

# Operator Manual

**Our energy working for you.™**



**Power  
Generation**

## PowerCommand® 1.1 - Rental



## FOREWORD

The purpose of this manual is to provide the Operator with sound, general information for the use and daily maintenance of the generator set. Refer to the Operator's engine specific manual for additional engine information which must also be read before operating the set.

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

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

Operators are respectfully advised that it is their responsibility to employ competent persons to carry out any installation work in the interests of good practice and safety. Consult your Authorised Distributor for further installation information. It is essential that the utmost care is taken with the application, installation and operation of any diesel engine due to their potentially dangerous nature. Careful reference should also be made to other Cummins Power Generation Limited literature, in particular the Health and Safety Manual 0908-0110-00.

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## Engine Specific Publications

**CAUTION:** *Important, additional engine specific information is contained within the Engine Operator's Manual. This information must be read in conjunction with the Control Manual before attempting to run the generator set.*

The relevant engine specific manual must be read in conjunction with this manual for the safe operation and maintenance of this generator set. The Engine Operator's Manual – Operator Level - will be supplied with the documentation package for your generator set.

## Supplementary Publications

The Supplementary Publications appropriate to your system will also be supplied. Where appropriate the corresponding Instruction Manual(s) will also be supplied with any accessory that you order.

Title	Publication No
Lead Acid Battery	0908-0101-00
Radiator Information	0908-0107-00
Health and Safety (Diesel Generator Sets)	0908-0110-00

If further, more detailed information is required, Engine Operation and Maintenance Manuals, and Service Manuals are available. Contact your authorised distributor.



## DISCLAIMER

**ALTHOUGH THIS GENERATOR SET MAY BE SUPPLIED WITH AN EARTHING ROD IT WILL NOT BE SUITABLE FOR ALL LOCAL CONDITIONS.**

**THE END USER IS RESPONSIBLE FOR ENSURING THAT AN EARTHING ARRANGEMENT THAT IS COMPLIANT WITH LOCAL CONDITIONS IS ESTABLISHED AND TESTED BEFORE THE EQUIPMENT IS USED.**

## TRANSPORTATION



**WARNING: BEFORE ANY TRANSPORTATION, THE FLUID CONTAINMENT AREA MUST BE INSPECTED AND EMPTIED OF ANY SPILLAGE OR ENGINE WASTE. THE GENERATOR SET DOOR(S) MUST BE LOCKED BEFORE TRANSPORTATION AND MUST REMAIN LOCKED DURING TRANSPORTATION AND SITING.**

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## Schedule of Abbreviations

AC	Alternating Current	MCB	Miniature Circuit Breaker
ACB	Air Circuit Breaker	MCCB	Moulded Case Circuit Breaker
ACH	Anti-Condensation Heaters	MF	Mains Failed
ATS	Automatic Transfer Switch	MFSS	Master First Start Sensor
AVR	Automatic Voltage Regulator	MR	Mains Returned
		MST	Mains Sensing Transformer
BHP	Brake Horsepower	MSU	Mains Sensing Unit
BMS	Building Management System	MV	Medium Voltage
BST	Busbar Sensing Transformer		
		NEC	Neutral Earthing Contact
CB	Circuit Breaker		
CCA	Cold Cranking Amps	PC	PowerCommand
CHP	Combined Heat and Power	PF	Power Factor
COP	Continuous Power Rating	PFC	Power Factor Controller
CT	Current Transformer	PLC	Programmable Logic Controller
		PMG	Permanent Magnet Generator
dB(A)	Unit of noise level	PRP	Prime Power Rating
DC	Direct Current	PSU	Power Supply Unit
DIP	Dual In-line Package	PT/CT	Potential Transformer / Current Transformer
DMC	Digital Master Control		
DMSU	Demand Load Standby Unit	QCC	Quadrature Current Control
EMCU	Engine Monitoring and Control Unit	RFI	Radio Frequency Interference
EMF	Electromotive Force	RMS	Root Mean Square
EPU	Engine Protection Unit	RPM	Revolutions Per Minute
		RTD	Resistance Temperature Detector
FSS	First Start Sensor		
GCP	Generator Control Panel	V	Volts
Genset	Generator set	VAC	Volts, Alternating Current
GKWT	Global Kilowatt Transducer	VCB	Vacuum Circuit Breaker
		VDC	Volts, Direct Current
HMI	Human/Machine Interface	VF	Volt-free
HV	High Voltage	VT	Voltage Transformer
IC	Integrated Circuit		
I/O	Input / Output		
kVA	Apparent Power		
kVAR	Reactive Power		
kW	Active / Real Power		
kWh	Unit of electrical energy or work		
LED	Light-Emitting Diode		
LTP	Limited Time Power Rating		
LTA	Low Temperature Aftercooling		
LV	Low Voltage		

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## SECTION 1 – PRELIMINARY AND SAFETY

### 1. Preliminary and Safety

#### 1.1 Warning, Caution and Note Styles Used In This Manual

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



**WARNING:** WARNS OF A HAZARD THAT MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.



*Caution* Warns of a hazard or an unsafe practice that can result in product or property damage.



*NOTE:* A short piece of text giving information that augments the current text.

#### 1.2 General Information

This manual should form part of the documentation package supplied by Cummins Power Generation Limited with specific generator sets. In the event that this manual has been supplied in isolation please refer to other Cummins Power Generation Limited literature, in particular the Health and Safety Manual (0908-0110-00).



*NOTE:* It is in the Operator's interest to read and understand all Health and Safety information together with all Warnings and Cautions contained within the documentation relevant to the generator set, its operation and daily maintenance.

#### 1.3 Generator Plant 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:** IMPROPER OPERATION AND MAINTENANCE CAN LEAD TO SEVERE PERSONAL INJURY OR LOSS OF LIFE AND PROPERTY BY FIRE, ELECTROCUTION, MECHANICAL BREAKDOWN OR EXHAUST GAS ASPHYXIATION. READ AND FOLLOW ALL SAFETY PRECAUTIONS, WARNINGS AND CAUTIONS THROUGHOUT THIS MANUAL AND THE HEALTH AND SAFETY MANUAL 0908-0110-00.



**WARNING:** LIFTING AND REPOSITIONING ON THE GENERATOR SET MUST ONLY BE CARRIED OUT USING SUITABLE LIFTING EQUIPMENT, SHACKLES AND SPREADER BARS IN ACCORDANCE WITH LOCAL GUIDELINES AND LEGISLATION BY SUITABLY TRAINED AND EXPERIENCED PERSONNEL. INCORRECT LIFTING CAN RESULT IN SEVERE PERSONAL INJURY, DEATH AND/OR EQUIPMENT DAMAGE. FOR MORE INFORMATION CONTACT YOUR AUTHORISED DISTRIBUTOR.

##### 1.3.1 Positioning of Generator Set

The area for positioning the set should be adequate and level and the area immediately around the set must be free of any flammable material.

## 1.3.2 AC Supply and Isolation

It is the sole responsibility of the customer to provide the AC power supply and the means to isolate the AC input to the terminal box. Refer to the wiring diagram supplied with the generator set.



**NOTE:** *A separate disconnecting device is required by BS EN 12601:2001.*

**NOTE:** *The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations.*

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

## 1.3.3 Spillage

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

## 1.3.4 Fluid Containment

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. (See Health and Safety manual 0908-0110-00). 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 above.



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

## 1.3.5 Exhaust Precautions



**WARNING:** **EXHAUST PIPES AND CHARGE AIR PIPES ARE VERY HOT AND THEY CAN CAUSE SEVERE PERSONAL INJURY OR DEATH FROM DIRECT CONTACT OR FROM FIRE HAZARD.**



**WARNING:** **HOT EXHAUST GAS CAN CAUSE BURNS RESULTING IN SEVERE PERSONAL INJURY.**

The exhaust outlet may be sited at the top of the set, or at the bottom, make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position.



**WARNING:** **CONTAMINATED INSULATION IS A FIRE RISK WHICH CAN RESULT IN SEVERE PERSONAL INJURY.**

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

To minimise the risk of fire ensure the following steps are observed:

- Ensure that the engine is allowed to cool thoroughly before topping up the oil or draining the fuel filters.
- Clean the exhaust pipe thoroughly.

## SECTION 2 - INTRODUCTION

### 2. Introduction

#### 2.1 General

Before any attempt is made to operate the generator set, the Operator should take time to read all of the manuals supplied with the generator set, and to familiarise 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. This manual includes a maintenance schedule and a troubleshooting guide.

#### 2.2 Generator set Identification

Each generator set is provided with a Generator Set Rating Plate similar to that shown below. This provides information unique to the generator set.




 Manston Park, Columbus Avenue, Ramsgate, Kent, England, CT12 5BF				
Model Number/Specification letter		C70 D5		
Serial Number		K07K934580		
Manufacturing Order Number		934090		
Year of Manufacture		2007		
Declared Rating		Standby		Prime
Rated power @ 27°C Ambient	Kva	69.8	-	63.0
	Kw	55.8	-	50.4
@ 40°C Ambient	Kva	69.8	-	63.0
	Kw	55.8	-	50.4
@ 45°C Ambient	Kva	60.1	-	62.6
	Kw	55.3	-	50.1
@ 50°C Ambient	Kva	66.5	-	62.1
	Kw	54.8	-	49.7
	Voltage	400	-	400
	Frequency	50 Hz	60 Hz	50 Hz 60 Hz
	Power factor	0.8	0.8	0.8 0.8
Generating set Max Mass - wet	kg	3,500	3,500	3,500 3,500
	Controller	1300	1300	1300 1300
Altitude before possible derate	ASL m	127	127	127 127
	Performance class ISO 8528-1	G2	G2	G2 G2
Declared rating Enclosed Noise		Standby		Prime
Sound Pressure Level @ 1m dB(A)		76	69	76 69
Average @ 7m dB(A)		69	69	69 69
Average @ 15m dB(A)		63	69	62 69
 <b>LWA</b> <b>97 dB</b> LWA, 50 Hz @ 75% Prime as per 2002/14/EC Directive.				
				

Figure 1 Typical Enclosed Generator Set Rating Plate

## 2.3 After Sales Services

We offer a full range of after sales services as follows:

### 2.3.1 Maintenance



**WARNING: INCORRECT SERVICE OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE TRAINED AND EXPERIENCED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.**

For customers who wish to have their generator sets expertly serviced at regular intervals your local distributor offers a complete maintenance contract package. This covers all items subject to routine maintenance and includes a detailed report on the condition of the generator set. In addition, this can be linked to a 24-hour call-out arrangement, providing assistance 365 days a year if necessary. Specialist engineers are available to maintain optimum performance levels from customer's generator sets, and it is recommended that maintenance tasks are only undertaken by trained and experienced engineers provided by your authorised distributor.

### 2.3.2 Warranty

All generator sets have a twelve months warranty from the commissioning date as standard. Extended warranty coverage is also available. In the event of a breakdown prompt assistance can normally be given by factory trained service engineers with facilities to undertake all minor and many major repairs to equipment on site.

For further warranty details contact your authorised distributor.



**NOTE:** *Any damage caused to the generator set as a direct result of running in the Battle Short mode will not be covered by the Warranty.*



**NOTE:** *Damaged to any component will be rejected if the incorrect mix of anti-freeze has been used. Please contact your authorised Cummins distributor.*

#### 2.3.2.1 Warranty Limitations

Cummins Power Generation Limited is not responsible for the repair or replacement of Product required because of normal wear; accident; misuse; abuse; improper installation; lack of maintenance; unauthorised modifications; improper storage; negligence; improper or contaminated fuel; or the use of parts that do not meet Cummins Power Generation Limited's specifications.

### 2.3.3 Spares

An extensive Spare Parts Department is available for any emergency breakdown and for the engineer who carries out his own routine maintenance. Please contact your authorised Cummins distributor. Please quote Plant Nos., Serial Nos., and Part Nos. when ordering spares.

### 2.3.4 Overseas

Agents and representatives in almost 100 countries throughout the world offer installation and after sales service for the equipment provided. We can provide the name and address of the agent for your specific location.

For details on any of the above services contact your authorised distributor.

### 2.3.5 Additional Literature

Should you require further, more detailed information regarding the engine or alternator please contact your authorised distributor. Please quote Plant Nos., and Serial Nos.



## SECTION 3 – SYSTEM OVERVIEW

### 3. System Overview

The PowerCommand®1.1 control consists of a control board with integral AVR, and a separate display panel (HMI). These units are contained within the control housing which is mounted on the bedframe at the rear of the generator set. This complete assembly is housed within a SilentPower™ canopy.

The PowerCommand®1.1 also provides the opportunity for a, second, remote, display panel; a bargraph; and an annunciator. Please contact your authorised distributor for further information.

#### 3.1 SilentPower™ Canopy – Main Features

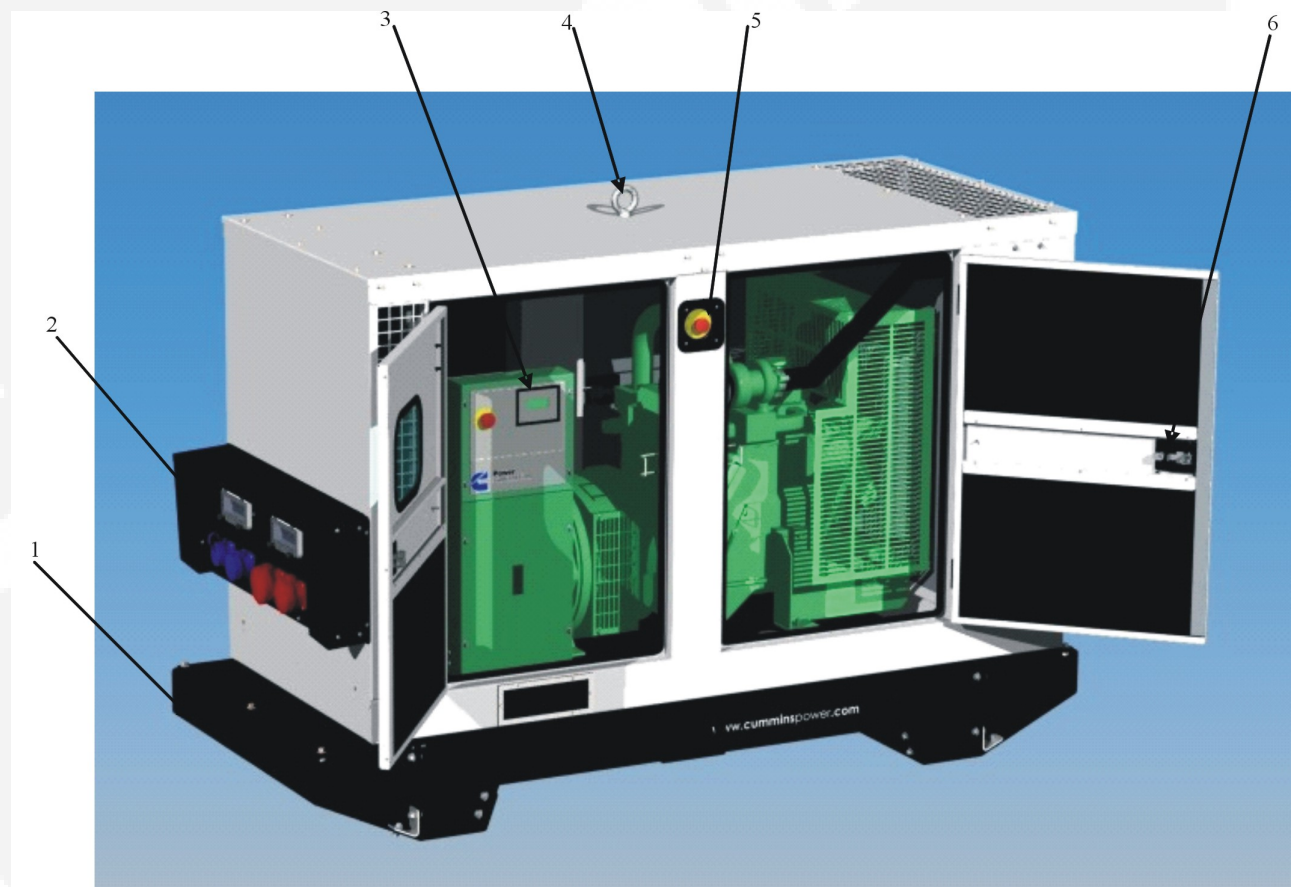


Figure 2 Typical SilentPower™ Canopy (Doors Open)

#### KEY

- |    |   |    |                                  |
|----|---|----|----------------------------------|
| 1. | Skid with Fork Lift Capability                              | 4. | Single Point Lift (up to 125kVA) |
| 2. | Socket Pack<br>(option for D5RS models – up to 100KVA only) | 5. | External Emergency Stop Button   |
| 3. | Display Panel   | 6. | Lockable Door for Security       |

### 3.2 Generator Components – Typical Generator Set

The main components of a typical C200 Generator Set are shown below, and referred to within this section. Refer to the Operator's engine specific manual for additional, generator set specific information.

