is a shutdown fault that initiates a Shutdown Without Cooldown sequence. (See the Troubleshooting section.)
Shutdown with Cooldown	This is a shutdown fault that initiates a Shutdown With Cooldown sequence.

### 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 16. 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

### 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.

### 3.3 Fault Messages - PowerCommand 2.3

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.

The Fault Codes - PowerCommand 2.3 section 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.

#### 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 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.

### 3.4 Operator Panel - Initial Operator Menu

[Figure 6 on page 40](#) shows the initial menu which is displayed over two pages. Use the soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the two pages.

Use the soft-key buttons below Genset, Alternator, or Engine to short-cut to those menus.

Pressing the **Home** button  from any screen will return the display to the main menu screens.

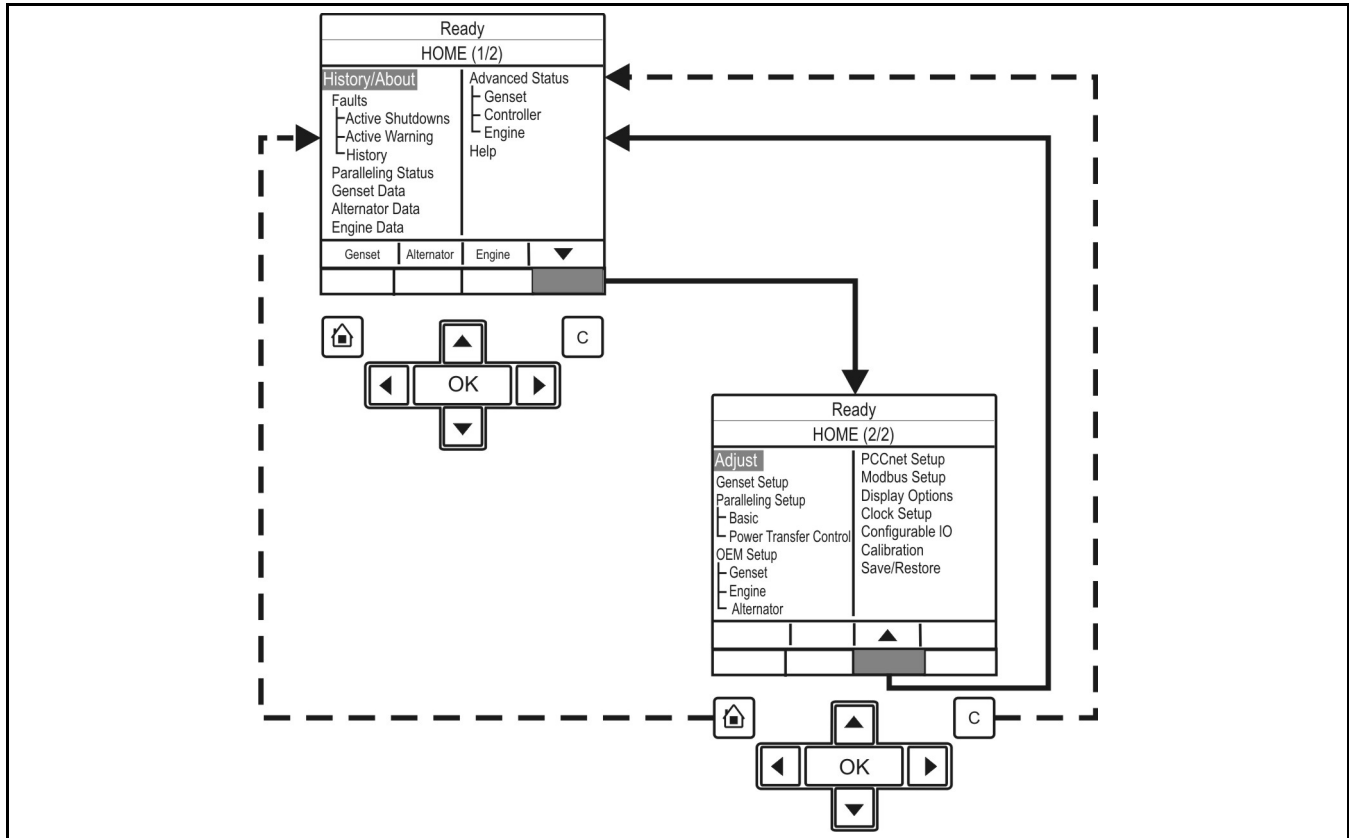
#### Initial Menu Data

This menu displays the information available through the menus.



**TABLE 17. INITIAL DATA MENU**

Name	Description
History/About	Use this screen to view historical information about your generator set.
Faults:	If there are no active Faults, these screens will not be available.

Name	Description	
	Active Shutdowns	Use this screen to view active Shutdown faults.
	Active Warning	Use this screen to view active Warning faults.
	History	Use this screen to view faults that have been cleared.
<b>Genset Data</b>	Use this screen to view the status of the generator set.	
<b>Alternator Data</b>	Use this screen to view the status of the alternator.	
<b>Engine Data</b>	Use this screen to view the status of the engine.	
<b>Advanced Status:</b>	---	
	Genset	Use this screen to view power, energy, phase difference, and other detailed generator set information.
	Controller	Use this screen to view sequences of operation, configurable inputs and outputs, and other detailed controller information.
	Engine	Use this screen to view pressures, voltages, temperatures, and other detailed engine information.
<b>Help</b>	Use this screen to obtain more information regarding the operator panel.	
<b>Adjust</b>	The use of these screens is restricted to authorized personnel only.	
<b>Genset Setup</b>		
<b>Paralleling Basic Setup</b>		
<b>OEM Setup</b>		
<b>PCCnet Setup</b>		
<b>Modbus Setup</b>		
<b>Display Options</b>		
<b>Clock Setup</b>		
<b>Configurable IO</b>		
<b>Calibration</b>		
<b>Save/Reserve</b>		



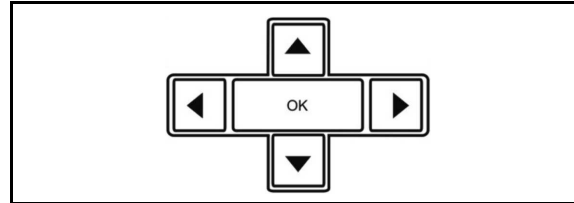
**FIGURE 6. INITIAL OPERATOR MENU**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

### 3.5 Operator Panel - Generator Set Data Operator Menu

The Genset Setup Data Menu - Typical Data table below shows a block representation of a typical Genset Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Genset. This will take you directly to the Genset menu.

The Genset Data menu is displayed on two pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.



**FIGURE 7. SELECTION BUTTONS**

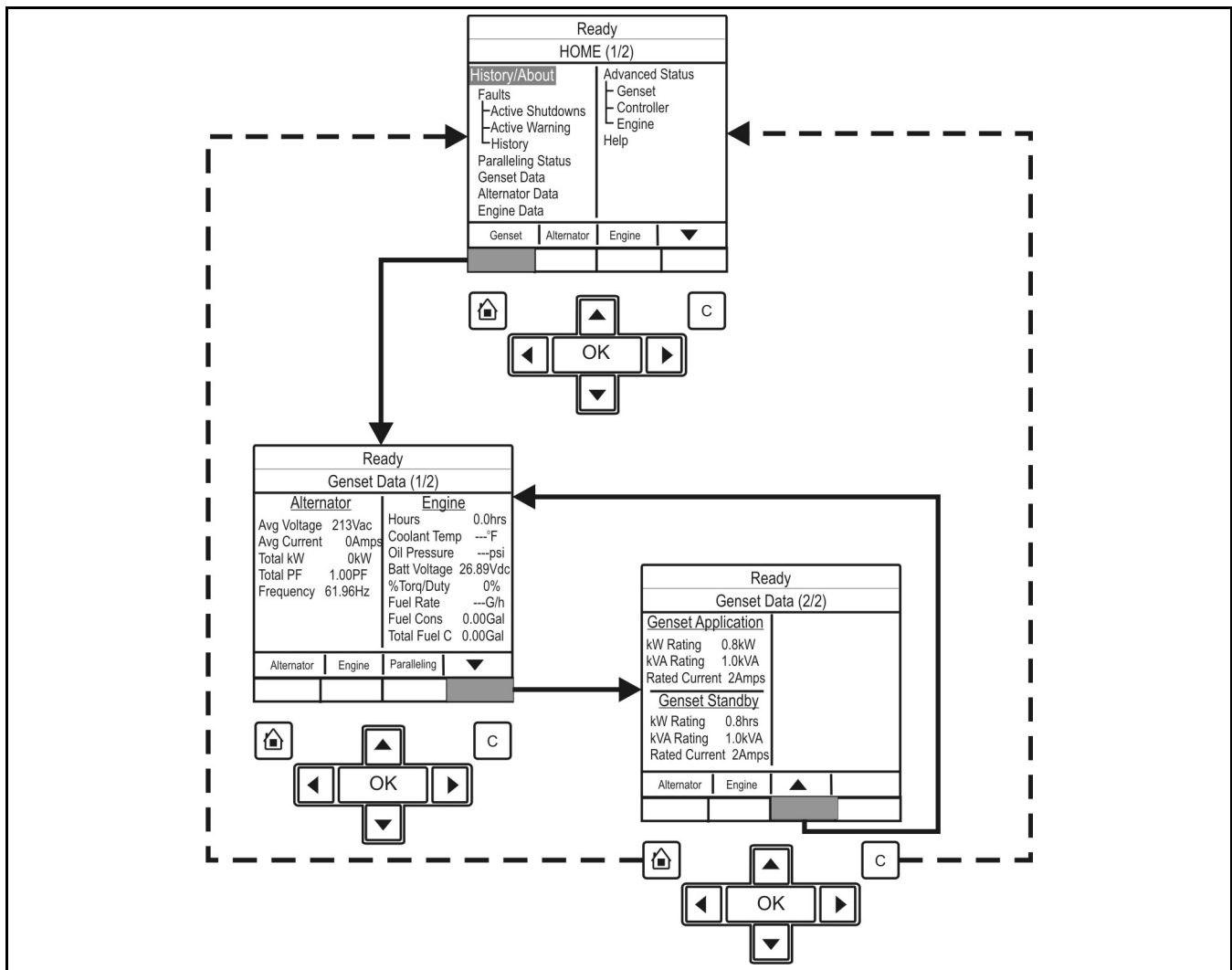
## Generator Set Data

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

**TABLE 18. GENERATOR SET STATUS**


Name	Description	Allowed Values
<b>Alternator</b>		
Avg Voltage	Generator set Line-to-Line average voltage	---
Avg Current	Generator set average current	---
Total kW	Generator set total kW	---
Total PF	Generator set power factor	---
Frequency	Generator set frequency	---
<b>Engine</b>		
Engine Hrs	Total engine run time	---
Coolant Temp	Monitor point for Coolant Temperature	---
Oil Pressure	Monitor point for Oil Pressure	0 to ~993 kPa (0 to ~145 PSI)
Batt Voltage	Battery voltage value	---
% Torq/Duty	Monitor point for the percent engine torque output and the governor percent duty cycle output when used with the HM ECM	-125 - ~125%
Fuel Rate	Monitor point for Fuel Rate	0 - ~845 L/hr (0 - ~223.2 gal/hr)
Fuel Cons.	Fuel consumption since last reset	---
Total Fuel C.	Total fuel consumption since start of engine	---
<b>Generator Set Application Rating</b>		
kW rating	The generator set kW rating	---

Name	Description	Allowed Values
kVA Rating	The generator set kVA Rating	---
Rated Current	The value of the generator set application nominal current	---
<b>Generator Set Standby Rating</b>		
kW rating	kW rating for the generator set in Standby configuration	---
kVA Rating	kVA rating for the generator set in Standby configuration	---
Rated Current	The value of the generator set Standby nominal current	---



**FIGURE 8. GENSET DATA MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.

- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

## 3.6 Operator Panel - Engine Data Operator Menu

The Engine Data Menu - Typical Data figure shows a block representation of a typical Engine Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Engine. This will take you directly to the Engine menu.

The Engine Data menu is displayed on one page.

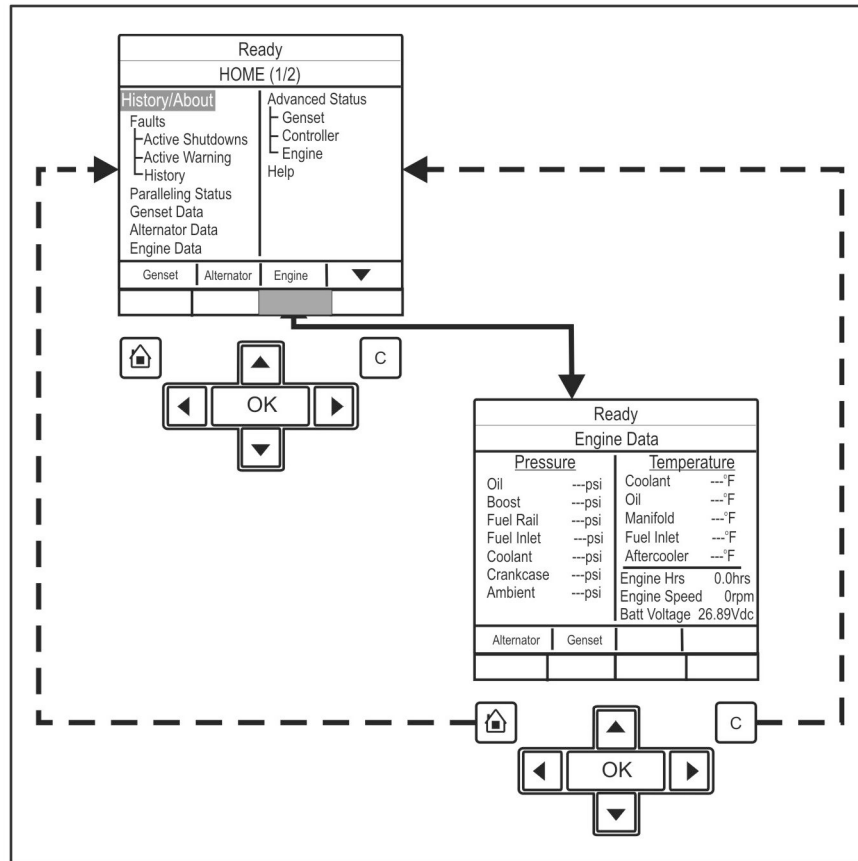
### Engine Data Menu

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



**TABLE 19. ENGINE DATA MENU**

Name	Description	Allowed Values
<b>Pressure</b>		
Oil	Monitor point for Oil Pressure	0 - ~993 kPa (0 - ~145 psi)
Boost	Monitor point for Boost Absolute Pressure	0 - ~1014 kPa (0 - ~148 psi)
Fuel Rail	Monitor point for Fuel Outlet Pressure	0 - ~249364 kPa (0 - ~36404 psi)
Fuel Inlet	Monitor point for Fuel Supply Pressure	0 - ~993 kPa (0 - ~145 psi)
Coolant	Monitor point for Coolant Pressure	0 - ~993 kPa (0 - ~145 psi)
Crankcase	Monitor point for Crankcase Pressure	-244 - ~260 kPa (-35.67 - ~38 psi)
Ambient	Monitor point for Barometric Absolute Pressure	0 - ~253 kPa (0 - ~37 psi)
<b>Temperature</b>		
Coolant	Monitor point for Coolant Temperature	N/A
Oil	Monitor point for Oil Temperature	-40 - ~210 °C (-40 - ~410 °F)
Manifold	Monitor point for Intake Manifold Temperature—	-40 - ~210 °C (-40 - ~410 °F)
Fuel Inlet	Monitor point for Fuel Temperature	-40 - ~210 °C (-40 - ~410 °F)
Aftercooler	Monitor point for Aftercooler Temperature	-40 - ~210 °C (-40 - ~410 °F)
<b>Other</b>		
Engine Hrs	Total engine run time	

Name	Description	Allowed Values
Engine Speed	Monitor point for Average Engine Speed	
Batt Voltage	Battery voltage value	



**FIGURE 9. ENGINE DATA MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

## History/About Menu

[Figure 10 on page 46](#) shows a block representation of a typical History/About menu.