Various options are listed although they may not be available for all models.

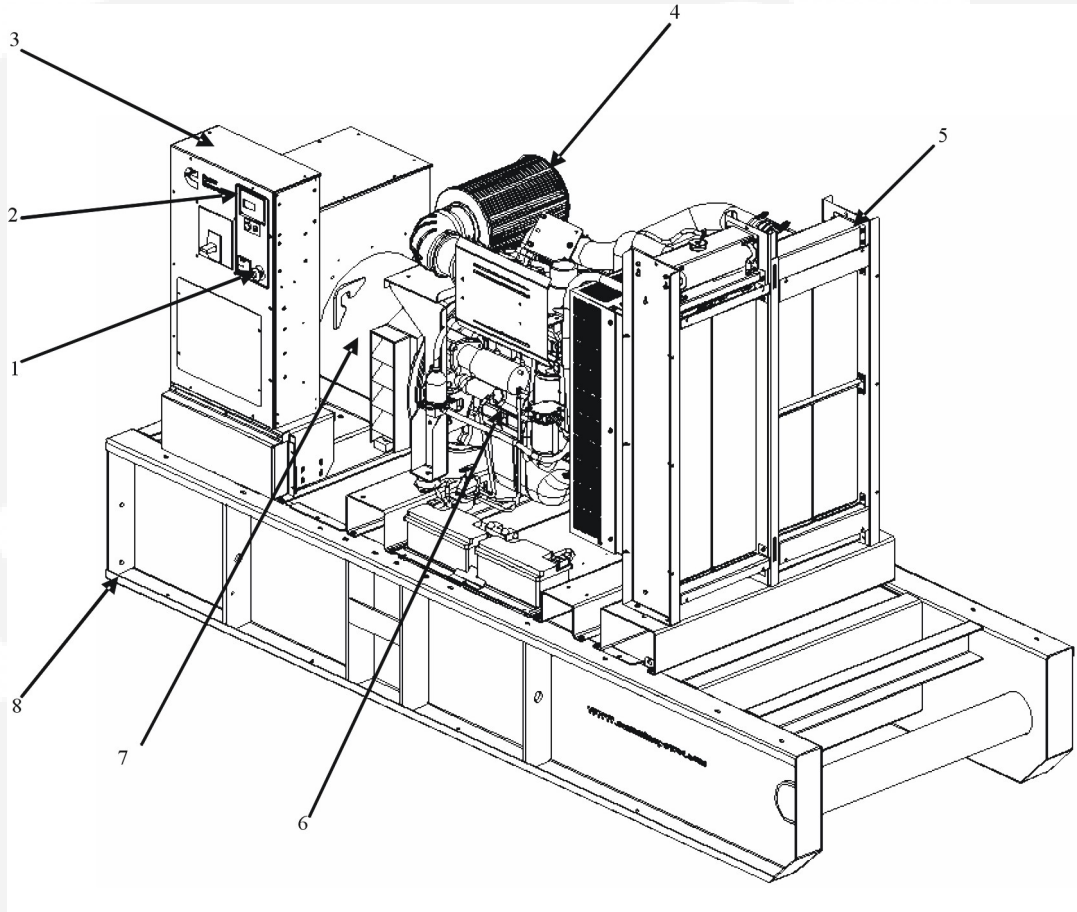


Figure 3 Typical C200 Generator Set

#### KEY

- 1. Emergency Stop Button
- 2. Display Panel
- 3. Control Housing
- 4. Air Cleaner
- 5. Radiator
- 6. Engine
- 7. Alternator
- 8. Bedframe

#### OPTIONS

- Batteries and Tray
- Circuit Breaker Entrance Box
- Engine Coolant Heater
- Alternator Heater
- Battery Charger

### 3.3 Generator Rating

For details of your generator set rating refer to the Generator Set Rating Plate. Refer to Section 5.4 for operation at temperatures or altitudes above those stated on the Rating Plate.

### 3.4 Engine

For engine specific information please refer to the relevant engine manual supplied with the generator set document package.

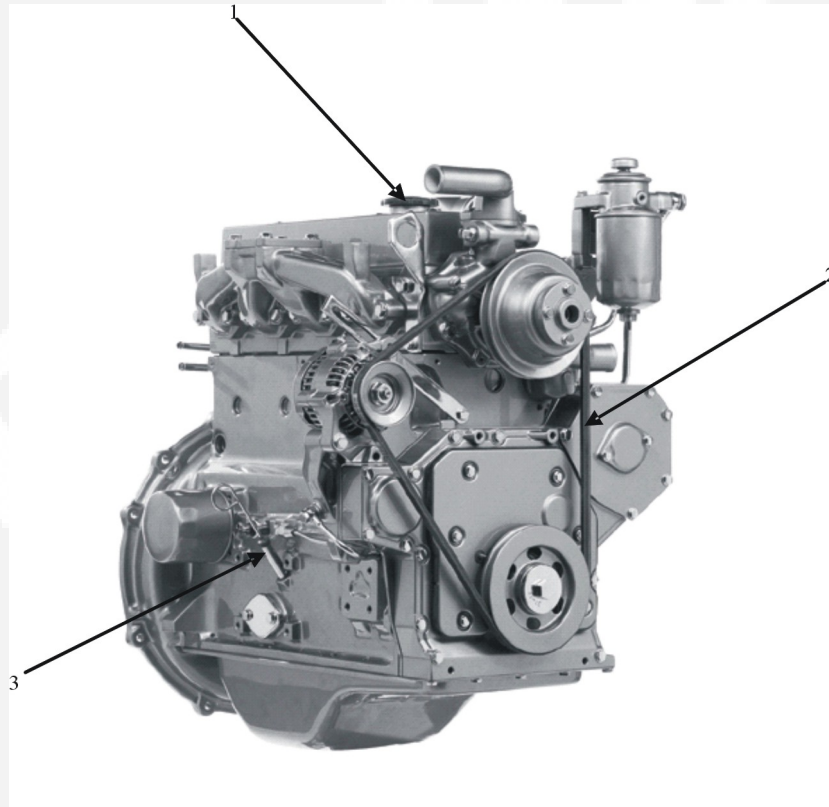


Figure 4 Typical Engine Components (B3.3)

**KEY**

- 1. Oil filler cap
- 2. Fan belt
- 3. Dipstick

### 3.4.1 Fuel Changeover System (Where Fitted)

A 3-way fuel valve system is provided to enable the generator set to be fuelled directly from an external tank.

Where the system comprises two valves it is essential that both valves are in the same position to prevent the following:

- Fuel spillage from the generator set tank vent when fuel is drawn from the external tank and spill returned to the generator set tank.
- Fuel shortage when fuel is drawn from the generator set tank and spill returned to the external tank.



**WARNING:** DO NOT ATTEMPT TO OPERATE THE GENERATOR SET WITH THE VALVES SET TO EXTERNAL TANK SUPPLY AND WITH THE BLANKING PLUGS FITTED AS THIS WILL CAUSE DAMAGE TO THE ENGINE'S FUEL SYSTEM.



**NOTE:** Consult your authorised distributor to establish the maximum head of fuel allowable at the generator set fuel pump.

### 3.4.2 Mains Powered Battery Charger – Set Mounted (Option)

Optional single phase, mains powered battery charger, which is panel mounted, is available to maintain the battery in a charged condition when the generator set is not running.



**NOTE:** It is the sole responsibility of the Customer to provide the power supply and the means to isolate the supply to the charger. Cummins Power Generation Limited accepts no responsibility for providing the means of isolation.



**NOTE:** The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations.



### 3.4.3 Battery Isolator (Where Fitted)

A battery isolator is provided which isolates the negative feed from the battery to the engine. This can be used to isolate the battery to prevent battery drain through prolonged periods of generator set inactivity or where static battery charging is not available.



**WARNING: THE BATTERY ISOLATOR SWITCH MUST NOT BE OPERATED WHILST THE GENERATOR SET IS RUNNING, AND MUST NOT BE USED TO STOP THE GENERATOR SET.**

### 3.4.4 Alarm Module (Option)

The Alarm Module provides audible warnings. A rocker switch provides the means to switch the alarm facility on or off.

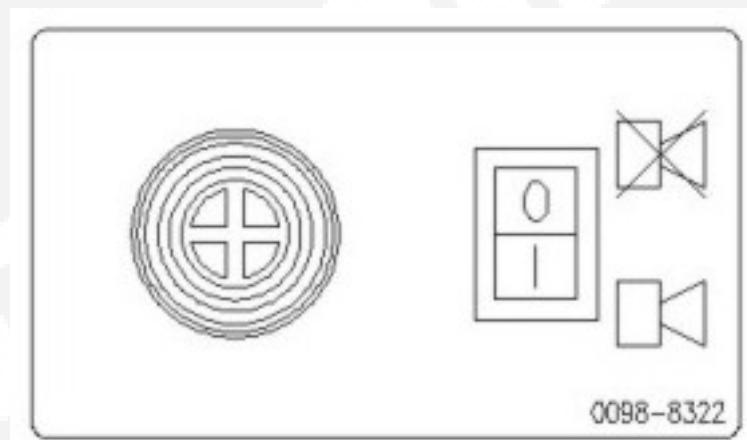


Figure 5 Typical Alarm Module Front Panel

### 3.4.5 Sensors

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

Engine-mounted sensors are able to monitor the following systems:

- Lube Oil Pressure
- Cooling System Temp
- Miscellaneous Areas

## 3.5 AC Supply and Isolation

It is the sole responsibility of the customer to provide the power supply and the means to isolate the AC input to the terminal box. Refer to the wiring diagram supplied with the generator set.



**NOTE:** *A separate disconnecting device is required by BS EN 12601:2001.*

**NOTE:** *The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations.*



**WARNING:** **THE DISCONNECTING DEVICE IS NOT PROVIDED AS PART OF THE GENERATOR SET, AND CUMMINS POWER GENERATION LIMITED ACCEPTS NO RESPONSIBILITY FOR PROVIDING THE MEANS OF ISOLATION.**

## 3.6 Heaters



**Caution:** *Heater(s) must not be energised if the coolant system has been drained.*

### 3.6.1 Heater Supply and Isolation

A heater supply is required for the operation of the engine and alternator heaters (if fitted). See Section 3.5.



**Note:** *This disconnecting device is not provided as part of the generator set.*

**Note:** *It is the sole responsibility of the customer to provide the power supply and the means to isolate the AC input to the terminal box. Cummins Power Generation Limited accepts no responsibility for providing the means of isolation.*

## 3.7 Mains Powered Battery Charger (Option)



**Caution:** *Isolate the charger before disconnecting the battery.*

### 3.7.1 Operation

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

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

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

## SECTION 4 – CONTROL SYSTEM

### 4. Control System

#### 4.1 Control System Description

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

All indicators, control buttons and the display screen are on the face of the display module as illustrated in Figure 6.

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 will immediately take the engine off-load and automatically shut it down.

The standard control system operates on 12 or 24VDC battery power. The auxiliary equipment operates on LV AC power. The history data is stored in non-volatile memory and will not be deleted due to loss of battery power.

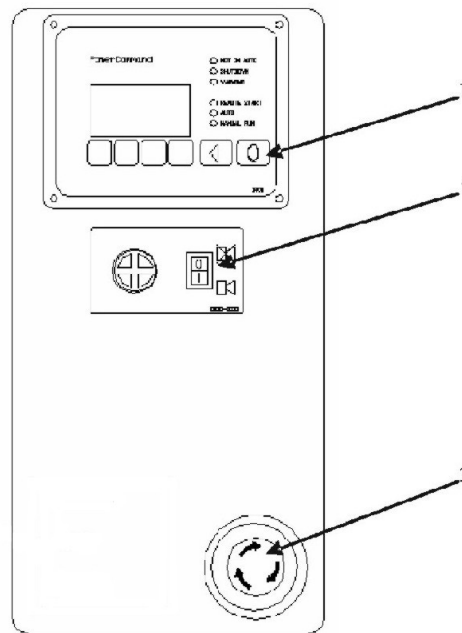


Figure 6 Typical Control System Panel

#### KEY

1. Display Module
2. Alarm Module (option)
3. Emergency Stop Button

## 4.1.1 Operating Modes

The PowerCommand@1.1 is operated by the Manual Run/Off/Auto buttons on the display module face.

### Off Mode

When in the Off mode, the control does not allow the generator set to start. Refer to Section 4.5 – Auto and Manual Run Modes – to re-start the generator set.

If the generator set is running, in either Manual Run or Auto mode, and the Off button is pressed, a normal shutdown sequence will be initiated.

Pressing the Off mode button will reset all active faults.

### Manual Run Mode

When in Manual Run mode, the generator set starts and continues to run until the control is put into the Off mode. Pressing the Off button initiates a normal shutdown sequence that does not include a time delay stop. While in the Manual Run mode, any remote start signal is ignored.

### Auto Mode

When in Auto mode, the control allows the generator set to be started at any time, with a remote signal only. When a remote start signal is received, the generator set starts after a time delay start is completed (default time is zero seconds).

When all remote start signals are removed, the control performs a normal shutdown sequence which may include a time delay stop (default time is zero seconds).

If the generator set is running in Auto mode and the Off button is pressed, the control immediately stops the generator set and the control transitions to the Off mode.

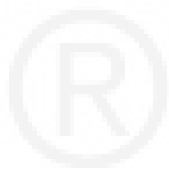
### Sleep Mode

The PowerCommand@1.1 control enters a low power (Sleep) mode of operation where the current drawn is less than 60 milliamps (DC) at normal battery voltage levels. Sleep mode is automatically enabled, and the display module will turn itself off after five minutes of keypad inactivity in the Off or Auto mode. It awakes from the sleep mode if any button is pressed.

The control will not enter the Sleep mode if there are any active, unacknowledged shutdown faults, if the control is in the Manual Run mode.



*Note: (Sleep mode can be disabled, contact your authorised distributor).*





## Battle Short Mode

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®1.1 is purchased.

Battle Short mode is a generator set mode of operation that prevents the generator set from being shutdown by all but a few, select, critical shutdown faults.



**Caution:** *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.*



**WARNING: USE OF THE BATTLE SHORT MODE FEATURE CAN CAUSE A FIRE OR ELECTRICAL HAZARD, RESULTING IN SEVERE PERSONAL INJURY OR DEATH AND/OR PROPERTY AND EQUIPMENT DAMAGE. OPERATION OF THE SET MUST BE SUPERVISED DURING BATTLE SHORT OPERATION.**

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.

Only trained and experienced service personnel should enable this feature. When shipped from the factory, this feature is disabled.



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

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 display module.



**Note:** *The Battle Short feature must be enabled or disabled using the PC Service tool.*

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 display module, Battle Short must be set to Operator Panel and enabled using the PC 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 ▲, ▼ or ◀ button is pressed to acknowledge the fault, the fault message is cleared from the display but remains in the Fault History file with an asterisk sign (\* indicates an active fault) 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 whilst in Battle Short mode. Fault code 1123 – Shutdown After Battle Short – is then displayed.

## 4.2 Display Module - Front Panel

Figure 7 shows the features of the front panel. It includes six LED indicators, the graphical display, and six buttons used to navigate through the menus and adjust parameters.

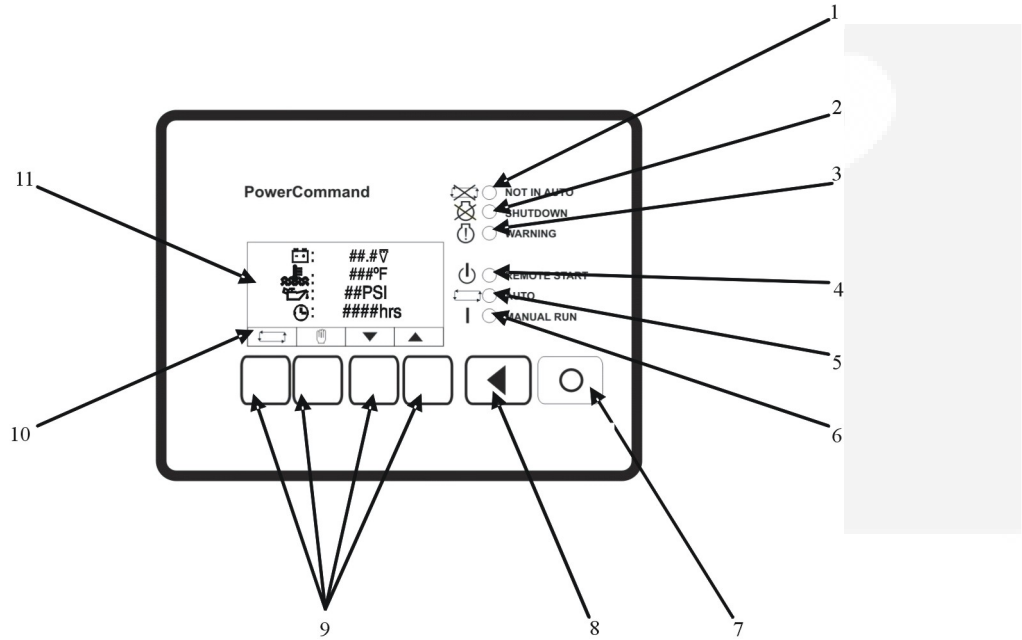


Figure 7 Display Module – Front Panel

### KEY

- |                                 |   |
|---------------------------------|---|
| 1. LED Indicator – Not in Auto  | 7. Generator Set Off Mode Button                      |
| 2. LED Indicator – Shutdown     | 8. Previous Screen Button                             |
| 3. LED Indicator – Warning      | 9. Selection Buttons (four)<br>(for use with Item 10) |
| 4. LED Indicator – Remote Start | 10. Menu Bar (provision for four symbols)             |
| 5. LED Indicator – Auto         | 11. Graphical LCD Display                             |
| 6. LED Indicator – Manual Run   |   |

## 4.2.1 Display Text or Symbols Version

This graphical display can be set to show text (English only) or symbols for fault messages, some Operator menus, and the Mode Change menu. Descriptions of commonly used symbols are included in Table 1. Combinations of symbols are used to display some fault conditions. Additional specialised symbols are also used for some faults (see Section 7.6).

When shipped from the factory, the display is set for symbols. Qualified service personnel are required to change the default setting.
















SYMBOL	DESCRIPTION	
	Actual text shown – English only	Translation
	Generator Warning Fault	
	Generator Shutdown Fault	
	Coolant Temperature	
	Oil Pressure	
	Voltage Alternating Current (VAC)	
	Voltage Direct Current (VDC)	
	AC Current	
<b>Hz</b>	Frequency	
	Battery	
	Out of Range	
	High or Pre-High	
	Low or Pre-Low	
	Annunciator	
	Over Speed	
	Crank Fail	
	Emergency Stop	

Table 1 Symbols

## 4.2.2 LED Indicators

Figure 7 shows the front panel of the Display Module. It includes six LED indicators, the graphical display and six buttons used to navigate through the menus and adjust parameters.

### Not in Auto

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

### 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.



*Note: When Battle Short mode has been enabled and an overridden shutdown fault occurs, the Shutdown lamp will be lit even though the generator set will continue to run.*


### Warning

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


### Remote Start

This green lamp indicates the control is receiving a remote run signal.

### Auto

This green lamp indicates that the control is in Auto mode. Auto mode can be selected by pressing the  selection button from any of the Operator menus (see Section 4.5).

### Manual Run

This green lamp indicates that the control is in the Manual Run mode. Manual Run can be selected by pressing the  selection button from any of the Operator menus (see Section 4.5).

## 4.2.3 Graphical Display and Buttons

Figure 7 shows the graphical display and the relevant menu selection buttons.

The graphical display is used to view menus of the menu-driven operating system. The Menu Bar at the bottom of the display indicates the functions that are available by pressing the four selection buttons. Refer to the menu trees later in this section.





**Note:** *In the following menu trees, the submenus are shown in the order in which they are displayed when scrolling up ▲, or when scrolling down ▼.*

System messages (communication, event, and fault) are also shown on the display. For more information see Section 4.3.

### 4.2.3.1 Selection Buttons


Four momentary (soft-key) buttons are used to step through the various menus. These selection buttons are active when a word or symbol in the Menu Bar of the graphical display is shown above the button. Some sub-menus do not include any active buttons.

The function of the four selection buttons varies with each menu.

- When the  symbol is displayed, the selection button can be used to switch to Auto mode.
- When the  symbol is displayed, the selection button can be used to switch to Manual Run mode.
- When the up and down triangles (▲ and ▼) are displayed, the selection buttons are used to navigate between a series of submenus.



**Note:** *When a fault is displayed, it can be cleared from the front panel by pressing the ▲ or ▼ button. Clearing the front panel does not reset the fault.*

- When a ◀ symbol is displayed, the selection button can be used to abort the Auto or Manual Run mode and return to the Operator menu that was displayed before the Auto or Manual Run mode was selected.
- When the → symbol is displayed, the selection button is used to navigate to an editable field within a menu.
- When the + and – symbols are displayed, the selection buttons are used to increase or decrease a parameter or value shown on the screen. When changing values, pressing the button below the + symbol increases the value and pressing the button below the – symbol decreases the value.
- When a black box  is displayed, the selection button has no function.

### 4.2.3.2 Control Buttons

Figure 8 illustrates the six control buttons.

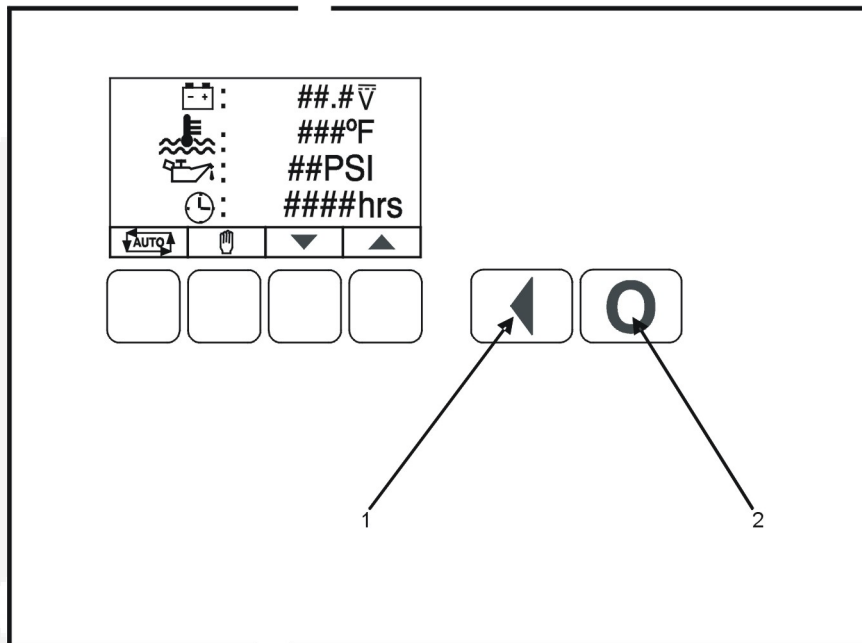


Figure 8 Control Buttons

#### KEY

1. Previous Main Menu Button
2. Off Button

#### Previous Main Menu Button ◀

Press this button to view the previously displayed main menu.



*Note:* Pressing the ▲ or ▼ button also clears the fault from the front panel display.

#### Off Button O

Press this button to switch to the Off mode. The Off Mode will disable the control Auto or Manual Modes. Pressing the Off button resets the control.

If the Off button is pressed during generator set operation (manual or remote start), the engine will immediately shut down. If possible, hot shutdown under load should be avoided to help prolong the reliability of the generator set.

*Note:* Switching to Off mode can be restricted to authorised personnel. If a control panel is set-up with the mode change access code featured enabled, an access code must first be entered before the mode can be changed. Refer to Section 4.5.

### 4.2.4 Default Settings

The control panel can display SAE or Metric units of measurement and should be set during the initial setup of the generator set. Qualified service personnel are required to change the default setting. Contact your authorised distributor.

### 4.3 Display Module - System Messages

A system pop-up message is displayed when the event it is displaying becomes active. These pop-up messages remain displayed until pre-empted by another pop-up message or until the ▼ or ◀ display button is pressed, or the event has expired. Once the ▼ or ◀ button is pressed, the previous menu is re-displayed.

#### 4.3.1 Communication Messages

System messages are displayed for initial power-up or when there is a subsequent loss of communications. Auto and Manual Run modes can also be selected when communication messages are displayed (for more information see Section 4.5).

Upon initial power-up, the message Establishing Communication with Control is displayed (see Figure 9). This menu also displays the screen's software number and version.

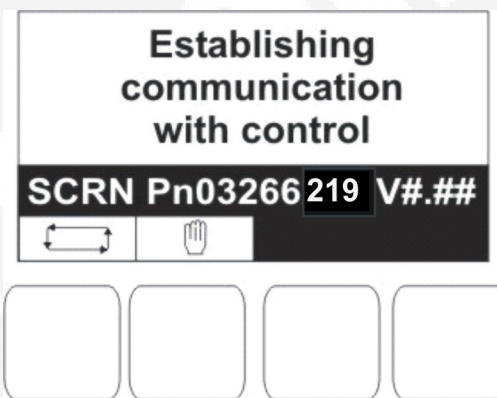


Figure 9 Establishing Communications Message

When the display detects that it is no longer communicating with the control, the Shutdown, Warning, and Remote Start LEDs are turned off.

If communications are lost, the message Re-establishing Communications with Control is displayed (see Figure 10) until communications have been re-established. The LEDs then return to the state determined by the control.

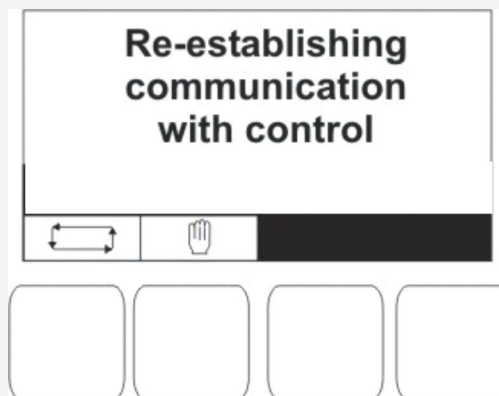


Figure 10 Re-establishing Communications Message



Note:

*If either communication message remains displayed (cannot view other menus), this indicates that communications between the control panel and the control logic has been lost. Contact your authorised distributor for assistance.*

### 4.3.2 Event Messages

When pre-set events (Start or Stop) are activated, Event messages are displayed showing the time remaining until the event occurs (see Figure 11).

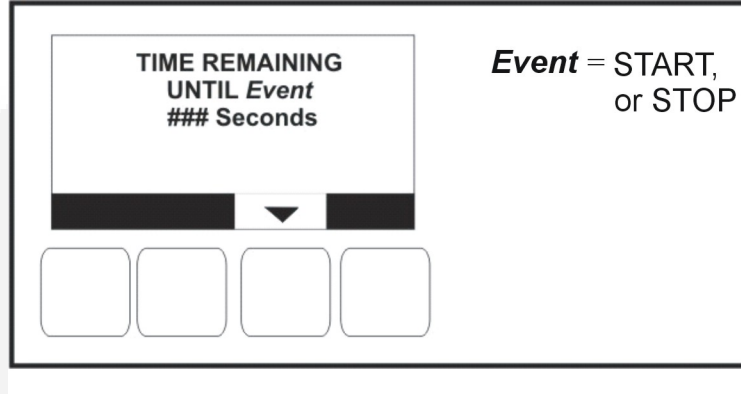


Figure 11 Event Message

### 4.3.3 Fault Messages

A Fault message is an indicator of a Warning or Shutdown condition that is also announced with a lamp indicator. Text fault messages include the fault code number, a short description, and when the fault occurred in 'Control On Time'. (see Figure 12).

Table 3 provides a list of fault codes, fault types, messages displayed, and descriptions of the faults.

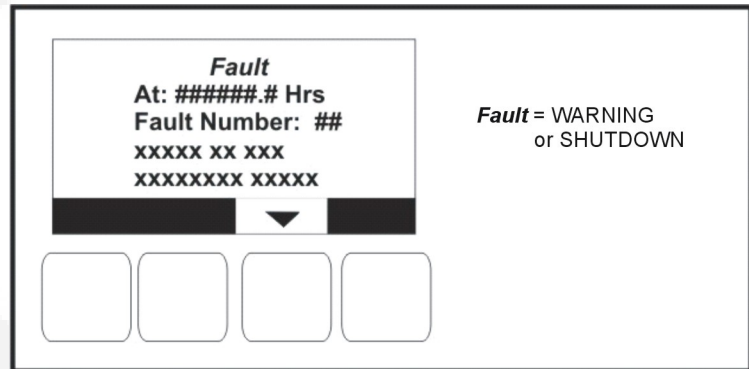




Figure 12 Fault Message – Text Version

Symbolic fault messages include the fault code number and symbols indicating the type of fault (see Figure 13).

With the symbolic versions of fault messages, the  and  symbols flash.

Five of the most recent faults are saved in a file and can be viewed within the Fault History Menus.

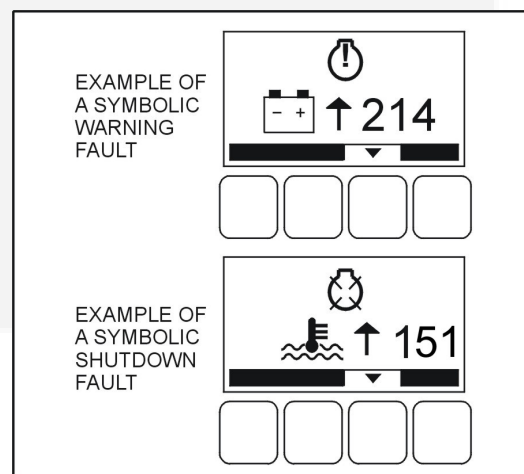


Figure 13 Fault Messages – Symbolic Version



### 4.3.4 Fault Reset/Acknowledgement

Shutdown faults must be acknowledged after the fault condition has been corrected. Shutdown faults are acknowledged by pressing the Off button, on the display panel.

Shutdown faults can also be acknowledged when in Auto mode, by using an external customer-supplied remote fault reset switch. This ability must be enabled using InPower (default condition is disabled). To reset the fault using the remote fault reset switch, the remote start command must be removed prior to the remote fault reset switch being activated.