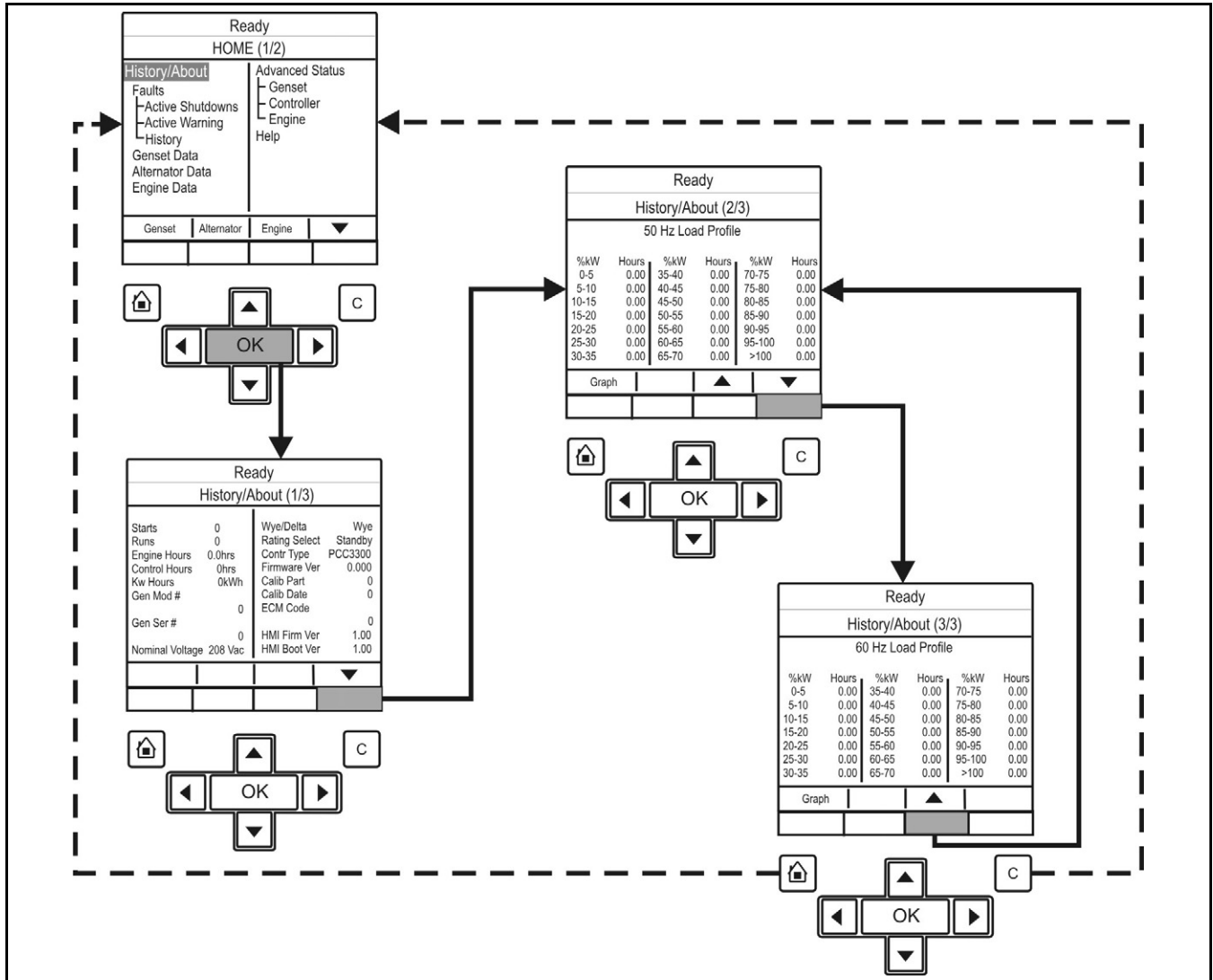
To navigate from the Home menu, toggle down until the History/About line of text is highlighted, and press the OK button. This information is displayed over three pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

This screen displays the historical information about the generator set.





**TABLE 20. HISTORY/ABOUT MENU**

Name	Description
Starts	Total number of start attempts.
Runs	Total number of generator set runs.
Engine Hours	Total engine run time.
Control Hours	Controller ON time in seconds. Upper limit is 136 years.
Kw Hours	Generator set total net kWh accumulation.
Gen Mod #	Number identifying the model of the generator set. (Password level: 2)
Gen Ser #	Serial number identifying the generator set.
Nominal Voltage	Generator set nominal Line-to-Line voltage.
Wye/Delta	Delta or Wye for Generator set connection.
Rating Select	Selects Standby/Prime/Base application rating.
Contr Type	Used by the PC tool.
Firmware Ver	Version of software loaded into the control. Obtained from PowerCommand® 2.3 Filename.
Calib Part	The unique calibration part number loaded into the control.
Calib Date	The revision date of the calibration part number loaded into the control.
ECM Code	The calibration coded the ECM is sending.
HMI Firm Ver	Parameter: HMI Local Parameter.
HMI Boot Ver	Parameter: HMI Local Parameter.
50 Hz Load Profile*	This shows how long the generator set has been running (50 Hz operation) at various percentages of its rated load.
60 Hz Load Profile*	This shows how long the generator set has been running (60 Hz operation) at various percentages of its rated load.
* When using the Load Profile Graph table (for 50 Hz or 60 Hz), the upper line's value indicates 100% of table.	



**FIGURE 10. HISTORY/ABOUT MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

### 3.7 Operator Panel - Alternator Data Operator Menu

[Figure 11 on page 48](#) shows a block representation of a typical Alternator Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Alternator. This will take you directly to the Alternator menu.

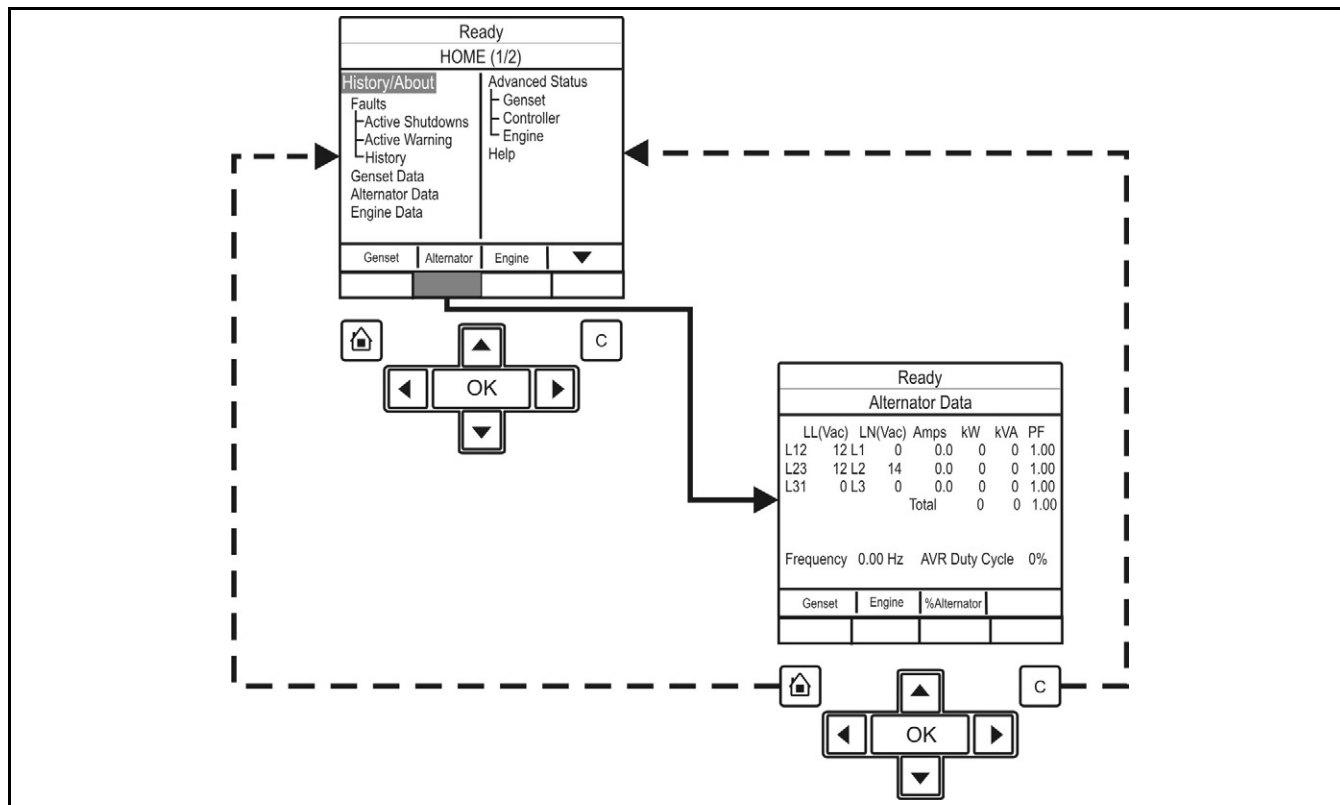
The Alternator Data menu is displayed on one page.

## Alternator Data



Use this menu 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.

**TABLE 21. ALTERNATOR STATUS**

Name	Description
L1 L2 L3	Alternator terminals
LL (VAC)	Generator set voltage: L1L2, L2L3, L3L1
LN (VAC)	Generator set voltage: L1N, L2N, L3N
Amps	Monitors the current generator set value: L1, L2, L3
kW	Generator set kW: L1, L2, L3
kVA	Generator set kVa: L1, L2 L3
PF*	Generator set power factor: L1, L2, L3
Total kW	Generator set total kW
Total kVA	Generator set total kVA
Total PF*	Generator set power factor
Frequency	Generator set frequency
AVR Duty Cycle	The AVR PWM software command; linear relationship between counts and % duty cycle with 10000 counts = 100% duty cycle
* A negative (-) value indicates a leading power factor; a positive (+) value indicates a lagging power factor.	



**FIGURE 11. ALTERNATOR DATA MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

## 3.8 Operator Panel - Faults and Warnings Menus

The Faults and Warning menu is divided into three main sub-sections; Shutdown Faults (Active Shutdowns); Warning Faults (Active Warnings); and Faults History (showing up to thirty-two faults that have been cleared).

### Shutdown Fault Menu

[Figure 12 on page 49](#) shows a block representation of a typical Shutdown Fault menu.

To navigate from the Home menu, toggle down until the Faults-Active Shutdowns line of text is highlighted, and press the **OK** button.

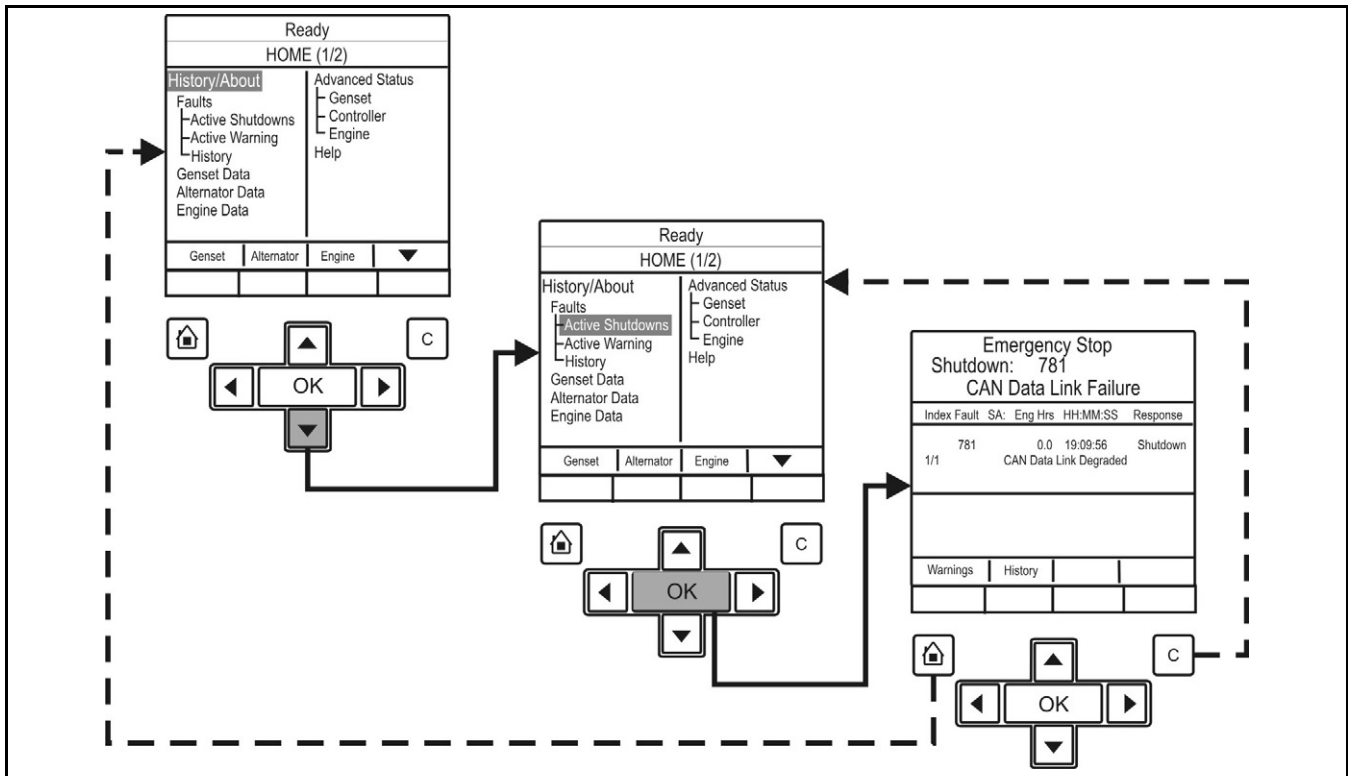
This will display information regarding the Shutdown fault(s). Use the two soft-key buttons below the up and down arrows (**▲** and **▼**) to toggle between the pages.

This screen displays up to five faults. The same event/fault code may appear multiple times if detected by different sources.