Faults are removed from the display when they are cleared.



*Note: Faults are cleared from the control panel display by pressing the ▲, or ▼ button.*

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

### 4.3.5 Status Messages

Status messages for some events are displayed on the control panel with a code number but are not announced with a lamp indicator. Text status messages include the event code, a short description, and the time the event occurred. Symbolic status messages include the event code and symbols to indicate the type of event that occurred.

#### Full Authority Engines Only

On Full Authority Electronic engines, the engine controller saves data after each run. During this time, the message shown in Figure 14 is displayed. The generator can still be started whilst the ECM Datasave is in progress.

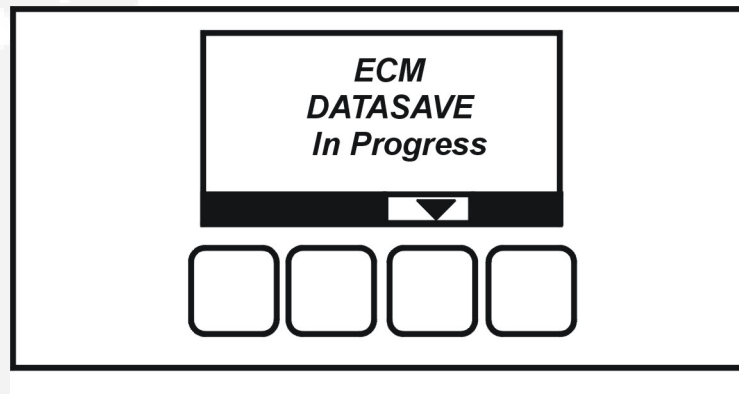


Figure 14 Datasave Status Message

## 4.4 Display Module - Operator Menus

Figures 15 and 16 show block representations of the following Operator menus:

- Engine Status
- Alternator Status
- Line-to-Line Voltage
- Line-to-Neutral Voltage
- Alternator Amperage

To navigate between the Operator menus, press the buttons below the ▼ and ▲ symbols in the graphical display.

The Operator menus can be used to select Auto or Manual Run modes (see Section 4.5).

### Engine Status Menu

This menu displays the engine starting battery voltage, engine coolant temperature, engine oil pressure, and hours of engine operation.

### Alternator Status Menu

This menu displays generator set load (in kVA), frequency (Hz), and engine speed (RPM).

### Alternator Line-to-Line Voltage Menu

This menu displays L1-L2, L2-L3, and L3-L1 line-to-line voltages for 3-phase applications only.

### Alternator Line-to-Neutral Voltage Menu

This menu displays line-to-neutral voltages for L1, L2, and L3 for 3-phase wye configurations only. In delta configurations, this menu is not shown.

### Alternator Single Phase Voltage Menu

This menu displays L1-N, L2-N, and L3-N voltages for single phase applications only.

### Alternator Amperage Menu

For applications that include current transformers, this menu displays L1, L2, and L3 current sense amperage.



Figure 15 Operator Menus – Text Version

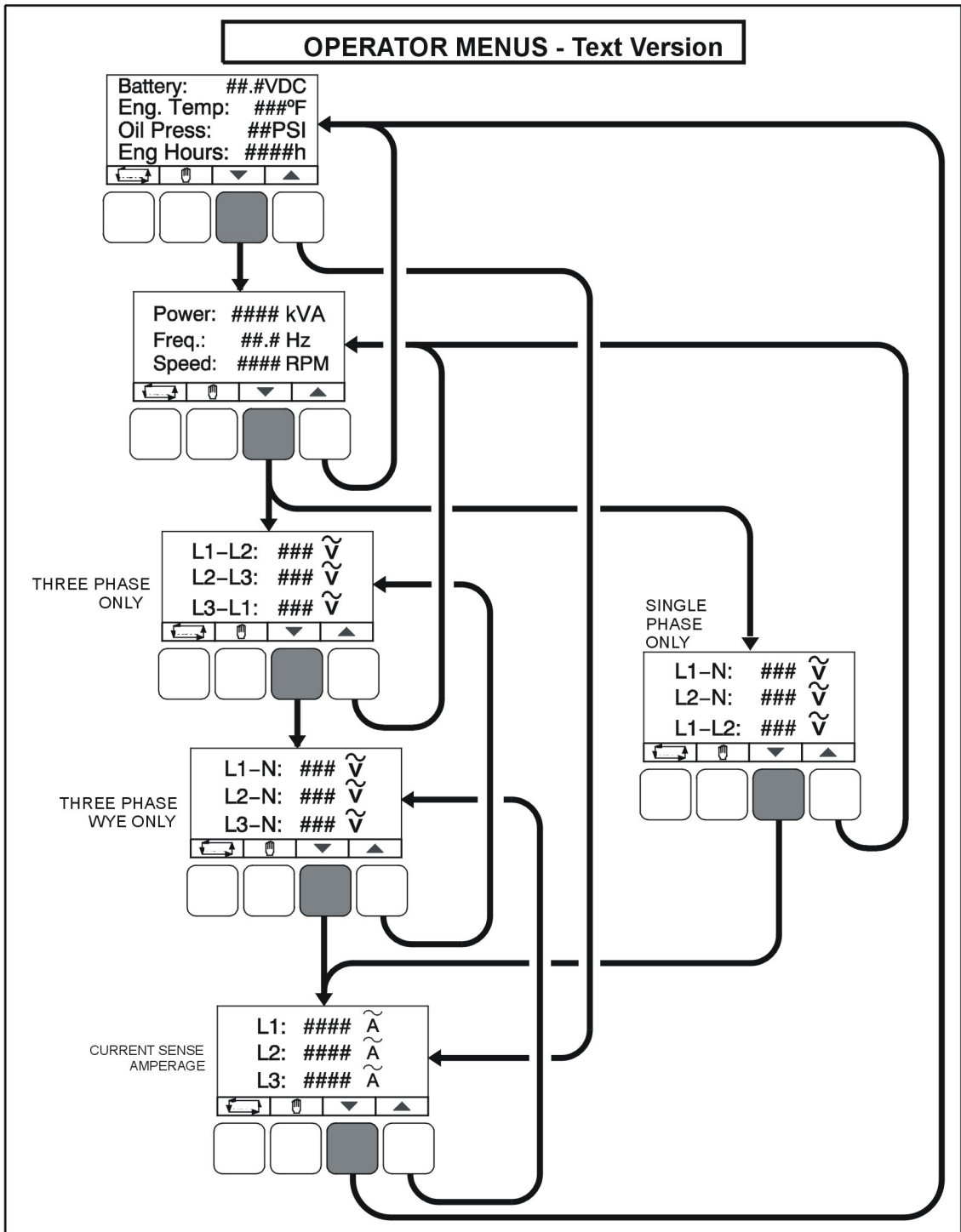
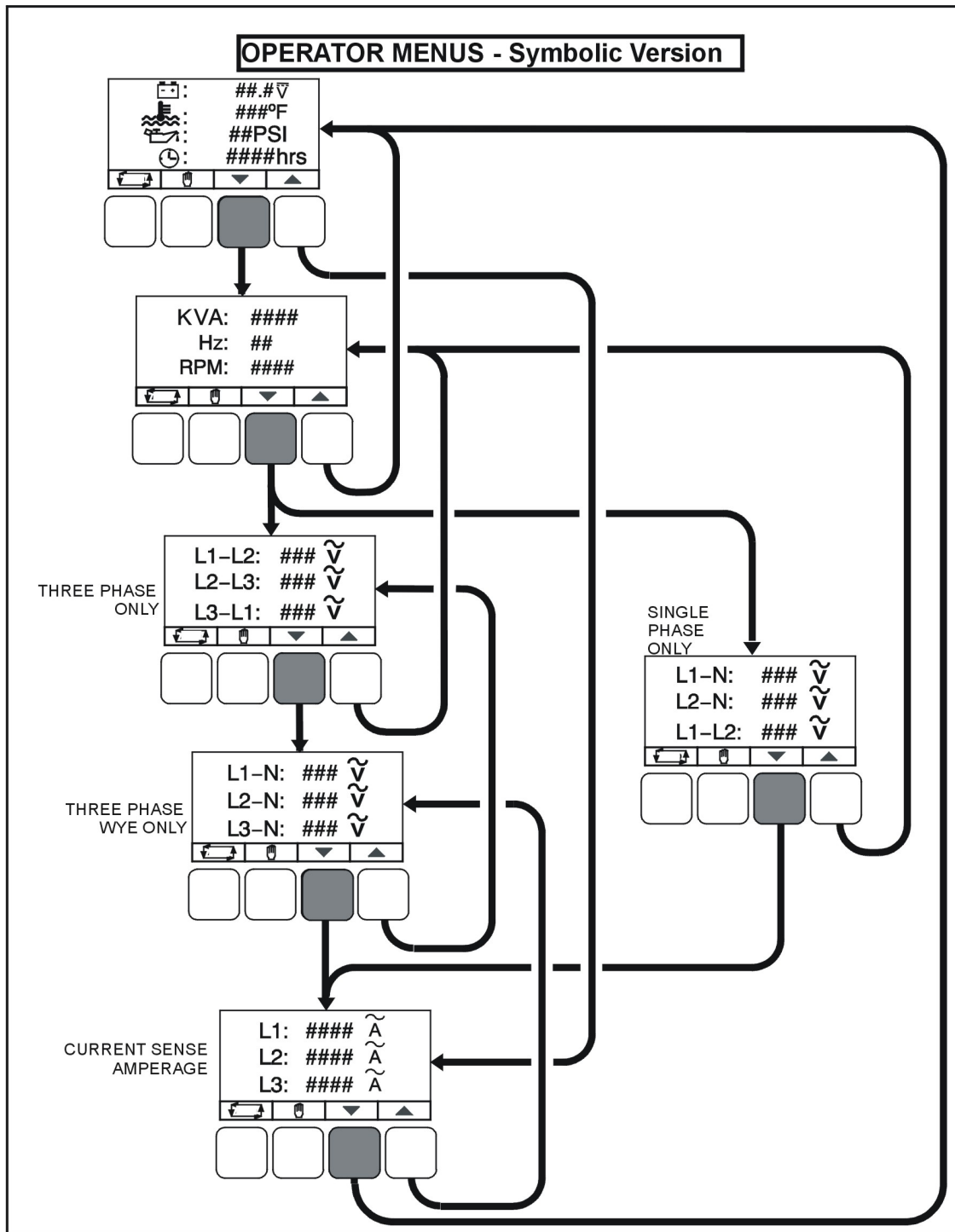


Figure 16 Operator Menus – Symbolic Version



## 4.5 Display Module - Auto and Manual Run Modes



**WARNING:** WHEN CHANGING MODES, THE GENERATOR SET MAY START OR STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START OR STOP WHEN CHANGING MODES.

Auto, Manual Run and Off modes can be selected as follows:

- From any of the Operator menus.
- When the message 'Establishing Communication with Control' is displayed.
- When the message 'Re-establishing Communication with Control' is displayed.

Switching to Auto, Manual Run, or Off mode can be restricted to authorised personnel. If a control panel is set-up with the mode change access code feature enabled, an access code must first be entered before the mode can be changed.



**Note:** *The default setting for switching between Auto, Manual Run and Off modes is restricted to authorised personnel with an Access code. Qualified service personnel are required to change the default setting. Contact your authorised distributor for assistance.*

The Auto or Off mode switch status is saved in non-volatile memory when it changes. When the control panel powers up (after sleeping or upon battery removal), the switch status is restored to its previous saved state.

### 4.5.1 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 Off modes. The text and symbolic versions of the Mode Change menu are shown in Figure 17.

To enter the mode change access code use the + and – buttons to increase or decrease the values in the relevant field. Use the → button to move the cursor within a field. Selected fields will be highlighted.

1. With the required character highlighted, press the button below the + or – symbols until the required value is displayed.
2. Press the arrow selection button → to move to the next numeric character.
3. Repeat steps 1 and 2 until all three characters of the Access Code are correct.
4. After you have completed entering the password, press the → arrow selection button.



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

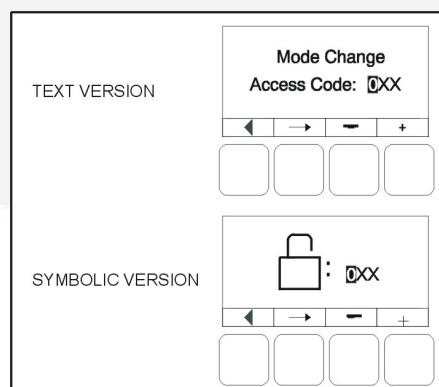







Figure 17 Mode Change Menu

### 4.5.1.1 Selecting Auto Mode



**WARNING: WHEN CHANGING MODES, THE GENERATOR SET MAY START OR STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START OR STOP WHEN CHANGING MODES.**

To switch to Auto mode (see Figure 18).

1. Ensure that it is safe to do so before proceeding to change the mode.
2. Press the  Auto button on any of the Operator menus, or the 'Establishing/Re-establishing Communication with Control' menus.
3. If the mode change access code feature is enabled, the Mode Change Access Code menu will be displayed. Enter the Mode Change Access Code as previously described (see Section 4.5.1).
4. A menu with alternating arrows will then be displayed above a second  Auto symbol.
5. Press this second  Auto button. The Operator menu that was displayed before Auto mode was selected is re-displayed, but with the  Auto symbols blacked out and  Manual Run symbols visible.

To disable Auto mode, press the Off button.

The generator set is now ready to receive a remote start signal that will initiate the Auto run mode.



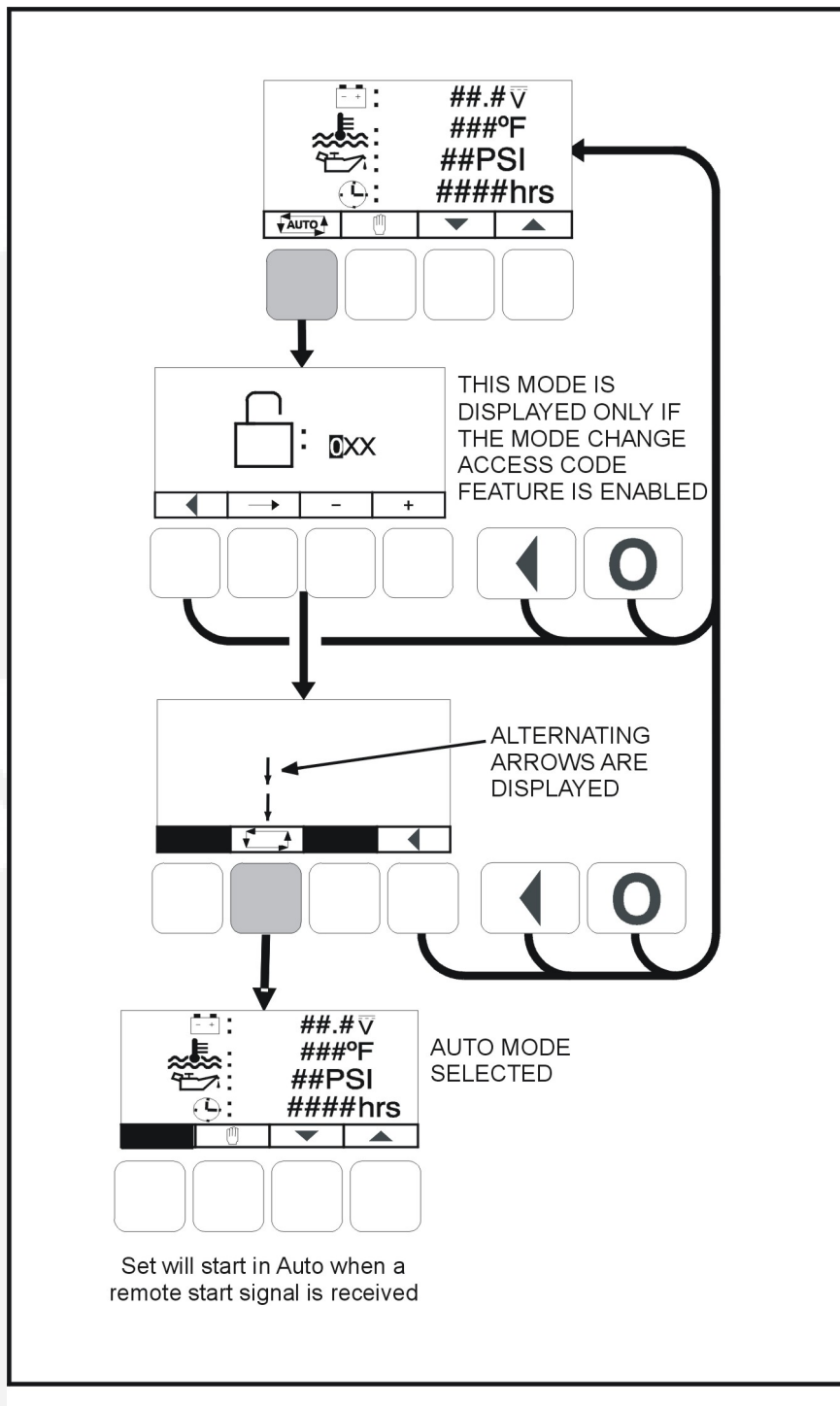
**WARNING: SHOULD A REMOTE START SIGNAL BE RECEIVED, THE GENERATOR SET WILL START AUTOMATICALLY. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START WITHOUT WARNING.**



**WARNING: MANUAL RUN MODE CAN ALSO BE SELECTED FROM AUTO MODE. SWITCHING TO MANUAL RUN MODE WILL RESULT IN THE GENERATOR SET STARTING UP.**



Figure 18 Selecting Auto Mode







### 4.5.1.2 Selecting Manual Run Mode



**WARNING:** WHEN CHANGING MODES, THE GENERATOR SET MAY START OR STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START OR STOP WHEN CHANGING MODES.