**TABLE 22. SHUTDOWN FAULTS**

Name	Description
Index	The index number of the fault
Fault	The Fault code
SA	The controller that identified the fault. It is blank if the PowerCommand® 2.3 control identified the fault
Eng Hrs	This is how many hours the engine had run (not necessarily continuously) when the fault was generated
HH/MM/SS	The time the fault was generated
Response	The type of fault that was generated

**Note:** The name of the fault appears below the rest of the information



**FIGURE 12. SHUTDOWN FAULTS MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

## 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.

## 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 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.

## Warning Fault Menu

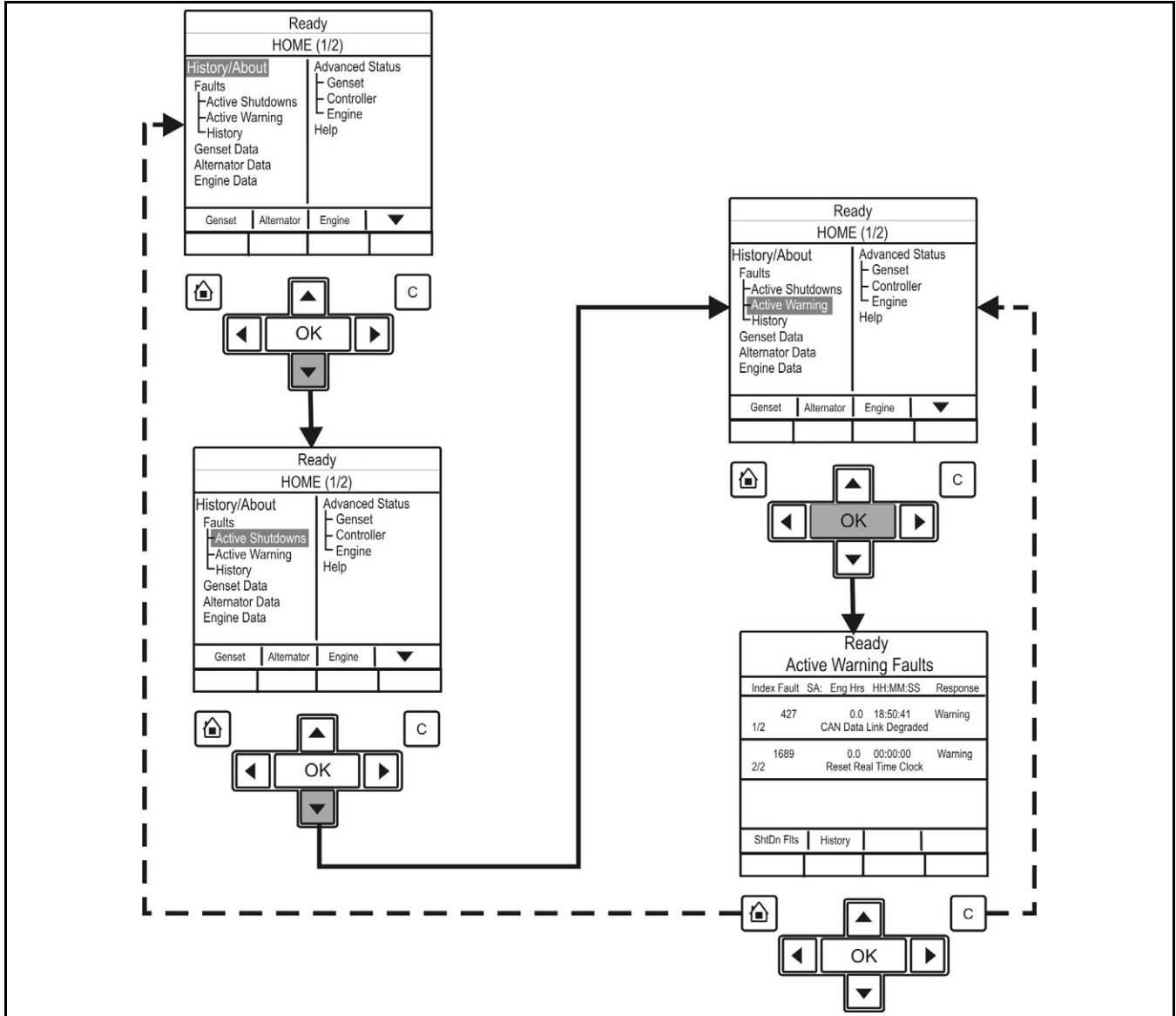
[Figure 13 on page 51](#) shows a block representation of a typical Warning Fault menu.

To navigate from the Home menu, toggle down until the Faults - Warning Fault line of text is highlighted and press the **OK** button. This will then display information regarding the current fault. Use the two soft-key buttons below the up and down arrows (**▲** and **▼**) to toggle between the pages.



This menu displays up to thirty-two faults. The same event/fault code may appear multiple times if detected by different sources.

**TABLE 23. WARNING FAULTS**

Name	Description
Index	The index number of the fault
Fault	The Fault code
SA	The controller that identified the fault. It is blank if the PowerCommand® 2.3 control identified the fault
Eng Hrs	This is how many hours the engine had run (not necessarily continuously) when the fault was generated
HH/MM/SS	The time the fault was generated
Response	The type of fault that was generated
<b>Note:</b> The name of the fault appears below the rest of the information	



**FIGURE 13. WARNING FAULT MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

### Faults History Data Operator Menu

[Figure 14 on page 53](#) shows a block representation of a typical Fault History menu.

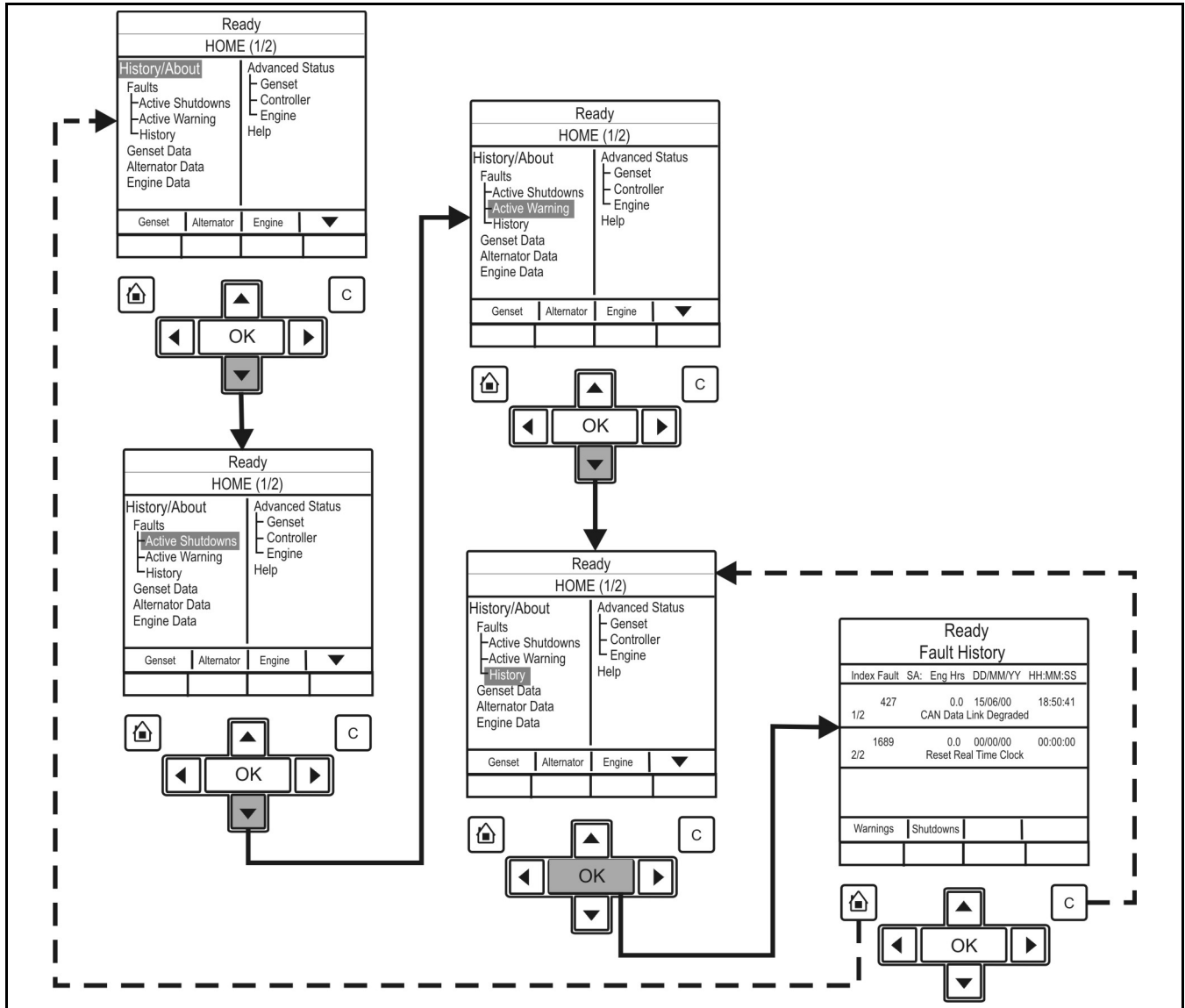
To navigate from the Home menu, toggle down until the Faults-History line of text is highlighted and press the **OK** button. This will then display information regarding the fault(s) history. Use the two soft-key buttons below the up and down arrows (**▲** and **▼**) to toggle between the pages.

This menu displays up to thirty-two faults. The same event/fault code may appear multiple times if detected by different sources.



**TABLE 24. FAULTS HISTORY DATA**

Name	Description
Index	The index number of the fault
Fault	The Fault code
SA	The controller that identified the fault. It is blank if the PowerCommand® 2.3 identified the fault
Engine Hrs	How many hours the engine had run (not necessarily continuously) when the fault was generated
DD/MM/YY	The date the fault was generated
HH/MM/SS	The time the fault was generated
<b>Note:</b> The name of the fault appears below the rest of the information.	





**FIGURE 14. HISTORY FAULT MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

### 3.9 Operator Panel - Adjust Menu

[Figure 15 on page 55](#) shows a block representation of a typical Adjust menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the down arrow in the display window. This will show the second page of the Home menu (HOME [2/2]). With the Adjust line of text highlighted, press the **OK** button to display the information.

The Adjust menu is displayed on one page.

**NOTICE**

If any of these settings require a change, please contact your authorized service center.

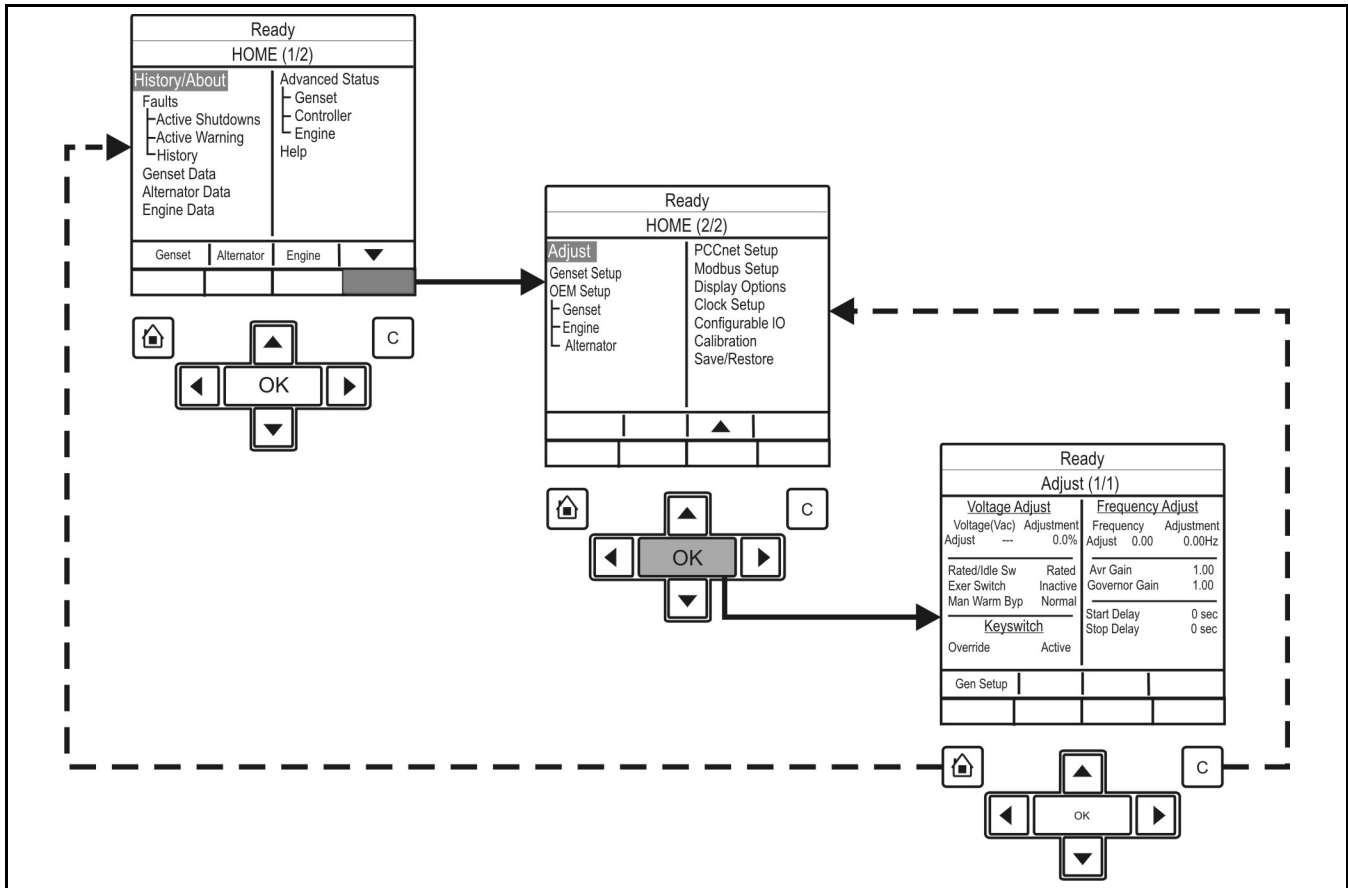
**NOTICE**

You cannot adjust Frequency Adjust or Voltage Adjust if Paralleling Speed Control Mode is set to Synchronize, Load Share, or Load Govern.



**TABLE 25. ADJUST MENU**

<b>Name</b>	<b>Description</b>	<b>Allowed Values</b>	<b>Default Value</b>
<b>Voltage Adjust</b>			
Genset LL Average Voltage	Generator set Line-to-Line average voltage	N/A	N/A
Voltage Adjust	A trim that allows the user to add/subtract an offset to the nominal voltage when calculating the voltage setpoint	-5 - ~5%	0%
Rated/Idle Sw	---	Rated, Idle	Rated
Exer Switch	---	Inactive, Active	Inactive
Man Warm Byp	---	Normal, Bypass Warmup	N/A
<b>Keyswitch</b>			
Keyswitch Status	---	Inactive, Active	N/A
<b>Frequency Adjust</b>			
Final Frequency Reference	The frequency scaled version of the final speed reference	0 - ~100 Hz	N/A
Frequency Adjust	A method of adding in a frequency offset to the base frequency subject to high and low limit calibrations.	-6 - ~6 Hz	0 Hz
Avr Gain	A trim that allows the user to modify the overall gains of the AVR.	0.05 - ~10	1

Name	Description	Allowed Values	Default Value
Governor Gain	A trim that allows the user to modify the overall gain of the governor.	0.05 - ~10	1
Start Delay	---	0 - ~300 seconds	0 seconds
Stop Delay	---	0 - ~600 seconds	0 seconds



**FIGURE 15. ADJUST MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

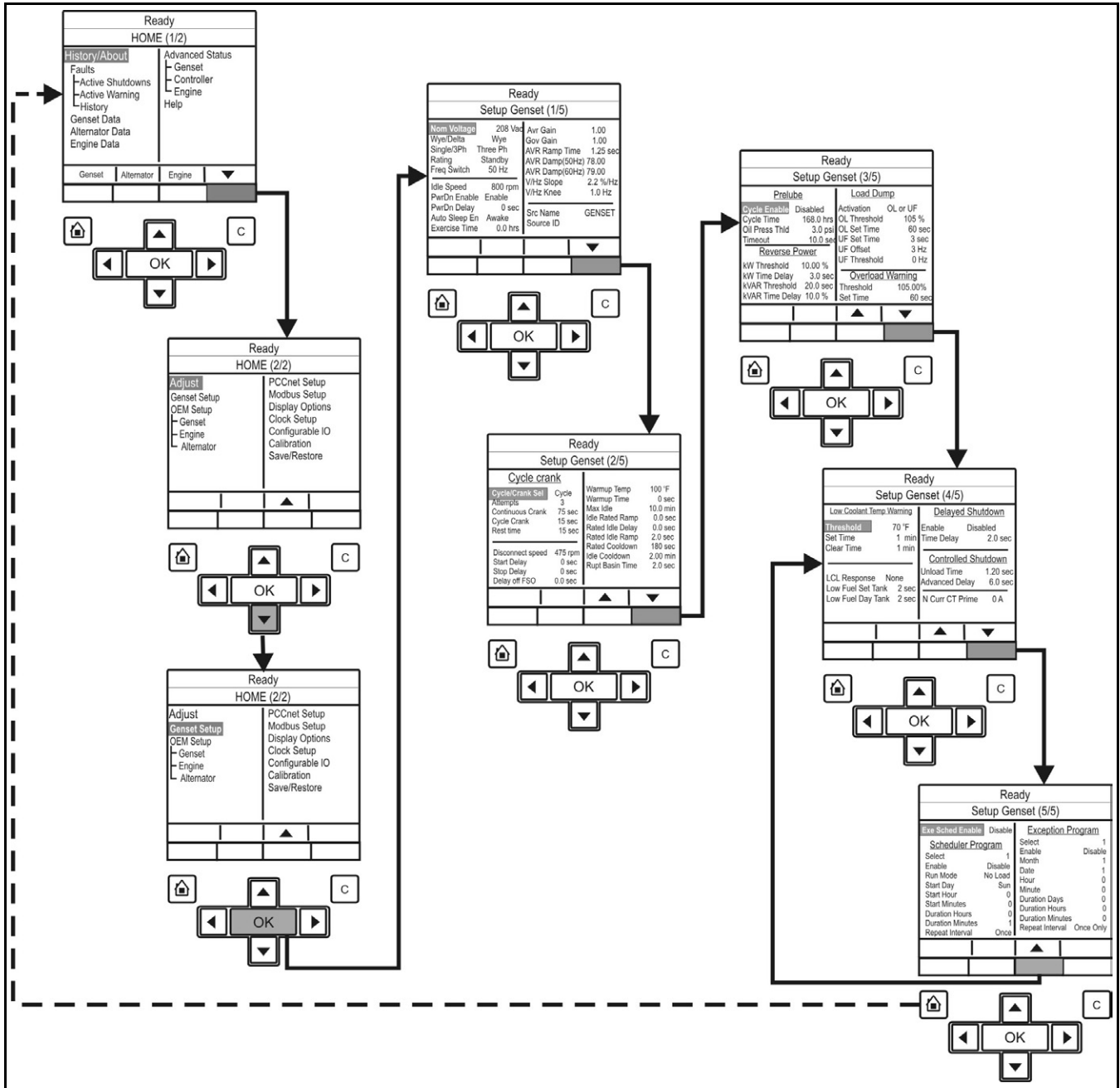
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## 3.10 Operator Panel - Genset Setup Data Operator Menu



The figure below shows block representations of the Genset Setup Data menu.

1. Page down to the second page of the Home menu (using the two soft-key buttons below the up and down arrows [▲ and ▼]). See the Operator Panel - Initial Operator Menu section.
2. In the HOME (2/2) menu, using the up and down arrows, toggle down again until the Genset Setup text is highlighted.
3. With the Genset Setup line of text highlighted, press the **OK** button. This will display the Setup Menu.
4. Use the two soft-key buttons below the up and down arrows [▲ and ▼] to page through the five pages of the generator Setup data.

<b>NOTICE</b>
<b>if any of these settings need to be changed, please contact your authorized service center.</b>



**FIGURE 16. GENSET SETUP DATA MENU - TYPICAL DATA**

- Press the **Home** Button  to return to the main menu at any time.
- Press the **C** Button  to return to the previous menus. Settings will not be saved when this button is pressed.

## 3.11 Selecting Operating Modes

### Passwords and Mode Change Access

#### Entering the Mode Change Access Code

The Mode Change submenus are intended for qualified 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 will appear when you try to switch between Auto, Manual Run, or Stop modes.

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.

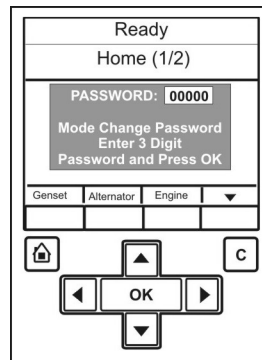


FIGURE 17. MODE CHANGE ACCESS CODE DISPLAY SCREEN

#### NOTICE

**If an incorrect password is entered, the Operator menu that was displayed before Auto, Manual Run, or Stop mode was selected is re-displayed.**

#### 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 26. PASSWORDS**

Level	Description	Comment
<b>0</b>	No password	None required
<b>1</b>	Operator password	Restricted
<b>2</b>	Service password	Restricted
<b>3</b>	Engineering password	Restricted

## 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.

## 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.

## 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.**

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# 4 Operation - PowerCommand 2.3

---

## 4.1 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.**

---

## 4.2 Introduction to Generator Set Operation

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

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

## 4.3 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.

## 4.4 Operating Recommendations

### 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.

### 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.

### 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.

---

## 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.

## 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.

## 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.**

---

## **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.

## **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.

---

## 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.

### 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.

## 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.

## 4.5 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.**

## 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.



## 4.6 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.

## 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 27. 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 <sup>1</sup>	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 <sup>2</sup>	Check the engine lubrication oil level and ensure that the correct level is always maintained.
Coolant <sup>3,4,5</sup>	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.

<sup>1</sup>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.


<sup>2</sup>*Generator sets shipped dry only:* 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.

<sup>3</sup>*Generator sets that require a mix of anti-freeze and DCA inhibitor only:* 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.

<sup>4</sup>*Radiators with two fill necks only:* Both fill necks must be filled after the cooling system has been drained.

<sup>5</sup>*Generator sets shipped dry only:* 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.

## Operator’s Pre-Start Checks

** WARNING**

***Arc Flash and Shock Hazard***  
***Electric arc flash can cause electrical shock, severe burns, or death.***  
***Make sure the alternator is dry before the generator set is operated.***

**⚠ 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.*****NOTICE*****Radiators with two fill necks only: Both fill necks must be filled when the cooling system has been drained.*****TABLE 28. OPERATOR'S PRE-START CHECKS**

<b>Check</b>	<b>Description</b>
Fuel Supply (Diesel Only)	<p>Make sure that:</p> <ul style="list-style-type: none"> <li>• The fuel tank is filled to the normal level with clean water-free fuel and that the fuel system is primed;</li> <li>• All the valves required for operation are open;</li> <li>• There are no leaks and that all fittings are tight; and</li> <li>• If equipped, the auxiliary fuel system is properly connected.</li> </ul>
DEF Supply (If Equipped)	<p>Make sure that:</p> <ul style="list-style-type: none"> <li>• The DEF tank is filled to the normal full level with DEF, and</li> <li>• If equipped, the auxiliary DEF system is properly connected.</li> </ul>
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.
Exhaust Outlet	<p>Make sure that:</p> <ul style="list-style-type: none"> <li>• Exhaust components are secured and not warped;</li> <li>• The exhaust outlet is unobstructed;</li> <li>• No combustible materials are near the system;</li> <li>• Gases are discharged away from building openings; and</li> <li>• There are no leaks and that all fittings are tight.</li> </ul>

Check	Description
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.

## Starting at the Operator Panel (Manual Run Mode)

NOTICE
<p><b>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 the generator set and connected load equipment that the generator set is about to start.</b></p>

### STARTING IN MANUAL RUN MODE

1. Make sure the main circuit breaker is in the open position.
2. To start the generator set in the **Manual Run** mode:

a. Press the **Manual** button  on the operator panel.

b. Press the **Start** button  within ten seconds.



NOTICE
<p><b>Failure to press the Start button within this time will result in the generator set changing to the Off mode. Refer also to the Selecting Manual Run Mode section.</b></p>

NOTICE
<p><b>If the mode change access code feature has been enabled, enter the access code when prompted. See the Passwords and Mode Change Access section.</b></p>

3. The PowerCommand<sup>®</sup> 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.

If the engine fails 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:

- a. Press the **Stop** button. 
- b. Press the **Reset** button. 

4. 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 the Troubleshooting section of the operator manual.

## DISABLING MANUAL MODE

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.

## 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.**

1. To start the generator set in the **Auto Run** mode, select the **Auto** button from



the operator panel. Refer also to the Selecting Auto Mode section.

Once the PowerCommand® control receives a remote start signal, and after a Time Delay to Start, the control will 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 the Passwords and Mode Change Access section.**

### NOTICE

**When the generator set is operating in the Remote Start mode, removing the Remote Start command does not shut off the engine if the load is more than 10%, the cooldown timer is set to zero, and the control is configured for a single unit (not in parallel). The generator set continues to operate until it runs out of fuel, the E-stop button is used, or the load is removed.**

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

## 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.

### 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.

## 4.7 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.

## Stopping at the Operator Panel (Manual Mode)

**NOTICE**

If possible, hot shutdown under load should be avoided to help prolong the reliability of the set. A hot shutdown results in a Hot Shutdown Warning.

**NOTICE**

Hot shutdown under load should be avoided whenever possible to prolong the reliability of the set. A hot shutdown may result in a Hot Shutdown Warning.


**NOTICE**

Pressing the stop button twice stops the generator set immediately without a cool down run after which the set enters the off mode.

To shut down a generator set that was started in manual mode.

1. Remove the load.
2. Open the main circuit breaker.
3. Press the stop button on the HMI operator panel. This initiates the generator set cool down run. The HMI displays the cool down count down timer at this time. Once the cool down timer has expired, the generator set shuts off and enters off mode.

## 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.



## Stopping from a Remote Location (Auto Mode)

If the control receives a remote stop signal, the generator set completes its normal shutdown sequence incorporating a Cooldown run. See the Selecting Auto Mode section. (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).

The set will remain in the **Auto** mode and subject to a remote start signal, unless the **Stop** button is pressed. If this button is pressed, the generator set will enter the **Off** mode.

### 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.

## 4.8 Frequency Changing

### ⚠ WARNING

#### *Hazardous Voltage*

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

*Make sure that only technically trained and experienced service personnel adjust the voltage and frequency settings. These settings may only be adjusted to correspond to the parameters of the installed input power supply.*

### NOTICE

Any change to the frequency settings must only be carried out by the rental fleet owner.

Within the PowerCommand® control **Set-up** menu is the option to select 50 Hz or 60 Hz running. This option is password protected and is determined at the initial setting up of the set.

The **Set-up** menu is used to control the displaying of a further menu that allows for adjusting the generator set frequency settings.

The **Frequency** menu is designed only for use with rental sets. Changing the parameters on this menu must only be done by trained service personnel.

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# 5 Maintenance

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## 5.1 Maintenance Safety

 **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**

***Hydrogen Gas***

***Arcing can ignite explosive hydrogen gas given off by batteries, causing severe personal injury or death. Arcing can occur when cables are removed or replaced, or when the negative (-) battery cable is connected and a tool used to connect or disconnect the positive (+) battery cable touches the frame or other grounded metal part of the generator set.***

***Insulated tools must be used when working in the vicinity of the batteries. Always remove the negative (-) cable first and reconnect last.***

 **WARNING**

***Explosive Fumes***

***Arcing can ignite explosive fumes causing severe personal injury or death.***

***Make sure hydrogen from the battery, engine fuel and other explosive fumes are fully dissipated before working on the generator set.***

 **WARNING**

***Working at Heights***

***Using the incorrect equipment when working at heights can result in severe personal injury or death.***

***Suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation. Failure to follow these instructions can result in severe personal injury or death.***

**⚠ WARNING****Access**

***Using the generator set or part of as a means of access when attaching lifting shackles, chains, or other lifting aids, may damage the generator set, causing severe personal injury or death.***

***Do not use the generator set as a means of access. Failure to follow these instructions can result in severe personal injury or death.***

**⚠ WARNING****Exposed Terminations**

***Some panel internal components may have live exposed terminations even if the generator set is not running. Voltages are present which can cause electrical shock, resulting in personal injury or damage to equipment.***

***Isolate all external electrical supplies prior to access of the control panel***

**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**

**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 performed, but be sure to assess them for health and safety risks before starting. For example, perform a task with someone present if doing so will add significantly to the safety of the task.

Read, understand, and comply with all Caution, Warning, and Danger notes in this section, the Important Safety Instructions section, and the documentation supplied with the generator set.

Make sure that adequate lighting is available.

## Locking the Generator Set Out of Service

### NOTICE

#### 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 (–) cable first.**

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 (or the STOP button if applicable), the generator set cannot be considered safe to work on until the engine is properly immobilized, as detailed in the following procedure.


### NOTICE

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

To immobilize the generator set:

1. Press the Off switch from the display and then press the E-Stop button to shut down the engine. This will prevent the starting of the generator set regardless of the Start signal source and will therefore provide an additional safety step for immobilizing the generator set. Alternatively, make sure the generator set is in manual mode (which allows it to be started by manually pushing the buttons).

### NOTICE

**When the E-Stop button is pressed, the Operator Panel indicates the Shutdown condition by illuminating the red Shutdown status LED  and displaying a message on the graphical LCD display.**

2. Thoroughly ventilate the generator set before disconnecting any leads.
3. Turn off and disconnect the heater (where fitted) from the AC source before disconnecting the battery cables.
4. Turn off and disconnect the battery charger (where fitted) from the AC source before disconnecting the battery cables.
5. Turn off the fuel supply to the engine.
6. Disconnect the battery. Disconnect the negative (–) cable first, using an insulated wrench.
7. Place warning notices at each of the above locations that state, "Maintenance in Progress – Immobilized for Safe Working."

## 5.2 Periodic Maintenance

 **WARNING**

***Electrical Generating Equipment***

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

***Before working on the generator set, make sure that the generator set is in Off mode, disable the battery charger, and remove the negative (-) battery cable from the battery to prevent starting.***

The table(s) that follow show the recommended service intervals for a generator set on standby service. If the generator set will be subjected to extreme operating conditions, the service intervals should be reduced accordingly.

At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

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

- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand

Consult with your authorized Cummins Inc. service provider 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 engine hours shown on the system status screen 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.

Repair or replace worn, damaged, or improperly functioning components identified during periodic maintenance procedures.

### Periodic Maintenance Guidelines

Regularly performing the following periodic maintenance tasks greatly reduces the chances of a generator set shutdown:

- Maintain an appropriate oil level.
- Keep battery connections clean and tight.
- Do not overload the generator set.
- Keep the air inlet and outlet openings clear.

## Periodic Maintenance Schedule

### NOTICE

Perform maintenance tasks as specified using daily or hourly periods, whichever is sooner.