To switch to Manual Run mode (see Figure 19).

1. Ensure that it is safe to do so before proceeding to change the mode.
2. Press the  Manual Run button on any of the Operator menus or the 'Establishing/Re-establishing Communication with Control' menus.
3. If the Mode Change Access Code menu is enabled, the Mode Change Access Code will be displayed. Enter the Mode Change Access Code as previously described (see Section 4.5.1).
4. A menu with alternating arrows is displayed above a second  symbol.
5. Press the second  Manual Run button, and the generator set will now begin the Manual start sequence. The Operator menu that was displayed before Manual Run mode was selected is re-displayed, but with the  symbol blacked out.

To disable Manual Run mode, press the Off button.







**Caution:** *Ensure that there is no danger to personnel or equipment when the generator set is started.*



**Note:** *Auto mode can also be selected whilst in Manual Run mode. Switching to Auto mode may result in the generator set shutting down.*

### 4.5.1.3 Aborting the Transition to Auto or Manual Run Mode

If the Mode Change Access Code menu or the menu showing alternating arrows above the  or  buttons is displayed, the transition to Auto or Manual Run mode is aborted when:

- Any of the , , or Off buttons are pressed.

Or

- A selection button is not pressed within ten seconds.

If the transition to Auto or Manual Run mode is aborted, the Operator menu that was displayed before Auto or Manual Run mode was selected is re-displayed.

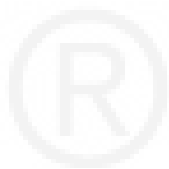
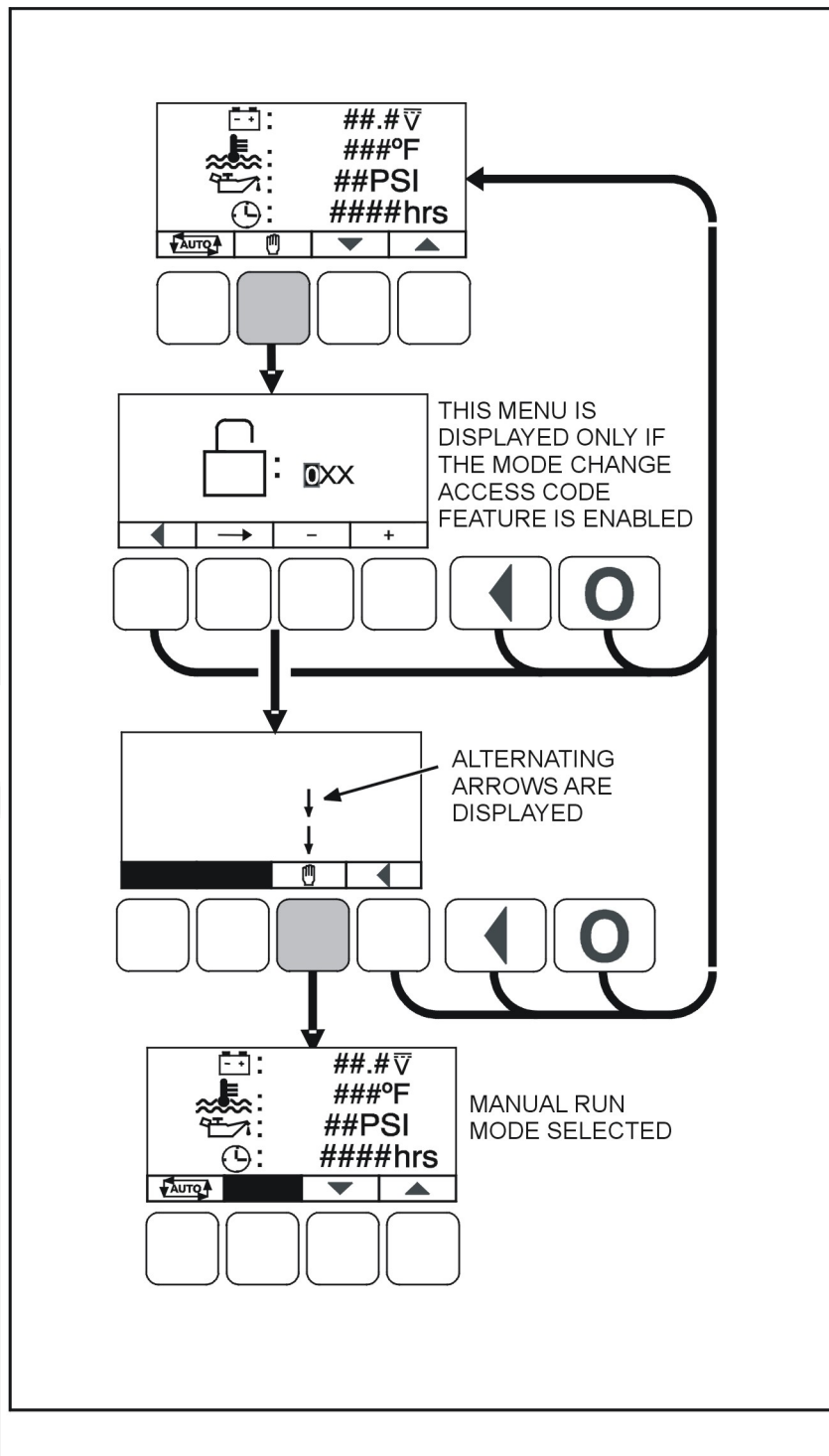




Figure 19 Selecting Manual Run Mode



#### 4.5.1.4 Selecting Off Mode



**WARNING:** WHEN CHANGING MODES, THE GENERATOR SET MAY STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET STOP WHEN CHANGING MODES.

To switch to Off mode (see Figure 20).

1. Ensure that it is safe to do so before proceeding to stop the set.
2. Press the Off button on any of the Operator menus or the 'Establishing/Re-establishing Communication with Control' menus.
3. If the Mode Change Access Code menu is enabled, the Mode Change Access Code will be displayed. Enter the Mode Change Access Code as previously described (see Section 4.5.1).
4. On entering the last, correct, digit, the basic screen will re-appear, and the set will stop without a Time Delay to Stop. Refer to Section 5.7.



**Caution:** Ensure that there is no danger to personnel or equipment if the generator set is stopped.

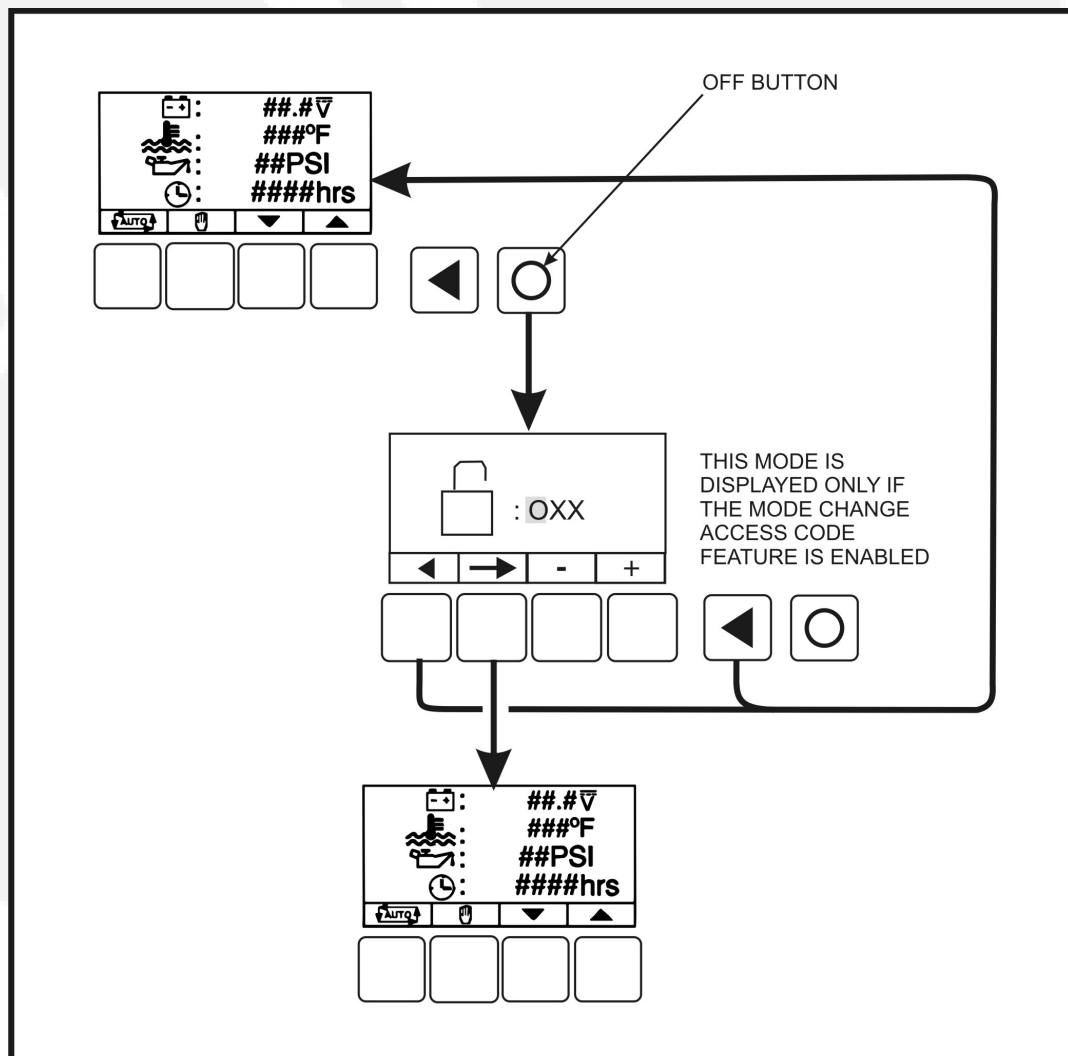


Figure 20 Selecting OFF Mode

## SECTION 5 – SYSTEM OPERATION

### 5. Operation

#### 5.1 Safety

Only suitably qualified and experienced personnel should carry out generator set operations. Before operating the system, the operator should become familiar with Section 1 of this manual – Preliminary and Safety Instructions, together with the Health and Safety Manual (0908-0110-00). Observe all of the WARNINGS and CAUTIONS at all times.



**WARNING: BEFORE OPERATING THE PLANT 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 PLANT IS OPERATED CORRECTLY.**



**WARNING: CONTACTING HIGH VOLTAGE COMPONENTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH BY ELECTROCUTION. DO NOT OPEN THE GENERATOR OUTPUT BOX WHILE THE GENERATOR SET IS RUNNING. READ AND OBSERVE ALL WARNINGS AND CAUTIONS IN YOUR GENERATOR SET MANUALS.**



*Caution: Only technically qualified personnel should open the control housing. Voltages are present which can cause electrical shock, resulting in personal injury. Even with the power removed, improper handling of components can cause electrostatic discharge and damage circuit board components.*

#### 5.2 Introduction

This section describes the operation of the generator set. The text should be read in conjunction with the System Overview and the Control System Sections of this manual, together with the Operator's specific engine manual supplied as part of the documentation pack. This latter manual will contain further information regarding the running and care of the generator set and also specific equipment instructions that may differ from the standard generator set.

All indicators, control switches/buttons, and graphical display are located on the face of the Control Panel as illustrated in Figure 6.

#### 5.3 Maintenance

To ensure maximum performance and reliability from your generator set it is essential that certain components are inspected periodically and, where necessary, maintenance procedures carried out as detailed in Section 6 – Maintenance.

## **5.4 Operating Recommendations**

### **5.4.1 Running –in**

Refer to the Maintenance section 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.

### **5.4.2 No Load Operation**

Periods of off-load operation should be held to a minimum. 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 heater element or load bank.

### **5.4.3 Exercise Period**

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

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

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

### **5.4.4 Low Operating Temperatures**

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins Power Generation Limited 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.

### **5.4.5 High Operating Temperatures**

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



## 5.4.6 Operating Conditions for Prime, Standby and Continuous Power Ratings



*Note: All generator sets supplied by The Company must be run under the following operating conditions.*

### 5.4.6.1 Continuous Power rating (COP) for constant load applications

The Continuous Power Rating 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 The Company Manuals. No sustained overload capability is available at this rating. This rating is applicable for utility base load operation. In these applications, generator sets are operated in parallel with a utility source and run under constant loads for extended periods of time.

### 5.4.6.2 Prime power rating

The prime power rating 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 The Company 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 3046-3:2006. Total operating time at the 10% overload power shall not exceed 25 hours per year.

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

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. Generators 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 will be reduced by constant high load operation. Any operation exceeding 750 hours per year at the prime power rating should use the Continuous Power Rating.

### 5.4.6.3 Standby power rating (for variable load applications)

The standby power rating 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 The Company 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 utilised as applicable.

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

#### 5.4.6.4 Notes applicable to all ratings

The following notes are applicable to all ratings, unless otherwise agreed by the Regional Sales Manager of The Company 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 shall be taken as 30% and time at standstill shall not be counted.
- Variable load is calculated in accordance with methods and formulae 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:
  - a) Ambient temperature — 27°C
  - b) Altitude above sea level — 150 metres
  - c) Relative humidity — 60%
  - d) Output power may be subject to de-rate if the above conditions are exceeded
- If any of the above conditions are not satisfied, the operational life of the generating set may be reduced.
- Short term parallel operation with the utility for load transfer purposes only is permitted with all ratings.

#### 5.4.7 De-Rating Factors

For de-rating factors applicable at specific sites please contact your authorised distributor.