**TABLE 29. PERIODIC MAINTENANCE SCHEDULE**

Maintenance Type	Action	Daily	250 Hrs. or 3 Mos.	500 Hrs. or 6 Mos.	1000 Hrs. or 1 Yr.	2000 Hrs. or 2 Yrs.	5000 Hrs. or 4 Yrs.
Air Intake Piping	Check	■					
Air Intake Piping	Inspect		■ <sup>3</sup>				
Engine Lubricating Oil Level	Check	■					
Crankcase Breather Tube	Inspect	■					
Engine Coolant Level	Check	■					
Fuel-Water Separator	Drain	■					
Fuel Tanks	Drain water & sediment		■				
Air Cleaner Restriction	Check		■				
Charge Air Cooler	Check		■ <sup>3</sup>				
Charge Air Piping	Check		■ <sup>3</sup>				
Radiator Hoses	Check		■ <sup>3</sup>				
Fan, Cooling	Check		■ <sup>3</sup>				
Coolant Level	Check		■ <sup>3</sup>				
Drive Belts	Check		■ <sup>3</sup>				
Rupture Basin Leak Detect Switch	Test			■			
Engine Coolant - Antifreeze	Check			■ <sup>1, 2, 3</sup>			
Fuel Filter (Spin-On Type)	Change			■ <sup>1, 2, 3</sup>			
Lubricating Oil and Filters	Change			■ <sup>1, 2, 3</sup>			

Maintenance Type	Action	Daily	250 Hrs. or 3 Mos.	500 Hrs. or 6 Mos.	1000 Hrs. or 1 Yr.	2000 Hrs. or 2 Yrs.	5000 Hrs. or 4 Yrs.
Radiator Pressure Cap	Check			■ <sup>1, 2, 3</sup>			
Cooling Fan Belt Tensioner	Check				■ <sup>3</sup>		
Fan Hub, Belt-Driven	Check				■ <sup>3</sup>		
Cooling System	Drain, flush, & fill					■ <sup>2, 3</sup>	
Vibration Damper, Rubber	Check					■ <sup>2, 3</sup>	
Vibration Damper, Viscous	Check					■ <sup>2, 3</sup>	
Overhead Set	Adjust						■ <sup>3</sup>
<p><sup>1</sup>The lubricating oil and lubricating oil filter interval is determined by the sulfur content of the fuel used, the lubricating oil type used, and the engine rating. See the Engine Oil section.</p> <p><sup>2</sup>The antifreeze check interval is every oil change or 500 hours or 6 months, whichever occurs first. The operator must use a heavy-duty year-round antifreeze that meets the chemical composition of ASTM D6210. The antifreeze change interval is 2 years or 2000 hours, whichever occurs first. Antifreeze is essential for freeze, overheat, and corrosion protection.</p> <p><sup>3</sup>Follow the manufacturer's recommended maintenance procedures for the engine, starter, alternator, generator set, batteries, electrical components, exhaust brake, charge air cooler, radiator, air cleaner, refrigerant compressor, and fan clutch.</p>							

### Maintenance Record

Record all periodic and unscheduled maintenance and service. See the Periodic Maintenance Schedule for a list of scheduled maintenance frequency.

Date	Engine Hours Meter Reading	Maintenance or Service Performed





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## 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.**

## 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

## 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

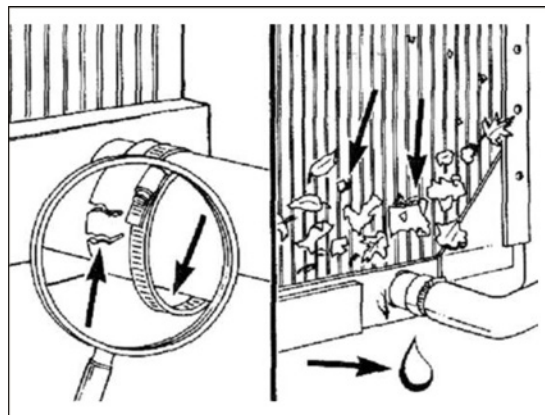
- Excessive white and/or black exhaust smoke.

## 5.3 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.

### Radiator Check



**FIGURE 18. 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.

### Cooling Fan Inspection

#### ⚠ WARNING

#### ***Fan Blade Damage***

***Personal injury can result from a fan blade that has become damaged. 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 (1), for cracks (2), and bent or loose blades (3).

Contact your authorized dealer if the fan is damaged.

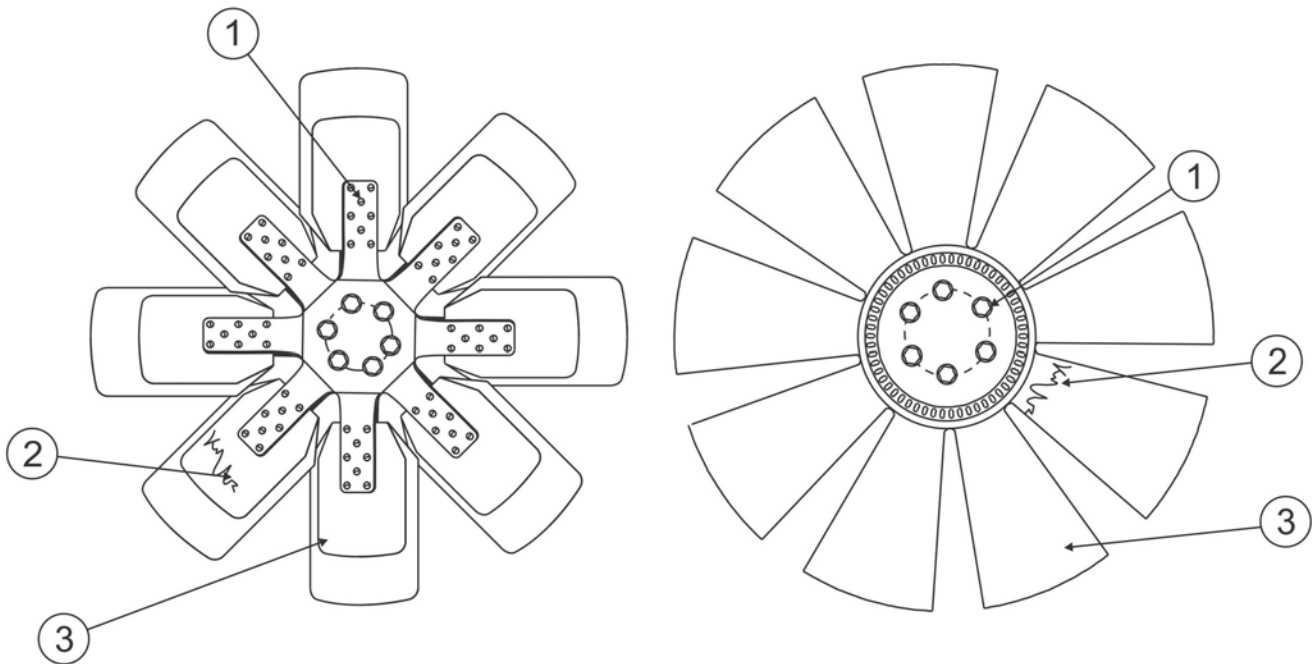


FIGURE 19. COOLING FAN INSPECTION

## 5.4 Engine Oil

### Recommended Engine Oil

Check the oil level prior to starting the generator set to verify that the oil level is between the High and Low marks.

Refer to the engine operator and maintenance manual for the oil specification.

### Checking Engine Oil Level

#### **⚠ WARNING**

***State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin. Accidental or remote starting of the generator set can cause severe personal injury or death. Disconnect the negative (-) battery cable and place the control switch in its OFF position before starting work.***

#### **⚠ WARNING**

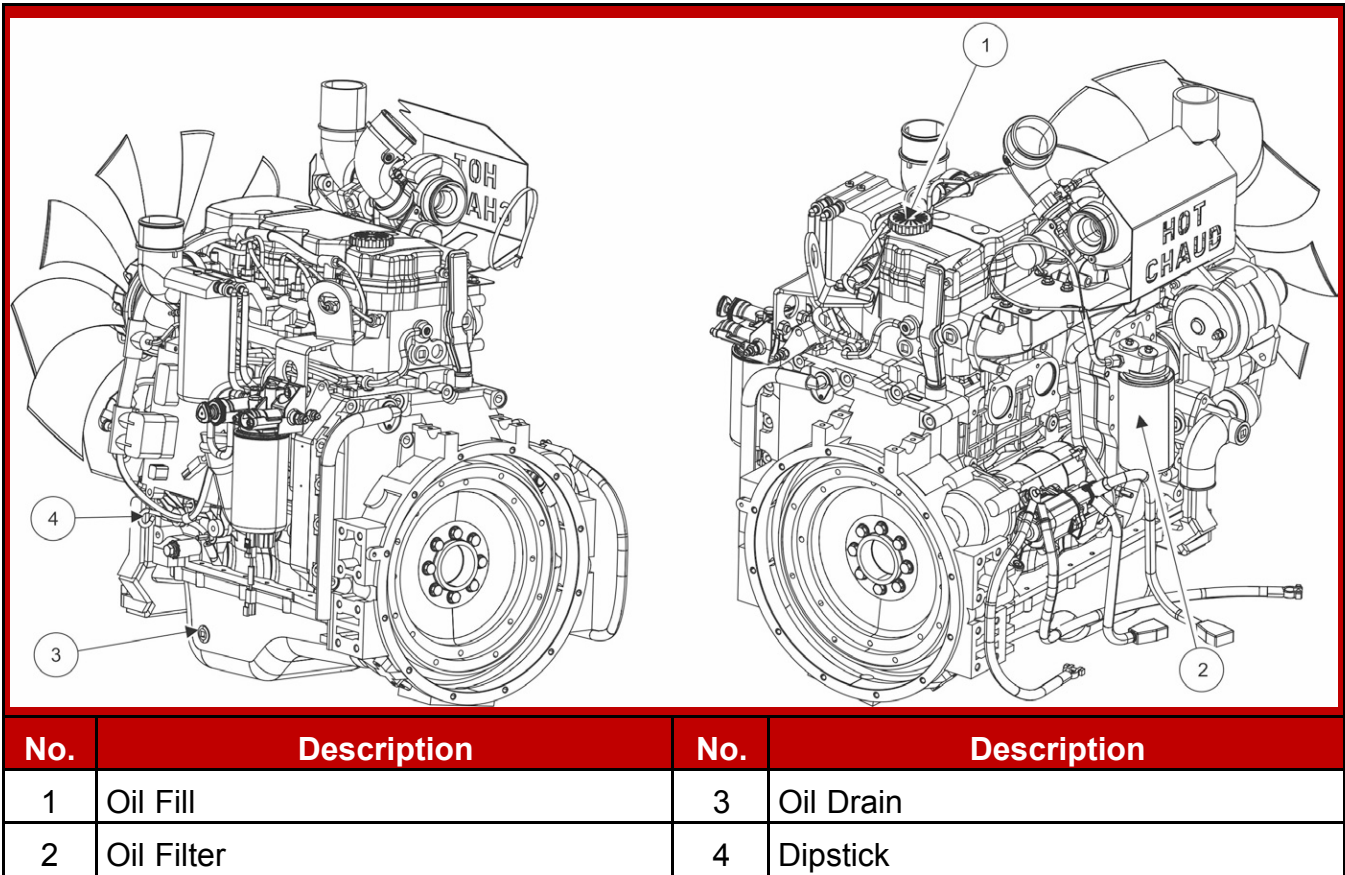
***Crankcase pressure can blow out hot oil and cause severe burns. Do NOT check oil while the engine is operating.***

**NOTICE**

**Check the engine oil level when the engine is not running and is out of Auto mode.**

**NOTICE**

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



**FIGURE 20. ENGINE OIL COMPONENTS**

To check the engine oil level:

1. Make sure that the engine has not been running for approximately five minutes.
2. Clean off the area surrounding the dipstick port to prevent entry of debris into the oil pan.
3. Pull out the dipstick and wipe it clean.
4. Reinsert and fully seat the dipstick.
5. Remove the dipstick and check the oil level.
6. Reinsert and fully seat the dipstick.

If the engine oil level check shows excessive or insufficient levels of oil (oil level line above the High mark or below the Low mark), oil must be drained or added. Refer to the following sections for instructions and guidelines for draining and adding oil.

## Adding or Draining Oil

### WARNING

#### **Hot Surfaces**

**Contact with hot surfaces can cause severe burns. Wear appropriate PPE when working on hot equipment and avoid physical contact with hot surfaces.**

### WARNING

#### **Hot Engines**

**Contact with hot engines can cause severe burns. Ensure that the generator set engine has cooled down before adding or draining the oil.**

### NOTICE

**Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the High and Low marks on the dipstick.**

## Adding Oil

If the oil level is found to be insufficient, oil must be added.

1. Ensure that the oil fill cap area is clean, and prevent debris from entering the engine.
2. Add the appropriate amount of oil, based on the engine oil level check. Refer to the Checking Engine Oil Level section and the Model Specifications section.
3. Recheck the engine oil level. Based on the results, add or drain oil.
4. Clean up and dispose of any oil in accordance with local/state regulations.

## Draining Oil

If the oil level is found to be excessive, oil must be drained from the engine.

1. Detach the oil drain hose from the side of the engine.
2. Place the end of the drain hose into an appropriate container.

Refer to local regulations to determine the appropriate container for used oil.

- Open the oil drain valve to release oil from the engine into the appropriate container.
- Recheck the engine oil level. Based on the results, add or drain oil.

- When a sufficient amount of oil has been drained from the system:
  1. Close the oil drain valve.
  2. Wipe the oil drain valve clean.
  3. Re-attach the drain hose to the side of the engine.
  4. Dispose of the used oil in accordance with local/state regulations.

## Changing Engine Oil and Oil Filter

### 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 (-) cable first.**

### WARNING

#### **Toxic Hazard**

**State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity.**

**Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.**

### NOTICE

**If the oil and/or oil filter are not reused, dispose of them in accordance with local environmental regulations.**

### NOTICE

**Change the engine oil and filter when the engine is not running and is out of Auto mode.**

### NOTICE

**Change the oil more often in hot and dusty environments.**

### NOTICE

**Cummins highly recommends that any service or maintenance work be performed by qualified technicians.**

1. Before changing the oil, the generator set should be operated until the water temperature is approximately 60 °C (140 °F).
2. Make sure the generator set is shut down and disabled:
  - a. Press the generator set's "O" (Off) button to stop the generator set. Allow the generator set to thoroughly cool to the touch.

- b. If applicable, turn off and disconnect the battery charger from the AC source before disconnecting the battery cables.
  - c. Disconnect the negative (–) cable from the battery and secure it from contacting the battery terminals to prevent accidental starting.
3. Drain the oil. Place the end of the drain hose into an appropriate container.

**NOTICE**

**Refer to local regulations to determine the appropriate container for used oil.**

4. Remove the oil filter, and clean the filter mounting surface on the engine block. Remove the old gasket if it remains.
5. Make sure the gasket is in place on the new filter and apply a thin film of clean oil to the gasket.
6. Install the new filter until the gasket just touches the block. Turn it an additional 1/2 to 3/4 turn. Do not over-tighten.
7. Remove the container used to collect oil when removing the oil filter.
8. Close the oil drain valve.
9. Add the appropriate amount of oil.

**NOTICE**

**Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the High and Low marks.**

10. Operate the engine at idle to inspect for leaks at the lubricating oil filter and the drain plug.
11. Confirm that the correct oil level is in the pan:
  - a. Shut the generator set off and wait 5 minutes.
  - b. Check the engine oil level.
12. Check and repair any leaks identified.
13. Dispose of the used oil and oil filter according to local environmental regulations.



## 5.5 Diesel Fuel System Safety and Requirements

### WARNING

#### ***Fuel Ignition***

***Ignition of fuel can cause serious personal injury or death by fire or explosion.***

***DO NOT permit any flame, cigarette, or other igniter near the fuel system, or in areas sharing ventilation.***

### WARNING

#### ***Fuel Mixtures***

***Mixing gasoline or alcohol with diesel fuel, can cause an explosion which may result in severe personal injury or death.***

***Do not mix gasoline or alcohol with diesel fuels.***

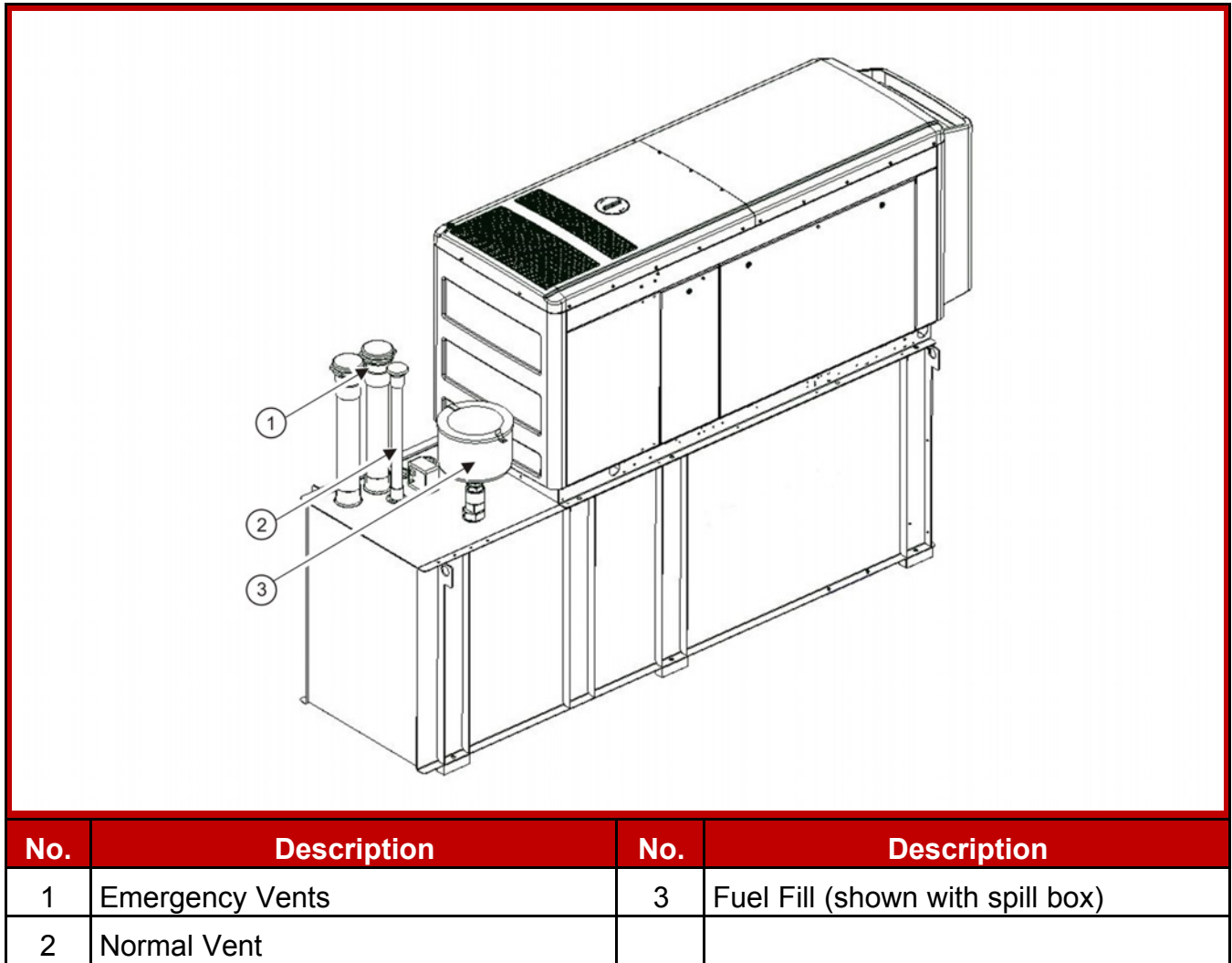
### NOTICE

**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.**

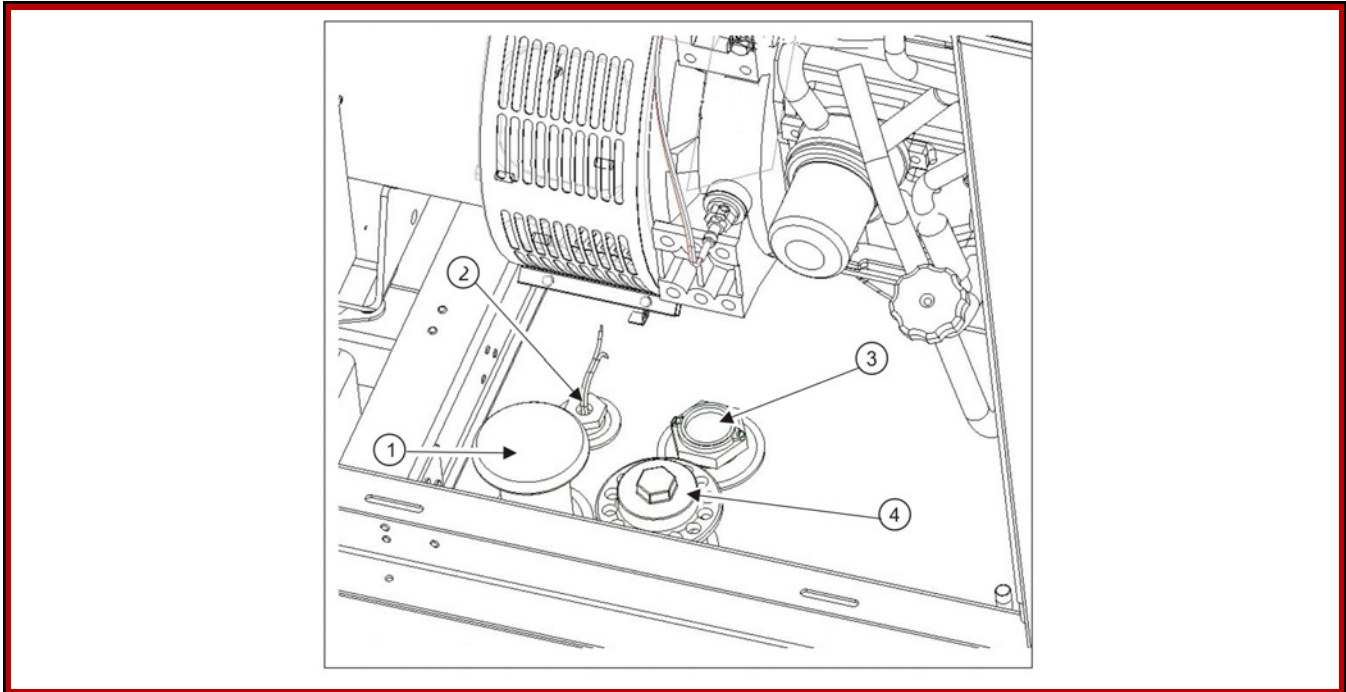
See the *Model Specifications* section for fuel requirements.

### Fuel Level

To avoid condensation problems, keep fuel supply tanks as full as possible by filling them each time the generator set 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.



**FIGURE 21. EXAMPLE OF REGIONAL FUEL TANK OPTION**



No.	Description	No.	Description
1	Normal Vent	3	Fuel Gauge
2	Fuel Low Level Switch	4	Fuel Fill

**FIGURE 22. EXAMPLE OF BASIC FUEL TANK OPTION**

### Fuel/Water Separator (Spin-On Type)

A set-mounted integral fuel/water separator is fitted to 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.

1. Turn off the generator set.
2. Wait 1 minute to remove any pressure in the fuel line.
3. Place a suitable container under the fuel filter.

**NOTICE**

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

4. Turn the valve counterclockwise, four complete turns, until the valve drops down approximately one inch. Drain the filter sump of water until clear fuel is visible.

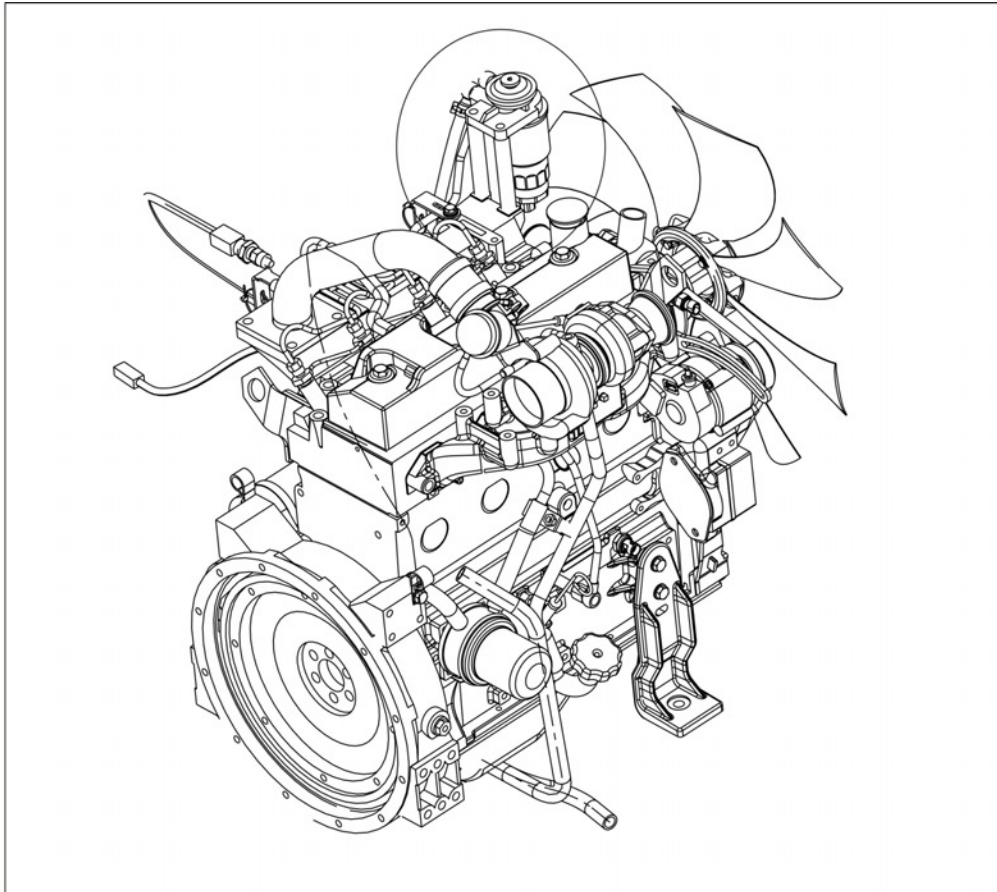
**NOTICE**

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

5. When clear fuel begins to flow out of the drain, push the valve up and turn the valve counterclockwise to close drain valve.
6. Before starting the engine, be sure to remove the container and clean up any fuel spillage.
7. Start the engine and check for any leaks.

**NOTICE**

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



**FIGURE 23. EXAMPLE OF FUEL/WATER SEPARATOR LOCATION**

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## Fuel Filter Maintenance

### Fuel Filter - Element Replacement

**⚠ WARNING*****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.***

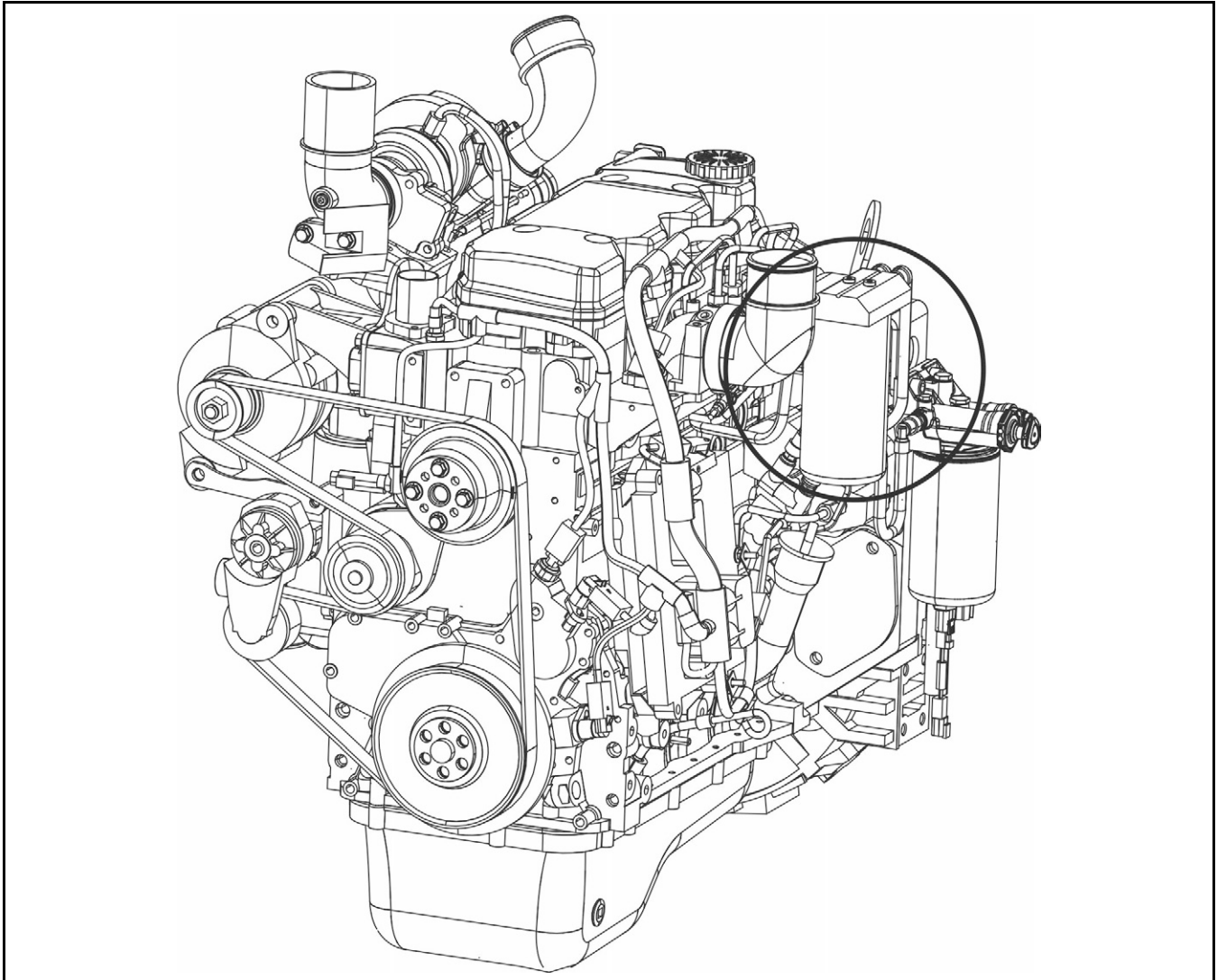
**NOTICE**

**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.**

**NOTICE**

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

1. Remove the existing filter.



**FIGURE 24. FUEL FILTER LOCATION**

2. Fill the fuel filter with clean fuel.
3. Install the o-ring.
4. Install the fuel filter as specified by the filter manufacturer.