## 5.5 Generator Set Operation

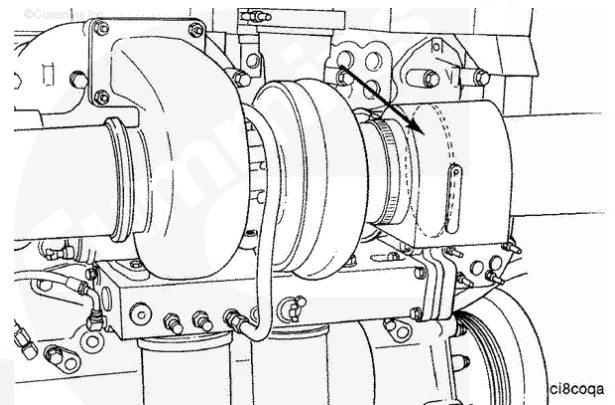
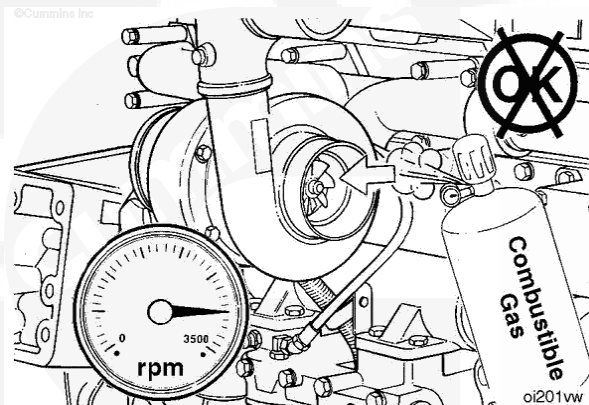
Correct care of your engine will result in longer life, better performance, and more economical operation.



**WARNING:** DO NOT OPERATE A DIESEL ENGINE WHERE THERE ARE OR CAN BE COMBUSTIBLE VAPOURS. THESE VAPOURS CAN BE SUCKED THROUGH THE AIR INTAKE SYSTEM AND CAUSE ENGINE ACCELERATION AND OVERSPEEDING, WHICH CAN RESULT IN A FIRE, AN EXPLOSION, AND EXTENSIVE PROPERTY DAMAGE. NUMEROUS SAFETY DEVICES ARE 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 ENGINE COMPANY, INC. DOES NOT KNOW HOW YOU WILL USE YOUR ENGINE. THE EQUIPMENT OWNER AND OPERATOR, THEREFORE, IS RESPONSIBLE FOR SAFE OPERATION IN A HOSTILE ENVIRONMENT. CONSULT YOUR CUMMINS AUTHORISED DISTRIBUTOR FOR FURTHER INFORMATION.



**Note:** Cummins Power Generation Limited recommends the installation of an air intake shutoff device or a similar safety device to minimise the risk of overspeeding where an engine will be operated in a combustible environment.



**Caution:** Do not idle the engine for excessively long periods. Long periods of idling (more than ten minutes) can damage an engine because combustion chamber temperatures drop so low the fuel will not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and can cause the valves to stick. If the engine coolant temperature becomes too low (60°C [140°F]), raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil. This will result in the moving parts of the engine not receiving the correct quality of lubrication.

## 5.5.1 Sequence of Operation

The generator set is run Automatically using a Remote Start signal, or Manually using the generator set control panel buttons. LEDs are provided on the display module front panel to indicate the operating run mode of the generator set. The PowerCommand®1.1 initiates a starter cranking signal and will perform 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 authorised 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 authorised personnel during the initial setup of the generator set.

## 5.6 Starting



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



**Caution:** *Do not use the Emergency Stop switch to shut down an engine unless a serious fault develops. The Emergency Stop push-switch 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.*



**Caution:** *Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. This loading will help to prevent the build up of carbon deposits in the injectors, due to unburnt fuel, and reduce the risk of fuel dilution of the engine lubricating oil. The engine must be shut down as soon as possible after the appropriate functions have been checked.*

Before attempting to start the generator set, the operator should read through this entire manual, together with the Health and Safety manual and the specific engine manual 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®1.1 control.

The following sub-sections 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®1.1 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.



**Note:** *The number of starting cycles, and the crank and rest times are set from within the Setup menu. Qualified service personnel are required to change the default setting. Contact your authorised distributor.*



## 5.6.1 Initial Pre-start Checks



**WARNING:** VOLTAGE PRESENTS SPECIAL HAZARDS OF SEVERE PERSONAL INJURY OR DEATH. EVEN AFTER GENERATOR SET SHUTDOWN AN ELECTRICAL SHOCK HAZARD MAY STILL EXIST, CAUSED BY INDUCED OR RESIDUAL VOLTAGE WITHIN THE ALTERNATOR OR CABLES. SERVICE PERSONNEL MUST BE WELL TRAINED/QUALIFIED TO WORK WITH DISTRIBUTION VOLTAGES.

Before starting, be sure competent personnel have made the following checks to ensure that the unit is ready for operation:

- Generator Set Grounding Procedure – This must be followed prior to performing service or inspection procedures that may expose personnel to conductors normally energized with voltages greater than 600 volts. Contact your authorised distributor.
- Megger and Insulation Testing – 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 Power Generation Limited. 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 authorised distributor.



**Caution:** *When Megger 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.*

- Lubrication - Check the engine lubrication oil level and ensure that the correct level is always maintained.



**Note:** *Generator sets may be shipped dry. They must be filled with the correct type and quantity of oil before use. Be sure to check oil level before initial start.*

- Coolant - Check the engine coolant level and ensure 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.



**Caution:** *It is essential that Cummins Power Generation Limited's recommendations for the correct type and concentration of anti-freeze and DCA inhibitor are complied with. Warranty claims for damage will be rejected if the incorrect mix has been used. Consult your authorised distributor for the correct anti-freeze specifications and concentration for your operating conditions.*



**Note:** *Some radiators have two fill necks, both of which must be filled when the cooling system has been drained.*



**Caution:** *Do not attempt to remove a radiator pressure cap while the generator is running, or is stationary but hot. Always allow it to cool before removing the cap.*



**Note:** *Generator sets may be shipped dry. They must be filled with the correct type and quantity of coolant before use. Be sure to check coolant level(s) before initial start.*

## 5.6.2 Operator's Pre-Start Checks



**WARNINGS: WINDINGS OF HIGH VOLTAGE, 601 TO 15,000 VOLTS, GENERATOR SETS MUST BE DRY BEFORE THE GENERATOR SET IS OPERATED. FAILURE TO ENSURE DRY WINDINGS BEFORE START-UP MAY RESULT IN CATASTROPHIC FAILURE, SEVERE PERSONAL INJURY OR DEATH.**

- Fuel Supply - Ensure that the fuel tank is filled to the normal level and that the fuel system is primed and all the valves required for operation are open. Ensure that there are no leaks and that all fittings are tight.
- Lubrication - Check the engine lubrication oil level and ensure that the correct level is always maintained.
- Coolant - Check the engine coolant level and ensure 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.



**Note:** *Some radiators have two fill necks, both of which must be filled when the cooling system has been drained.*



**Caution:** *Do not attempt to remove a radiator pressure cap while the generator is running, or is stationary but hot. Always allow it to cool before removing the cap.*

- Cooling Air Inlet/Outlets - Ensure that the cooling air inlets/outlets are unobstructed.
- Exhaust Outlet - Ensure that exhaust components are secured and not warped; that the exhaust outlet is unobstructed; that no combustible materials are near the system, and gases are discharged away from building openings. Ensure that there are no leaks and that all fittings are tight.
- Batteries – Ensure that the batteries are charged, that the electrolyte is at the correct level and that all connections are correct.
- Auxiliary AC Supplies - Ensure that all auxiliary equipment is receiving power from the customer's supply.
- Emergency Stop/Fire Detection Equipment - Ensure that all related equipment is fully operational.



### 5.6.3 Starting at Display Panel (Manual Run Mode)



**WARNING:** ENSURE THAT ALL PRE-START CHECKS ARE CARRIED OUT BEFORE STARTING THE GENERATOR SET. DO NOT ATTEMPT TO START THE GENERATOR UNTIL IT IS SAFE TO DO SO. WARN ALL OTHERS IN THE VICINITY THAT THE SET IS ABOUT TO START.




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



**Caution:** Do not use an Emergency Stop switch to shut down an engine unless a serious fault develops. The Emergency Stop push-switch 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 heat away from the engine combustion chamber and bearings in a safe manner.



**Caution:** Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. This loading will help to prevent the build up of carbon deposits in the injectors, due to unburnt fuel, and reduce the risk of fuel dilution of the engine lubricating oil. The engine must be shutdown as soon as possible after the appropriate functions have been checked.

To start the generator set in the Manual Run mode, select the  symbol from the menu bar of the display module front panel. Follow the instructions in Section 4.5.1.2 (Selecting Manual Run Mode).



**Note:** Any Remote Start/Stop signal is ignored whilst in Manual Run Mode.

The PowerCommand®1.1 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.

In the Manual Run mode the control will not complete the Time Delay to Start or Time Delay to Stop.

The Not in Auto red LED, and the Manual Run, green LED will be lit.


If the engine does not start, the starter will disengage after a specified period of time and the control will indicate a Fail to Start Shutdown.

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 Section 7 – Troubleshooting.

## 5.6.4 Starting from Remote Location ( Auto Mode)



**WARNING: ENSURE THAT ALL PRE-START CHECKS ARE CARRIED OUT BEFORE STARTING THE GENERATOR SET. DO NOT ATTEMPT TO START THE GENERATOR UNTIL IT IS SAFE TO DO SO. WARN ALL OTHERS IN THE VICINITY THAT THE SET IS ABOUT TO START.**

To start the generator set in the Auto Run mode, select the  symbol from the menu bar of the display module front panel. Follow the instructions in Section 4.5.1.1 (Selecting Auto Mode).

The Auto, green LED will be lit.

Only on receipt of a remote start signal, and after a Time Delay to Start, will the PowerCommand@1.1 initiate the starting sequence as above.

The Remote Start LED will be lit.

## 5.6.5 Cold Starting with Loads



**WARNING: ENSURE THAT ALL PRE-START CHECKS ARE CARRIED OUT BEFORE STARTING THE GENERATOR SET. DO NOT ATTEMPT TO START THE GENERATOR UNTIL IT IS SAFE TO DO SO. WARN ALL OTHERS IN THE VICINITY THAT THE SET IS ABOUT TO START.**

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins Power Generation Limited 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 Power Generation Limited recommends equipping diesel 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 Power Generation Limited 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).

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

## 5.7 Stopping



**Note:** *The access code may be required before initiating the Off button sequence. Refer to Section 4.5.*

### 5.7.1 Stopping at Display Panel (Manual Mode)

The module will not respond to any Remote Stop signal whilst in Manual Run Mode. When in Manual run mode, pressing the Off button will initiate a normal (Manual) shutdown sequence.

In the Manual Run mode the control will not complete the Time Delay to Stop.



**Note:** *Remove load and run set for five minutes to reduce engine heat before pressing the Off button.*

### 5.7.2 Stopping from Remote Location (Auto Mode)

In Auto mode, the control allows the generator set to be started with a Remote Start Signal only.

If the control receives a Remote Stop signal, the generator set will complete its normal shutdown sequence which includes a Time Delay Stop.


If the generator set is running in Auto mode and the Off button is pressed, the control immediately stops the generator set and the control transitions to the Off mode.

### 5.7.3 Emergency Stop (Code 1433 or 1434)

The Local Emergency Stop Button is situated on the front of the Control Panel. This is a mechanically latched switch that will unconditionally stop the engine when pressed, bypassing any time delay to stop. Push this button in for Emergency Shutdown of the engine.



**Note:** *If the engine is not running, pushing the button in 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 panel 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 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 Off button on the Display Module to acknowledge this action.
3. Press the Auto or Manual Run Button, as previously determined. (See Section 4.5).



**Caution:** *Do not use an Emergency Stop switch to shut down an engine unless a serious fault develops.*



**Note:** *Ensure the remote start control is not active or when the Emergency Stop is reset the generator set could start running.*



**Caution:** *Ensure that the cause of the emergency stop is fully investigated and remedied before a fault Reset and generator Start are attempted.*



**Note:** *An external Emergency Stop button is situated in close proximity to the control panel viewing window.*

## 5.8 Frequency Changing

Within the PowerCommand@1.1 Set-up menus is the option to select 50 or 60Hz running. The option to have this choice Password protected is determined at the initial setting up of the set.

The Volts and Hz menu is used to control the displaying of a further menu that allows for adjusting the generator set voltage and frequency settings.

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



**WARNING: ANY CHANGE TO THE FREQUENCY OR VOLTAGE SETTINGS MUST ONLY BE CARRIED OUT BY THE RENTAL FLEET OWNER.**

The Volts/Frequency menu is only viewable if the control is configured through the Genset Service Menus to display the Volts & Hz category.

When available, the Volts/Frequency menu can be viewed by pressing the (3) button on the second Service Menu.



**WARNING: ADJUSTING THE VOLTAGE AND FREQUENCY SETTINGS MUST ONLY BE DONE BY TECHNICALLY TRAINED AND EXPERIENCED SERVICE PERSONNEL. THE VOLTAGE AND FREQUENCY SETTINGS MUST ONLY BE ADJUSTED TO CORRESPOND TO THE PARAMETERS OF THE INSTALLED INPUT POWER SUPPLY. SAVING SETTINGS THAT DO NOT CORRESPOND TO THE POWER SUPPLY CAN CAUSE SEVERE PERSONAL INJURY AND EQUIPMENT OR PROPERTY DAMAGE.**

Refer to the Frequency Changing Manual specific to your Generator Set for further information.



## SECTION 6 – MAINTENANCE

### 6. Maintenance

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

Read, understand and comply with all Caution and Warning notes in this section, those contained within Section 1 - Preliminary and Safety, and those contained within the Health and Safety Manual (0908-0110-00). Refer also to the Operator's engine specific manual supplied as part of the generator set documentation pack. This latter manual will contain further information regarding the running and care of the generator set and also specific equipment instructions that may differ from the standard generator set.



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

*Caution: Maintenance must only be carried out by authorised and qualified maintenance engineers, who are familiar with the equipment and its operation.*



**WARNING: DEPENDENT UPON THE CONTROL SYSTEM FITTED, THIS UNIT MAY OPERATE AUTOMATICALLY AND COULD START WITHOUT WARNING.**



*Caution: Before carrying out any maintenance work, become familiar with the Generator Plant Safety Code given in Section 1 of this manual, together with the Health and Safety Manual (0908-0110-00).*



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



**WARNING: ACCIDENTAL STARTING OF THE GENERATOR SET WHILE WORKING ON IT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. PREVENT ACCIDENTAL STARTING BY DISCONNECTING THE STARTING BATTERY LEADS (NEGATIVE [-] FIRST).**

**ENSURE BATTERY AREA HAS BEEN WELL-VENTILATED BEFORE SERVICING THE BATTERY. SPARKS OR ARCING CAN IGNITE EXPLOSIVE HYDROGEN GAS GIVEN OFF BY BATTERIES, CAUSING SEVERE PERSONAL INJURY. ARCING CAN OCCUR WHEN LEADS ARE REMOVED OR REPLACED, OR WHEN THE NEGATIVE (-) BATTERY LEAD IS CONNECTED AND A TOOL USED TO CONNECT OR DISCONNECT THE POSITIVE (+) BATTERY LEAD 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 (-) LEAD FIRST AND RECONNECT LAST.**

**ENSURE HYDROGEN FROM THE BATTERY, ENGINE FUEL AND OTHER EXPLOSIVE FUMES ARE FULLY DISSIPATED. THIS IS ESPECIALLY IMPORTANT IF THE BATTERY HAS BEEN CONNECTED TO A BATTERY CHARGER.**



**WARNING: TO COMPLETE MAINTENANCE TASKS AT HEIGHT REFER TO LOCAL LEGISLATIVE REQUIREMENTS. 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:** DO NOT USE THE SKID (BEDFRAME) OR ANY PART OF THE GENERATOR SET AS A MEANS OF ACCESS. USE OF THE GENERATOR SET AS ACCESS MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH AND/OR PROPERTY AND EQUIPMENT DAMAGE.