## Hoses and Fuel Lines Check

**⚠ WARNING**

***Moving Parts***

***Moving parts can cause severe personal injury or death.***

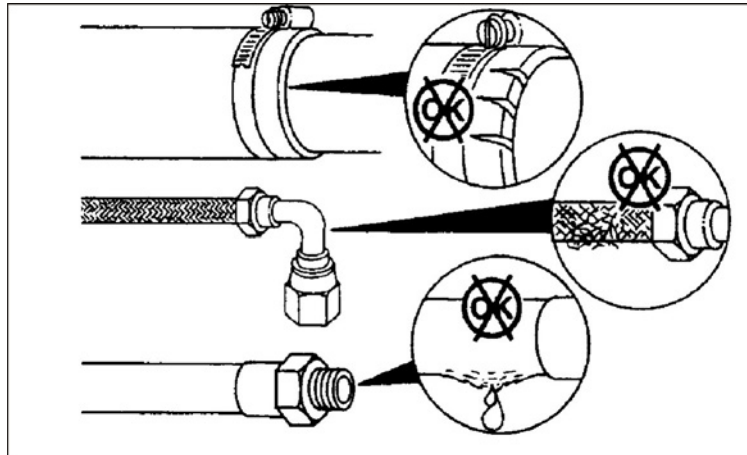
***Use extreme caution around moving parts. To prevent personal injury, turn off and remove power while troubleshooting.***

**⚠ WARNING**

**Hot Surfaces**

**Contact with the hot surfaces can cause severe burns.**

**Wear appropriate PPE when working on hot equipment and avoid physical contact with hot equipment where possible.**



**FIGURE 25. HOSES AND FUEL LINE INSPECTION**

1. Inspect the fuel lines, filters, and fittings for leaks.
2. Check any flexible sections for cuts, cracks and abrasions and ensure they are not rubbing against anything that could cause breakage.
3. If any leaks are detected, shut down the generator set (if possible). Contact your authorized dealer and have the leaks corrected immediately.

## 5.6 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 which point the filter elements should be changed. Refer to the Model Specifications section.

### Normal Duty Air Cleaner

#### Normal Duty Air Cleaner Element Replacement

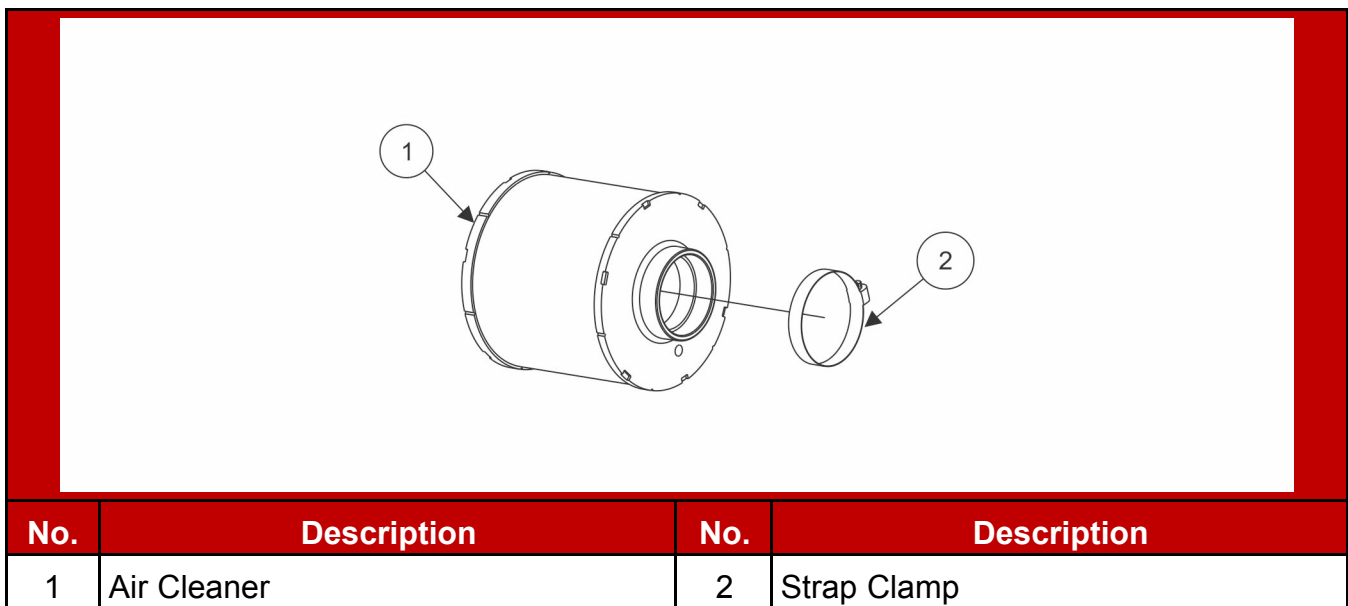
**NOTICE**

**Holes, loose-end seals, dented sealing surfaces, corrosion of pipes, and other forms of damage render the air cleaner inoperative and require immediate element replacement or engine damage can occur.**

**NOTICE**

**Cummins Inc. does not recommend cleaning paper-type air cleaner elements.**

1. Remove the existing air cleaner:
  - a. Loosen the strap clamp (2).
  - b. Wipe away any debris accumulated around the air cleaner connection to the engine. Ensure that no debris is allowed to enter the body of the air cleaner or the connection on the engine.
  - c. Remove the dirty air cleaner (1).
  - d. Dispose of the dirty element in accordance with local environmental agency requirements.
2. Install the replacement air cleaner (1) as follows:
  - a. Install the air cleaner (1).
  - b. Tighten strap clamp (2). Torque to 2.5 - 3.3 ft-lb (4.3 - 4.65 Nm).



**FIGURE 26. EXAMPLE OF NORMAL DUTY AIR CLEANER**



## Heavy Duty Air Cleaner

### Air Cleaner Service Indicator

#### WARNING

***Hot exhaust components.***

***Exhaust components become very hot when the generator set is in use and remain hot for a period of time after the generator set has been shut down. These components can cause severe personal injury or death from contact.***

***Allow these components to cool completely before performing any maintenance tasks.***

#### WARNING

***Moving parts.***

***Moving parts can cause severe personal injury or death.***

***Use extreme caution around hot manifolds, moving parts, etc.***

The air cleaner service indicator, available only on heavy duty air cleaners, is located on the air cleaner assembly.

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

### 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.

When there is a filter pre-cleaner, it 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.

### Heavy Duty Air Cleaner Element Replacement

#### CAUTION

***Holes, loose-end seals, dented sealing surfaces, corrosion of pipes, and other forms of damage render the air cleaner inoperative and require immediate element replacement or engine damage can occur.***

**NOTICE**

**Cummins Inc. does not recommend cleaning paper-type air cleaner elements.**

1. To remove the existing air cleaner element:
  - a. Before disassembly, wipe dirt from the cover and the upper portion of the air cleaner.
  - b. Lift the latch (3) and turn the end cover (4) counterclockwise.
  - c. Pull the end cover (4) away from the housing (1).
  - d. Remove the air filter element (2) from the housing (1).
  - e. Dispose of the dirty element in accordance with local environmental agency requirements.
2. To install the replacement air cleaner element:
  - a. Ensure that no debris enters the filter element or connection point on the air cleaner housing.
  - b. Insert the air filter element (2) into the housing (1).
  - c. Install the end cover (4) onto the housing (1).
  - d. Turn the end cover (4) clockwise until the latch (3) snaps into place.

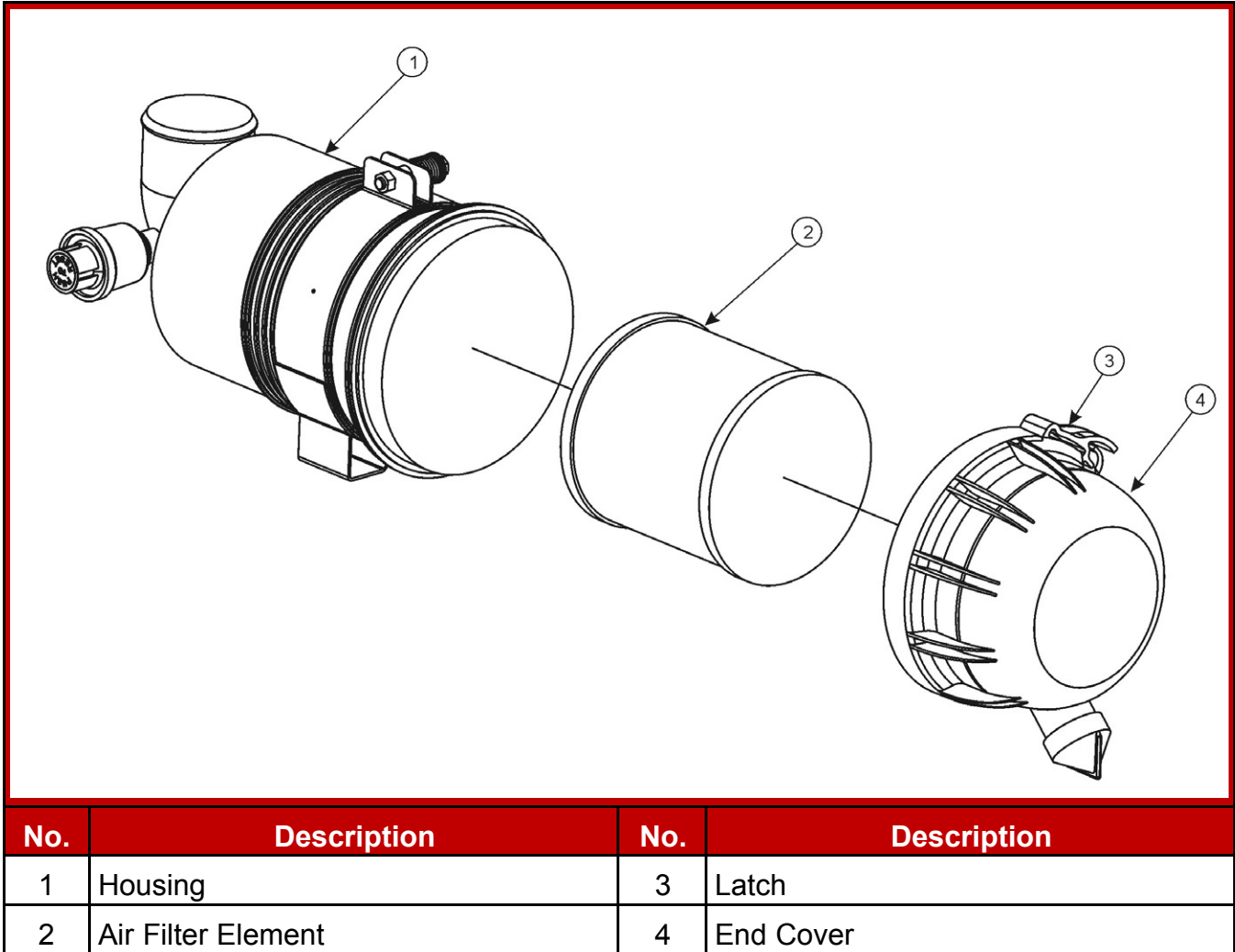


FIGURE 27. EXAMPLE OF HEAVY DUTY AIR CLEANER

## 5.7 Exhaust System Maintenance

**⚠ WARNING**

**Hot Exhaust Components**  
*Exhaust components become very hot when the generator set is in use and remain hot for a period of time after the generator set has been shut down. These components can cause severe personal injury or death from contact. Allow these components to cool completely before performing any maintenance tasks.*

**⚠ WARNING*****Inhalation of Exhaust Gases***

***Inhalation of exhaust gases can result in serious personal injury or death. Be sure deadly exhaust gas is piped outside and away from windows, doors or other inlets to buildings. Do not allow to accumulate in habitable areas.***

**⚠ WARNING*****Moving Parts***

***Moving parts can cause severe personal injury or death. Use extreme caution around moving parts, etc.***

With the generator set operating, 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 ensure that exhaust pipes are not heating surrounding areas excessively. If any leaks are detected, shut down the generator set (if possible). Contact your authorized dealer and have the leaks corrected immediately.

## 5.8 Generator Set Output - AC Electric System Checks

1. Check the following while the generator set is operating.

**TABLE 30. AC ELECTRIC SYSTEM CHECKS**

<b>Check</b>	<b>Description</b>
Frequency	The generator set frequency should be stable and the reading should be the same as the generator set nameplate rating. See the Model Specifications section.
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 by illuminating each of the indicator lamps in turn.

2. If all of the LEDs do not illuminate, replace the operator panel.

## 5.9 DC Electrical System

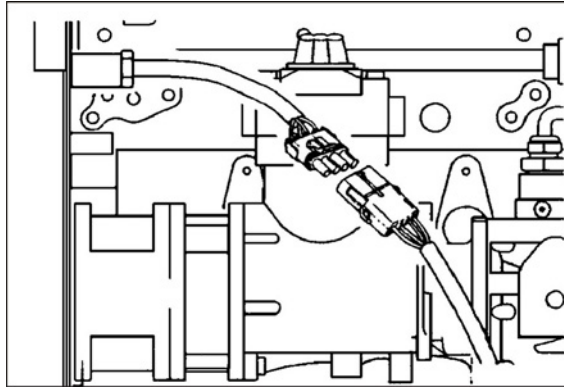
### ⚠ WARNING

#### **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.**

1. Check the harness connections. If any harness connections are damaged, contact your service representative.



**FIGURE 28. CHECK HARNESS CONNECTIONS**

2. Check the terminals on the batteries for clean and tight connections. Loose or corroded connections create resistance, which can hinder starting. Clean and reconnect the battery cables if loose, using an insulated wrench. Always disconnect both ends of the negative battery cable. Reconnect one end of the cable to the negative battery terminal and the other end to ground. This will make sure that any arcing will be away from the battery and least likely to ignite explosive battery gases.
3. Check connections at the battery charging alternator.
4. Visually inspect the alternator belt to make sure it is not loose or cracked.

## 5.10 Batteries

Batteries are an essential part of any standby generator set system. A significant amount of generator set failures are due to battery issues.

It is therefore vital that batteries are stored, commissioned, and maintained as detailed here. Reference should also be made to the battery manufacturer's instructions.

Maintenance free batteries (if supplied with the generator set) need no maintenance for commissioning.

## 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.

## 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.

### General Precautions for Maintenance-Free Batteries

Handling and proper use of batteries is not hazardous if the correct precautions are observed and personnel are trained in their use.

#### WARNING

##### ***Arcing Hazard***

***Laying tools or metal objects across the battery can cause arcing that may ignite battery gases causing explosions resulting in personal injury.***

***Never lay tools or metal objects across the top of the battery.***

#### WARNING

##### ***Electric Shock Hazard***

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

***Use tools with insulated handles to prevent the risk of electric shock.***

#### CAUTION

##### ***Toxic Hazard***

***Electrolyte is a dilute sulphuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive.***

***Wear full eye protection and protective clothing. If electrolyte contacts the skins, wash it off immediately with water. If electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention. Wash spilled electrolyte with an acid neutralizing agent.***

#### NOTICE

**Keep batteries upright to prevent spillage.**

## Fire Hazard

### WARNING

#### **Combustible Gases**

***Lead acid batteries present a risk of fire because they generate hydrogen gas.***

***Do not smoke near the batteries. Do not cause flame or spark in the battery area. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface.***

### WARNING

***Before disconnecting a battery, always remove power from the AC powered battery charger.***

### WARNING

***When putting a battery into service on a generator set, connect the negative lead LAST; when removing the battery, disconnect the negative lead FIRST.***

## Vented Batteries

### WARNING

#### **Toxic Hazard**

***The electrolyte in vented batteries is a dilute sulfuric acid that is harmful to the skin and eyes. It is also electrically conductive and corrosive.***

***Always:***

- 1. Wear full eye protection and protective clothing;***
- 2. If the electrolyte contacts the skin, wash it off immediately with water;***
- 3. If the electrolyte contacts the eyes, flush them thoroughly and immediately with water and seek medical attention; and***
- 4. Wash spilled electrolyte down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda (also known as baking soda or sodium bicarbonate) to one gallon (4 liters) of water.***
- 5. Continue to add the bicarbonate of soda solution until the evidence of reaction (that is, foaming) has stopped.***
- 6. Flush the resulting liquid with water and dry the area.***

## Battery Maintenance

### WARNING

#### ***Automated Machinery***

***Accidental or remote starting of the generator set can cause severe personal injury or death. Arcing at battery terminals or in light switches or other equipment, and flames or sparks can ignite battery gas causing severe personal injury.***

***Always follow these procedures to avoid injury and/or damage:***

- ***Ventilate the battery area before working on or near the battery.***
- ***Wear safety glasses.***
- ***Do not smoke.***
- ***Switch a work light on or off away from the battery.***

***Make sure the generator set is shut down and disabled:***

1. ***Press the generator set's red STOP button on the local display to stop the generator set. Allow the generator set to thoroughly cool to the touch.***
2. ***Turn off and disconnect the battery charger from the AC source before disconnecting the battery cables.***
3. ***Disconnect the negative (-) cable from the battery and secure it from contacting the battery terminals to prevent accidental starting.***
4. ***Once work is complete, reconnect the negative (-) battery cable last.***

See *Battery Charger Maintenance* for troubleshooting the charger.

Always:

- Keep the battery case and terminals clean and dry and the terminals tight.
- Remove battery cables with an insulated wrench or battery terminal puller.
- Make sure which terminal is positive (+) and which is negative (-) before making battery connections, always removing the negative (-) cable first and reconnecting it last to reduce arcing.

### NOTICE

**If the battery needs to be replaced, make sure that the replacement battery specifications match those found in the Model Specifications in this manual.**

## Charging

Where a consistent source of AC power is available, Cummins recommends the use of a battery charger to maintain battery condition and charge. Cummins offers several battery chargers.



Where generator sets are used infrequently and a consistent source of AC power is not available, battery recharging must be put on a recharge schedule to ensure that a fully charged condition is maintained.

**NOTICE**

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

Follow the battery charger operating instructions for proper use.

## 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.

## 5.11 Cleaning the Generator Set Housing

The housing of the generator set housing can be damaged by pressure washing or solvents and other cleaning agents. Only use soap and water or an "all citrus degreaser" to clean the housing.

## 5.12 Complete System Test

**NOTICE**

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

A complete system test is recommended to verify that the electrical system is working properly. Testing the system once every 200 hours or every 2 years is required to make sure the transfer switch will transfer the load to the generator set if there is a utility power failure. For more information, see the transfer switch owner manual.

---

To initiate a complete system test:

1. Before starting:
  - Check the oil level.
  - Make sure there is enough fuel.
  - See the Checklist section in the installation manual.
2. Place the generator set in Standby mode.
3. Switch the main utility disconnect from the ON to the OFF position.
4. Make sure the following occurs:
  - a. The generator set starts.
  - b. After the generator set starts and stabilizes, the load is transferred from the utility to the generator set.
5. Switch the main utility disconnect from the OFF to the ON position.
6. Make sure the following occurs:
  - a. After approximately 5 minutes, the load is transferred back to the utility.
  - b. Once the transfer switch is connected to utility power, after approximately 5 minutes, the generator set stops.

**NOTICE**

**If the test fails, call your authorized Cummins service provider to fix the problem.**

# 6 Troubleshooting

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## 6.1 Avoiding Generator Set Shutdowns

By regularly performing the following periodic maintenance and guidelines, you will greatly reduce the chances of a generator set shutdown:

- Maintain an appropriate oil level.
- Keep battery connections clean and tight.
- Do not overload the generator set.
- Keep the air inlet and outlet openings clear.

Refer to the Maintenance section for more information.

## 6.2 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.

## 6.3 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**

***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*****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).***

Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review the safety precautions in the Important Safety Instructions section.

High voltages are present when the generator set is running. Do not open the generator set output box while the generator set is running.

**NOTICE**

**Disconnect the battery charger from the AC source before disconnecting the battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the generator set.**

When troubleshooting a generator set that is shut down, make certain the generator set cannot be accidentally restarted as follows:

1. Make sure the generator set is in the Off mode.
2. Turn off or remove AC power from the battery charger.
3. Using an insulated wrench, remove the negative (-) battery cable from the generator set starting battery.

## 6.4 Fault Codes - PowerCommand 2.3

### Fault Code Introduction

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 engine-specific operator manual, if it exists. The engine operator 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.

For any fault codes that occur but are not listed, contact your Cummins service representative.

## Fault Finding

### WARNING

***Troubleshooting procedures.***

***Troubleshooting procedures present hazards that can result in severe personal injury or death.***

***Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures.***

***Review safety precautions listed in this manual together with the documentation supplied with the generator set.***

For any symptom not listed, contact your authorized dealer 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 cooling air flow 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

## 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.

## 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.**

## **Code 143 - Engine Oil Pressure Low (Warning)**

**Logic:** Engine oil pressure is below the low oil pressure warning threshold.

**Possible Causes:**

1. Lubricating oil level is low
2. External leak

**Diagnosis and Repair:**

1. Lubricating oil level is low
  - a. Check the oil level. Add oil, if necessary.
2. External leak
  - a. Inspect the engine and surrounding area for external oil leaks.
  - b. If a leak is present, contact your Cummins service representative.

## **Codes 146 and 151 - Engine Coolant Temperature High (Warning or Shutdown)**

**Logic:**

- *Code 146:* Engine coolant temperature has exceeded the warning threshold and duration parameters set in the ECM or control.
- *Code 151:* Engine coolant temperature has exceeded the shutdown (alarm) threshold for high coolant temperature.

**Possible Causes:**

1. High ambient temperature
2. Enclosure air intake blocked
3. Coolant level below specification
4. Blocked radiator
5. Blocked enclosure air discharge
6. Broken or loose fan belt

**Diagnosis and Repair:**

1. High ambient temperature
  - a. Reduce loads or recirculation of discharge air to generator set.
2. Blocked enclosure air discharge
  - a. Inspect for dirt, debris, or obstructions.
  - b. Remove blockage or snow/ice buildup if applicable.

3. Coolant level below specification
  - a. Check coolant level.
  - b. Add coolant if applicable.
4. Blocked radiator
  - a. Inspect for dirt, debris, or obstruction.
  - b. Remove blockage or winterfront if applicable.
5. Enclosure air discharge blocked
  - a. Inspect for dirt, debris, or obstructions.
  - b. Remove blockage or snow/ice buildup if applicable.
6. Broken or loose fan belt
  - a. Inspect belt(s) for damage, wear, and proper tension.
  - b. Repair or replace belt(s) if damaged or worn.

### **Code 197 - Coolant Level Low (Warning)**

**Logic:** Coolant level sensor signal is showing a low coolant level for greater 10 seconds.

**Possible Cause:**

1. Low coolant

**Diagnosis and Repair:**

1. Low coolant
  - a. Remove radiator cap and check that coolant is up to the required level.

### **Code 359 - Fail to Start**

**Logic:** If the engine has failed to start, the fault 359 (shutdown) becomes active.

**Possible Causes:**

1. Battery voltage low, interrupted, or a bad connection
2. Insufficient/low fuel level
3. Fuel system restriction above normal
4. Customer-supplied fuel shutoff valve solenoid malfunction
5. Air intake system restriction is above normal
6. Poor fuel quality

**Diagnosis and Repair:**

1. Make sure the AC battery charger is connected and functioning.
2. Make sure the fuel level is adequate.
3. Remove any dirt, debris or blockage from the air intake and air filter.

4. If the previous steps do not resolve the problem, contact your Cummins service representative.

### **Code 415 - Engine Oil Pressure Low (Shutdown)**

**Logic:** Engine oil pressure is below the low oil pressure shutdown threshold.

**Possible Causes:**

1. Lubricating oil level is low
2. External leak

**Diagnosis and Repair:**

1. Lubricating oil level is low
  - a. Check the oil level. Add oil, if necessary.
2. External leak
  - a. Inspect the engine and surrounding area for external oil leaks.
  - b. If a leak is present, contact your Cummins service representative.

### **Code 421 - Engine Oil Temperature High (Warning)**

**Logic:** The control has detected the engine oil temperature has exceeded the warning threshold.

**Possible Cause:**

1. High ambient temperature
2. Blocked enclosure air intake
3. Coolant level below specification

**Diagnosis and Repair:**

1. High ambient temperature
  - a. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Blocked enclosure air intake
  - a. Inspect for dirt, debris, or obstructions.
  - b. Remove blockage or snow/ice buildup as applicable.
3. Coolant level is below specification
  - a. Check coolant level.
  - b. Add coolant as necessary.

### **Code 441 - Battery Voltage Low (Warning)**

**Logic:** Battery voltage is low.

**Possible Causes:**

1. Loose or damaged battery cable connections



2. Battery charger not connected (if equipped)
3. Battery not completely charged
4. Battery is old and does not maintain a charge

**Diagnosis and Repair:**

1. Loose or damaged battery cable connections
  - Inspect the battery cable connections for corrosion and loose connections. Adjust or repair if needed.
2. Battery charger not connected (if equipped)
  - a. Make sure that the battery charger is connected to the AC power supply.
  - b. Make sure that the battery charger is connected correctly to the battery.
3. Battery not completely charged
  - Using a voltmeter or multimeter, determine if the voltage is below 11 V. If so, recharge the battery.
4. Battery is old and does not maintain a charge
  - Replace the battery.

**Code 442 - High Battery Voltage**

**Logic:** Battery voltage is high.

**Possible Causes:**

1. Incorrect battery voltage setup
2. Battery voltage above high battery voltage threshold
3. Battery charger overcharging battery
4. Faulty engine DC alternator

**Diagnosis and Repair:**


1. Make sure the correct batteries are installed.
2. Make sure the correct battery charger is installed.
3. If the previous steps do not resolve the problem, contact your Cummins service representative.

**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.**

## Code 1435 - Low Coolant Temperature

**Logic:** Engine coolant temperature is below the low coolant temperature warning threshold.

### Possible Causes:

1. Ambient temperature too cold for specified generator set
2. Coolant heater malfunction or not installed
3. Blockage in coolant system

### Diagnosis and Repair:

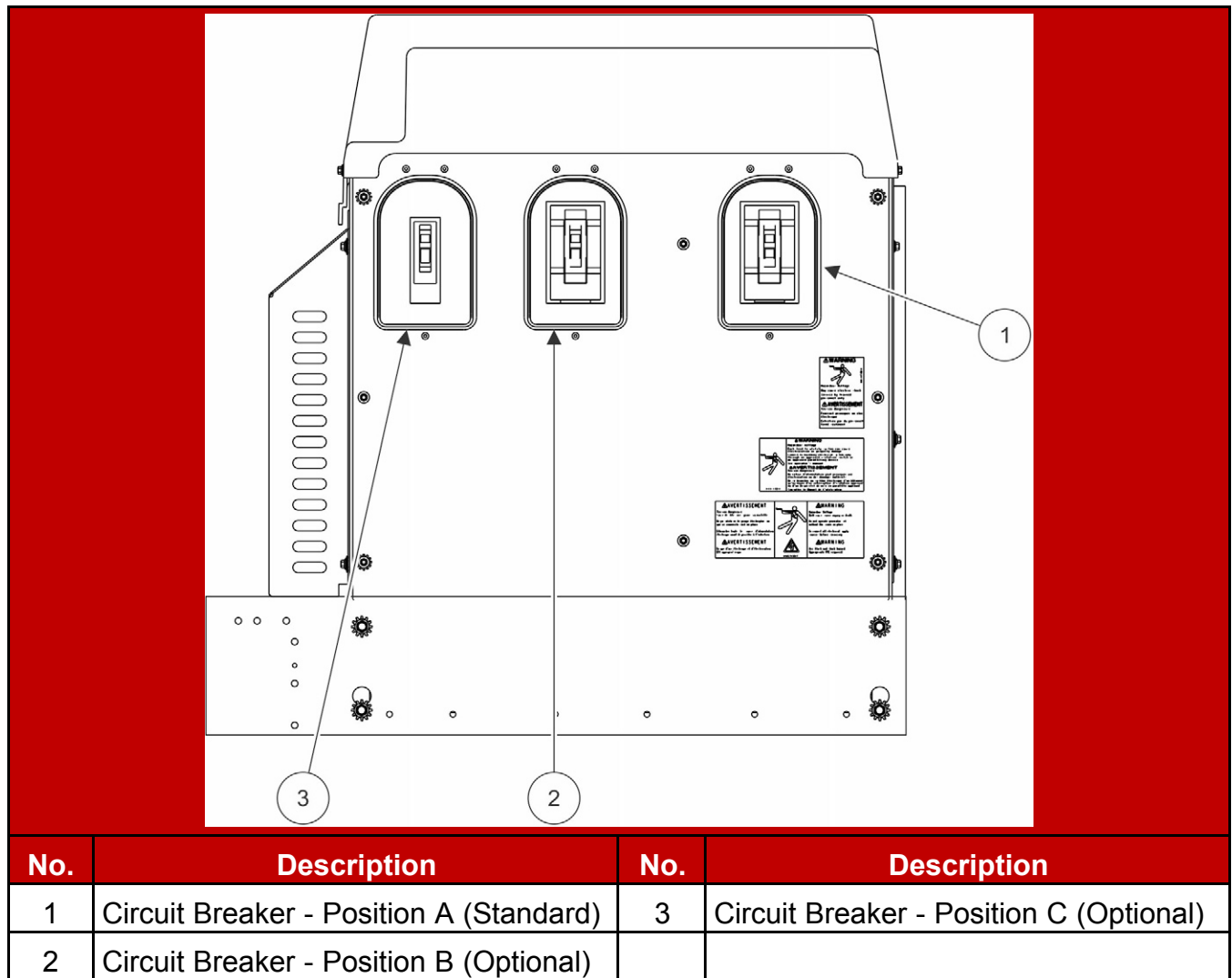
1. Make sure the generator set meets its performance specifications.

2. Make sure the coolant heater is installed and powered.
3. If the previous steps do not resolve the problem, contact your Cummins service representative.

## 6.5 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.

### Line Circuit Breaker Location



**FIGURE 29. LINE CIRCUIT BREAKER LOCATION**

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