**WARNING:** BEFORE CARRYING OUT ANY MAINTENANCE WORK, LOCK OFF FOR SAFE WORKING:

1. PRESS THE OFF MODE SWITCH ON THE GENERATOR SET CONTROL PANEL.
2. AS AN ADDITIONAL PRECAUTION, PRESS THE EMERGENCY STOP BUTTON, AND HOLD IN FOR 30 SECONDS.
3. ISOLATE ALL SUPPLIES TO THE GENERATOR SET.
4. ISOLATE THE BATTERY CHARGER.
5. DISCONNECT THE BATTERY.
6. REMOVE THE STARTER CONTROL WIRES.
7. A SUITABLE WARNING PLATE STATING 'MAINTENANCE IN PROGRESS' SHOULD BE DISPLAYED PROMINENTLY.



**WARNING:** SOME PANEL INTERNAL COMPONENTS MAY HAVE LIVE EXPOSED TERMINATIONS EVEN IF THE GENERATOR SET IS NOT RUNNING. ISOLATE (LOCK AND TAG) ALL EXTERNAL ELECTRICAL SUPPLIES PRIOR TO ACCESS OF THE CONTROL PANEL.

## 6.1 Locking the Generator Set Out of Service

### 6.1.1 Introduction

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



**Caution:** Refer also to the Operator's engine specific manual included in the documentation package supplied with the generator set. This manual will contain specific equipment instructions that may differ from the standard generator set.



**WARNING:** BEFORE CARRYING OUT ANY MAINTENANCE, ISOLATE ALL SUPPLIES TO THE GENERATOR SET AND ANY CONTROL PANELS. RENDER THE SET INOPERATIVE BY DISCONNECTING THE PLANT BATTERY.



**Caution:** If the engine has been running recently explosive gases (given off during battery charging) may be present in the vicinity of the batteries. Ensure the area is well ventilated before disconnecting batteries.

### 6.1.2 Immobilising the Generator Set for Safe Working




**Note:** Shutdown the engine first, as described in Section 5.7 - Stopping.

To immobilise the engine:

1. Press the Off Mode switch on the display panel.
2. Press the Emergency Stop Button, (and hold in for 30 seconds). This will prevent the starting of the generator set regardless of the Start signal source and will therefore provide an additional safety step for immobilising the generator set. (See also Section 5.7).



**Note:** When this Stop Button is pressed the display panel 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  
EMERGENCY STOP**



or  
**Fault Number: 1434**  
**REMOTE EMERGENCY STOP**



*Note: This Fault will affect the Fault History memory bank.*

3. As an additional precaution, thoroughly ventilate the plant room before disconnecting any leads.
4. Isolate and lock off the supply to the heater, where fitted.
5. Isolate and lock off the supply to the battery charger, where fitted.
6. Isolate the fuel supply to the engine.
7. Disconnect the starting batteries and control system batteries, (if separate). Disconnect the negative (-) lead first. Attach a padlock through one of the battery leads and tag for safe working.
8. Fit warning notices at each of the above points to indicate Maintenance in Progress - Plant Immobilised for Safe Working.

## 6.2 General

The maintenance procedures covered in this manual are intended for Operator-level service only and must be performed at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

Table 1 covers the recommended service intervals for a generator set on Standby service. If the generator set will be subjected to Prime usage or extreme operating conditions, the service intervals should be reduced accordingly. Consult your authorised distributor.

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

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

Consult with an authorised distributor if the generator set will be subjected to any extreme operating conditions and determine a suitable schedule of maintenance. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated, or after the number of operating hours indicated, whichever comes first. Use Table 1 to determine the maintenance required and then refer to the sections that follow for the correct service procedures.

Refer also to the Operator's engine manual supplied with the generator set.

Table 2 Periodic Maintenance Schedule

MAINTENANCE ITEMS		Daily or after 8 Hours	Weekly or after 50 Hours <sup>7</sup>	Monthly or after 100 Hours <sup>7</sup>	3 Months or after 250 Hours <sup>5, 7</sup>
<b>Perform maintenance tasks as specified using Daily or Hourly periods – whichever is the sooner</b>					
<b>Check:</b>	Fuel tank level	■			
	Fuel lines and hoses	■ <sup>1</sup>			
	Bedframe fluid containment (where fitted), drain if necessary	■ <sup>8</sup>			
	Engine oil level	■ <sup>1</sup>	■ <sup>6</sup>		
	Coolant level of radiator(s) (water jacket & LTA)	■ <sup>4</sup>			
	Coolant lines and radiator hoses for wear and cracks	■ <sup>1</sup>			
	Cooling fan blades	■			
	All exhaust components, and hardware (fittings, clamps, fasteners, etc.)	■ <sup>1</sup>			
	Drive belt, condition and tension		■ <sup>2</sup>		
	Air cleaner restriction indicator (where fitted)	■			
	Air intake system for leaks	■			
	Electrical connections (battery, starter motor and alternator connections)		■		
	Safety controls and alarms	■			
	Operation of Emergency Stop Button		■		
<b>Drain:</b>	Water from fuel pre-filter (where fitted)	■ <sup>3</sup>			
<b>Clean:</b>	Radiator matrix			■ <sup>4,5</sup>	

- 1 – Check for oil, fuel, coolant and exhaust system leaks. Check exhaust system audibly and visually with generator set running. (Refer to [Sections 6.8](#) and [6.9](#)).
- 2 – Visually check belt for evidence of wear or slippage. Replace if hard or brittle (to be undertaken by a Service Engineer).
- 3 – Drain one cup, or more, of fuel to remove water and sediment.
- 4 – Refer to Section 6.4 of this manual and to the Radiator Information Manual 0908-0107-00 supplied with this generator set.
- 5 – To be undertaken by a Service Engineer. Please refer to your Authorised Distributor.
- 6 – Engine oil and filter must be replaced after the initial running-in period of 50 hours. Please refer to your authorised distributor.
- 7 – All maintenance checks and inspections listed at lesser maintenance intervals must also be carried out at this time.
- 8 – For generator sets with QSB7 engines refer to Engine Operators manual for that model.

## 6.3 Daily or Refuelling Maintenance Procedures

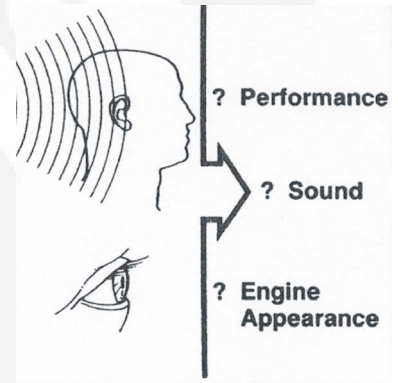
Monitor fluid levels, oil pressure, and coolant temperature frequently. During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. The following sections cover areas that must be frequently inspected for continued safe operation.

### 6.3.1 General Information

Preventative maintenance begins with day-to-day awareness of the condition of the generator set.

Before starting the generator set check the oil and coolant levels and look for:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine or generator set appearance.



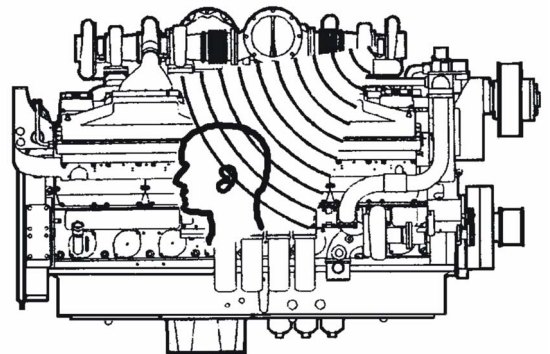
### 6.3.2 Engine Operation Report

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

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

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

- Low lubricating oil pressure
- Low power
- Abnormal water or oil temperature
- Unusual engine noise
- Excessive exhaust smoke
- Excessive use of coolant, fuel or lubricating oil
- Any coolant, fuel or lubricating oil leaks.
- Misfire
- Vibration



## 6.4 Cooling System



**WARNING:** CONTACT WITH HOT COOLANT CAN RESULT IN SERIOUS SCOLDING. ALLOW COOLING SYSTEM TO COOL BEFORE RELEASING PRESSURE AND REMOVING WATER JACKET RADIATOR CAP OR LTA EXPANSION TANK CAP.



**Caution:** Loss of coolant can allow engine to overheat without protection of shutdown device, and cause severe damage to the engine. Maintain coolant level for proper operation of high engine temperature shutdown system.

### 6.4.1 Coolant Level - Check



**WARNING:** DO NOT REMOVE THE RADIATOR CAP FROM A HOT ENGINE; WAIT UNTIL THE TEMPERATURE IS BELOW 50°C (122°F) BEFORE REMOVING PRESSURE CAP. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY FROM HEATED COOLANT SPRAY OR STEAM. REMOVE FILLER CAP SLOWLY TO RELEASE COOLANT SYSTEM PRESSURE.

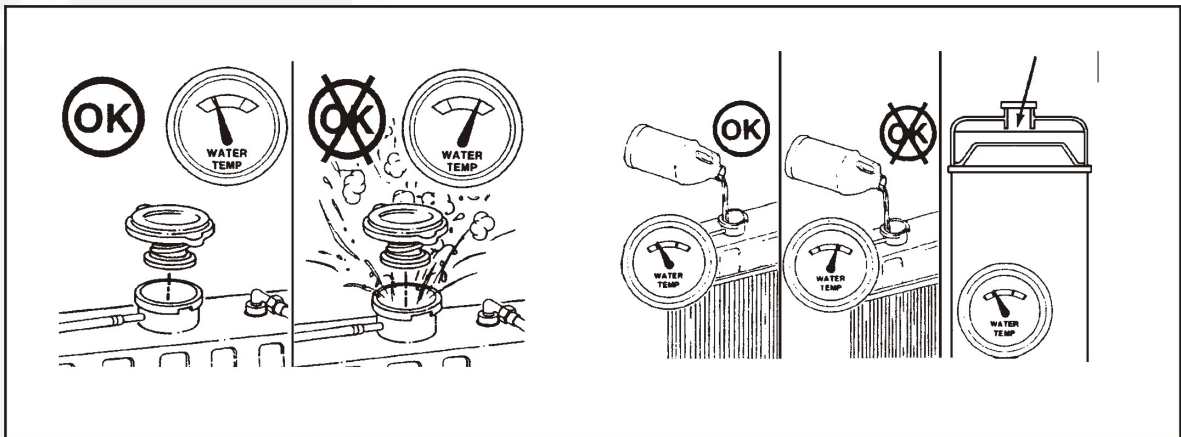


**Caution:** Avoid prolonged or repeated skin contact with antifreeze. Refer to the Health and Safety Manual 0908-0110-00 for handling and disposal of antifreeze.



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

Coolant level must be checked daily. The standard coolant concentration is either 25% or 50% Ethylene Glycol and water, this concentration must be maintained. Warranty claims for damage will be rejected if the incorrect mix of anti-freeze has been used. Consult your authorised distributor for the correct anti-freeze specifications and concentration for your operating conditions. The recommended antifreeze is Fleetguard® Compleat ES which is a low-silicate antifreeze, or its equivalent.



**Caution:** Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C (122°F) before adding coolant.



**Note:** On applications that use a coolant recovery system, check to ensure the coolant is at the appropriate level on the coolant recovery tank dependent on engine temperature.

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



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

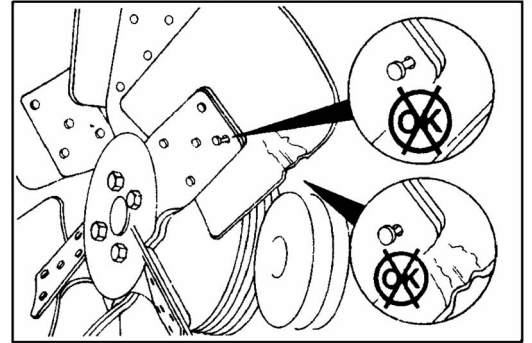
### 6.4.2 Cooling Fan - Inspect



**WARNING: PERSONAL INJURY CAN RESULT FROM A FAN BLADE FAILURE. NEVER PULL OR PRY ON THE FAN, THIS CAN DAMAGE THE FAN BLADE(S) AND CAUSE FAN FAILURE.**

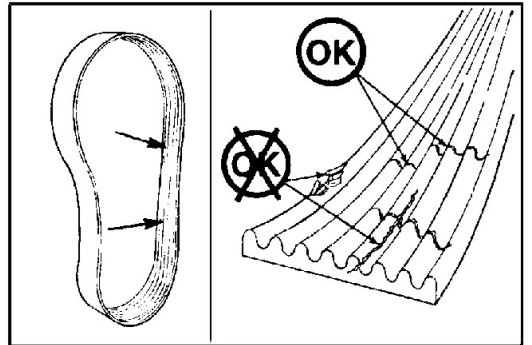
A visual inspection of the cooling fan is required daily. Check for cracks, loose rivets, and bent or loose blades. Check the fan to make sure it is securely mounted.

Contact your authorised distributor if the fan is damaged.



### 6.4.3 Drive Belt - Inspect

Visually inspect the belt through the guarding, checking for intersecting cracks. Small transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are NOT acceptable. Contact your authorised distributor if the belt is frayed or has pieces of material missing.

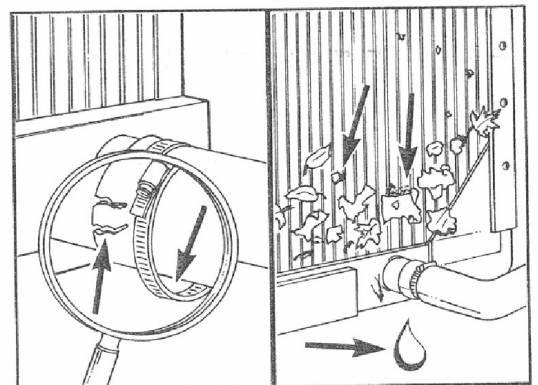


### 6.4.4 Radiator - Check

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 build up of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To ensure the continued efficiency of the radiator, the core will require cleaning.

Refer to the Radiator Information Manual 0908-0107-00 for further details on cleaning the radiator.



## 6.5 Engine Oil

### 6.5.1 Engine Oil Level – Check



**WARNING:** CRANKCASE PRESSURE CAN BLOW OUT HOT OIL AND CAUSE SEVERE BURNS. DO NOT CHECK OIL WHILE THE GENERATOR SET IS OPERATING.



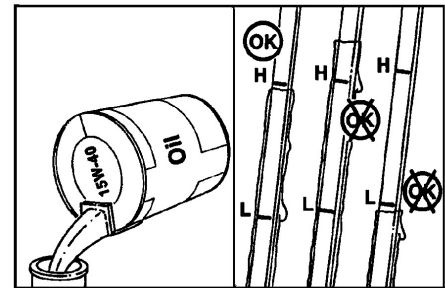
**Caution:** Do not operate the engine with the oil level below the low mark or above the high mark. Overfilling can cause foaming or aeration of the oil while operation below the low mark may cause loss of oil pressure.



**Caution:** Prolonged and repeated skin contact with used engine oils can cause skin disorders or other bodily injury.  
Refer to the Health and Safety Manual (0908-0110-00) supplied with your generator set for precautions when handling or disposing of used engine oil.

Check the engine oil level during engine shutdown periods at the intervals specified in the Maintenance Table 1.

Never operate the engine with the oil level below the L (Low) mark, or above the H (High) mark. Wait at least fifteen minutes, after shutting off the engine, before checking the oil level. This allows time for the oil to drain back to the oil pan.



**Note:** Use high-quality 15W-40 multi-viscosity lubricating oil such as Cummins Premium Blue® or its equivalent. Consult your authorised distributor for the correct lubricating oil for your operating conditions.



## 6.6 Fuel System



**WARNING:** 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:** ENGINE FUEL ACTUATORS CAN OPERATE AT VOLTAGES UP TO 140 VOLTS DC.



**WARNING:** DO NOT MIX GASOLINE OR ALCOHOL WITH DIESEL FUEL. THIS MIXTURE CAN CAUSE AN EXPLOSION AND DAMAGE TO THE ENGINE – GASOLINE AND ALCOHOL HAVE INFERIOR LUBRICITY.



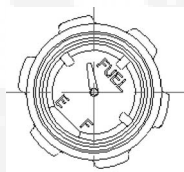
**Caution:** *Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the injection pump and the injection nozzles.*

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



**Note:** *A diesel fuel to BS 2869:2006; (Fuel oils for agricultural, domestic and industrial engine and boilers), conforming to the requirements and test methods of that specification would be an acceptable alternative to ASTM No. 2D.*

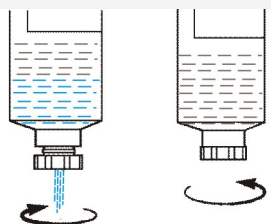
### 6.6.1 Fuel Level



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

A base fuel tank may be incorporated into the bedframe. This tank is fitted with a large filler cap with in-built coarse filter, and provides a minimum of eleven hours operation at a nominal 100% load.

### 6.6.2 Fuel/Water Separator - Drain



Drain the water and sediment from the separator daily.

Set-mounted fuel/water separators are fitted to provide protection for the engine fuel injection system as water-free fuel supplies cannot be guaranteed.

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

Push the valve up and turn the valve clockwise to close drain valve.



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



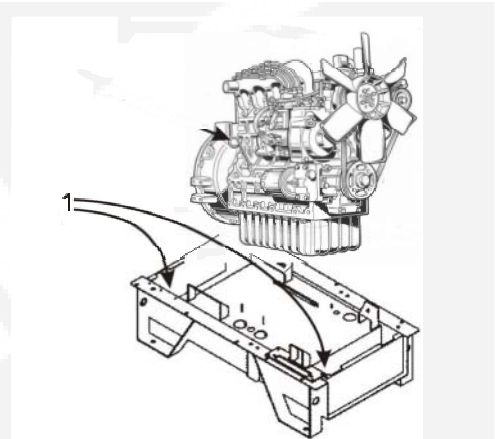
**Note:** *If more than 2 oz is drained, refilling of the filter is required to prevent hard starting.*

## 6.7 Fluid Containmentment

The bedframe fluid containment area (if applicable) must be inspected at regular intervals and any liquid must be drained off and disposed off in line with local health and safety regulations. (Refer also to Health and Safety manual 0908-0110-00). Failure to perform this action may result in spillage of liquids likely to contaminate the surrounding area.

### KEY

1. Containment Area



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

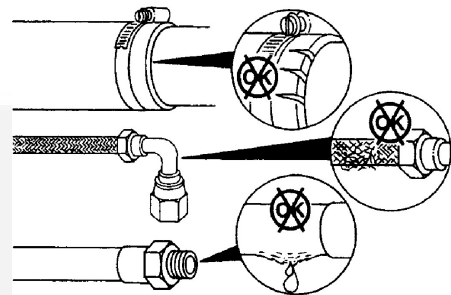
## 6.8 Hoses and Fuel Lines - Check



**WARNING: MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. USE EXTREME CAUTION AROUND HOT MANIFOLDS, MOVING PARTS, ETC..**

**TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT METAL PARTS SUCH AS RADIATOR, TURBOCHARGER AND EXHAUST SYSTEM.**

With the generator set operating, inspect the supply lines, return lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and ensure they are not rubbing against anything that could cause breakage. If any leaks are detected, shut down the generator set (if possible), contact your authorised distributor and have the leaks corrected immediately.





## 6.9 Exhaust System



**WARNING:** 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 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 CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. USE EXTREME CAUTION AROUND HOT MANIFOLDS, MOVING PARTS, ETC..

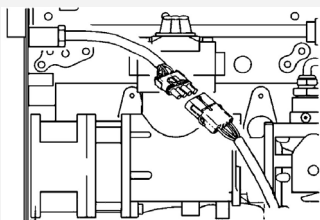
With the generator set operating, inspect the exhaust system visually and audibly where possible checking for leaks within the system, with out removing guarding and panels. If any leaks are detected, shut down the generator set, contact your authorized distributor and have the leaks corrected immediately.

## 6.10 Generator Set Output - AC Electric System

Check the following while the generator set is operating:

- Frequency: The generator set frequency should be stable and the reading should be the same as the generator set nameplate rating (50Hz/1500RPM or 60Hz/1800RPM).
- AC Voltage: At no load, the line-to-line voltage(s) 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.

## 6.11 DC Electrical System



ignite explosive battery gases.



**WARNING:** IGNITION OF EXPLOSIVE BATTERY GASES CAN CAUSE SEVERE PERSONAL INJURY. DO NOT SMOKE, DO NOT USE NAKED FLAMES OR CAUSE SPARKS WHILE SERVICING BATTERIES.

Refer to Supplementary Publication 0908-0101-00 for cleaning and safety precautions of the battery.

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## SECTION 7 – TROUBLESHOOTING

### 7. Troubleshooting

#### 7.1 Introduction

Fault codes information together with Warning and Shutdown information is provided in this section to assist in locating and identifying the possible causes of faults in the generator set system. Refer also to the Operator's engine specific manual supplied as part of the generator set documentation pack. This latter manual will contain further information regarding the running and care of the generator set and also specific equipment instructions that may differ from the standard generator set.

#### 7.2 Control Unit

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.

This section lists the Warning and Shutdown Fault Codes/Messages (Table 3), and suggests possible causes of the fault.



**Note:** *Displayed error codes that are not listed in Table 3 will require an authorised service representative to correct the fault. Contact an authorised service centre for assistance.*

## 7.3 Safety Considerations

Fault finding work, particularly in confined areas, should be carried out by two engineers working together. Read, understand and comply with all safety precautions listed within Section 1 – Preliminary and Safety – and observe all instructions and precautions throughout this manual, the Operator's engine specific manual, and the Health and Safety Manual (0908-0110-00).

The installation of a generator set can be designed for remote starting. When troubleshooting a generator set that is shutdown ensure that the set cannot be accidentally re-started. Refer to Section 6.2 – Locking the Generator Set out of Service.



**WARNING:** HIGH VOLTAGES ARE PRESENT WHEN THE GENERATOR SET IS RUNNING. DO NOT OPEN THE OUTPUT BOX WHILE THE GENERATOR SET IS RUNNING.



**WARNING:** SOME PANEL INTERNAL COMPONENTS MAY HAVE LIVE EXPOSED TERMINATIONS EVEN IF THE GENERATOR SET IS NOT RUNNING. ISOLATE ALL EXTERNAL ELECTRICAL SUPPLIES PRIOR TO ACCESS OF THE CONTROL PANEL.



**WARNING:** CONTACTING HIGH VOLTAGE COMPONENTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH BY ELECTROCUTION. KEEP THE OUTPUT BOX COVERS IN PLACE DURING TROUBLESHOOTING. ONLY PERSONNEL QUALIFIED TO PERFORM ELECTRICAL SERVICING SHOULD CARRY OUT TESTING AND/OR ADJUSTMENTS.



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



**WARNING:** VENTILATE BATTERY AREA BEFORE WORKING ON OR NEAR BATTERY – WEAR GOGGLES – STOP GENERATOR SET AND DISCONNECT CHARGER BEFORE DISCONNECTING BATTERY CABLES – DISCONNECT NEGATIVE(-) CABLE FIRST AND RECONNECT LAST.



**WARNING:** IGNITION OF EXPLOSIVE BATTERY GASES CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ARCING AT BATTERY TERMINALS, LIGHT SWITCH OR OTHER EQUIPMENT, FLAME, PILOT LIGHTS AND SPARKS, CAN IGNITE BATTERY GAS. DO NOT SMOKE, OR SWITCH INSPECTION LIGHT ON OR OFF NEAR BATTERY. DISCHARGE STATIC ELECTRICITY FROM BODY BEFORE TOUCHING BATTERIES BY FIRST TOUCHING A GROUNDED METAL SURFACE.



**WARNING:** ACCIDENTAL STARTING OF THE GENERATOR SET WHILE WORKING ON IT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. PREVENT ACCIDENTAL STARTING BY DISCONNECTING THE STARTING BATTERY LEADS (NEGATIVE [-] FIRST).

## 7.4 Fault Finding

Should a fault condition occur during operation follow the procedures in the following tables to locate and correct the problem. For any symptom not listed, contact an authorised service centre 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
- The fuel oil level is correct
- The lubricating oil level is correct
- The coolant level is correct
- The radiator matrix is free from obstruction
- The battery charge condition is satisfactory and the connections are secure
- The generator set electrics and alternator connections are secure
- The panel connections are secure
- The protection circuits have been reset
- Blown fuses have been replaced
- Tripped contactors or circuit breakers have been reset



**WARNING:** MANY 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 WITHIN SECTION 1 - PRELIMINARY AND SAFETY SECTION - OF THIS MANUAL TOGETHER WITH THE HEALTH AND SAFETY MANUAL (0908-0110-00).

## 7.5 Status Indicators

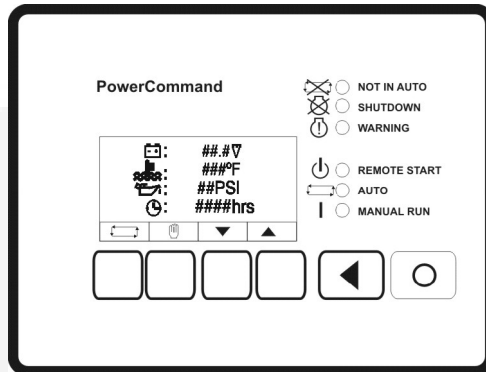


Figure 21 Display Module – Front Panel

### Not in Auto

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

### 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.



*Note:* When Battle Short mode has been enabled and an overridden shutdown fault occurs, the Shutdown lamp will be lit even though the generator set will continue to run.


### Warning

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


### Remote Start

This green lamp indicates the control is receiving a remote run signal.

### Auto

This green lamp indicates the control is in Auto mode. Auto mode can be selected by pressing the  selection button from any of the Operator menus (see Section 4.5).

### Manual Run

This green lamp indicates the control is in the Manual Run mode. Manual Run can be selected by pressing the  selection button from any of the Operator menus (see Section 4.5).

## 7.6 Fault/Status Codes



**WARNING:** MANY 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. ACCIDENTAL STARTING OF THE GENERATOR SET WHILE WORKING ON IT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. PREVENT ACCIDENTAL STARTING BY DISCONNECTING THE STARTING BATTERY LEADS (NEGATIVE [-] FIRST).

The fault codes have been divided into five categories to help you determine what corrective action to take for safe operation of the generator set. Use Table 3 to find the category (CTG) and fault description for all codes.



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

### Category A Fault Codes:

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

### Category B Fault Codes:

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

### Category C Fault Codes:

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

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



*Caution:* Continued operation may void generator set warranty if damage occurs that relates to fault condition.












### Category D Fault Codes:

Consist of faults that are repairable by site personnel. Service will be required by trained and experienced service personnel if site personnel cannot resolve the problem after taking the corrective actions suggested in Table 4.













### Category E Fault Codes:










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











Table 3 Fault Codes








CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
A	121	Shutdown	SPEED SIGNAL LOST	 121	Indicates that no magnetic pickup pulses were sensed for a Loss of Speed delay. If a magnetic pickup is disabled, this fault is not activated.
B	135	Warning	OIL PRESS SENSOR OOR HIGH	 135	Indicates the oil pressure sensor output is out of range (OOR), high.
C	141	Warning	OIL PRESS SENSOR OOR LOW	 141	Indicates the oil pressure sensor output is out of range (OOR), low.
B	143**	Warning	PRE-LOW OIL PRESSURE	 143	Indicates the engine oil pressure is approaching an unacceptable level.
C	144	Warning	COOLANT SENSOR OOR LOW	 144	Indicates the coolant temperature sensor output is out of range (OOR), low.
C	145	Warning	COOLANT SENSOR OOR HIGH	 145	Indicates the coolant temperature sensor output is out of range (OOR), high.
C	146**	Warning	PRE-HIGH COOLANT TEMP	 146	Indicates that the engine is operating near cooling system capacity. Increase in load or higher ambient temperature may cause High Coolant Temp (code 151) shutdown.
D	151**	Shutdown	HIGH COOLANT TEMP	 151	Indicates that the engine coolant temperature is above normal and has reached the Shutdown trip point.
C	153	Warning	INTAKE MANIFOLD TEMP OOR HIGH	 153	Indicates that the intake manifold temperature sensor is out of range (OOR), high.
C	154	Warning	INTAKE MANIFOLD TEMP OOR LOW	 154	Indicates that the intake manifold temperature sensor is out of range (OOR), low.
D	155	Shutdown	INTAKE MANIFOLD TEMP HIGH	 155	Indicates that the intake manifold temperature sensor is above normal and has reached the shutdown trip point.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  ^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					

























CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
C	195	Warning	COOLANT LEVEL OOR HIGH	 195	Indicates that a sensor on the radiator has detected that the coolant level is out of range (OOR), high.
C	196	Warning	COOLANT LEVEL OOR LOW	 196	Indicates that a sensor on the radiator has detected that the coolant level is out of range (OOR), low.
D	197	Warning	COOLANT LEVEL LOW	 197	Indicates that a sensor on the radiator has detected that the coolant level is below normal.
A	234**	Shutdown	OVERSPEED	 234	Indicates that the engine has exceeded normal operating speed. The default thresholds are 1725 RPM (50Hz) or 2075 RPM (60Hz).
A	285	Shutdown	ECM PGN TIMEOUT	 285	Datalink failure. PowerCommand®1.1 control not responding to the engine control module.
A	286	Shutdown	ECM CONFIGURABLE ERROR	 286	Indicates an engine control module configuration error – out of calibration,
D	359	Shutdown	FAIL TO START	 359	The system has failed to start after a set number of crank attempts. This indicates a possible fuel system or air induction problem (engine cranks but fails to start).
A	415**	Shutdown	LOW OIL PRESSURE	 415	Indicates the engine oil pressure has dropped below normal and has reached the shutdown trip point.
C	421^	Shutdown	OIL TEMP HIGH	 421	Indicates the engine oil temperature is above normal and has reached the shutdown trip point. (I/O Module option).
B	425^	Shutdown	OIL TEMP OOR	 425	Indicates the engine oil temperature output is out of range (OOR). High or low. (I/O Module option).
A	426	Shutdown	DATA LINK ERROR	 426	Datalink failure. No communications between the PowerCommand®1.1 control and the engine control module.
A	427**	Warning	CAN LINK LOST	 427	Datalink fault. Indicates that important data was lost between the PowerCommand®1.1 control and the engine control module.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  ^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					








CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
D	441**	Warning	LOW BATTERY	 441	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation can occur.
D	442**	Warning	HIGH BATTERY	 442	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur.
D	488^	Shutdown	INTAKE MANIFOLD TEMP HIGH	 488	Indicates that the intake manifold temperature is above normal and has reached the shutdown trip point. (I/O Module option).
A	689	Shutdown	ENGINE SPEED ERRATIC	 689	Indicates a fault condition in the engine crankshaft sensor circuit.
A	781	Shutdown	CAN LINK LOST	 781	Datalink failure. No communications between the PowerCommand®1.1 control and the engine control module
D	1117	Warning	ECM POWER LOST	 1117	Indicates battery voltage supply to the engine control module was lost.
B	1123*	Shutdown	SHUTDOWN AFTER BS	 1123	A shutdown fault occurred while the Battle Short mode was enabled.
D	1131*	Warning	BATTLE SHORT ACTIVE	 1131	Indicates that the control is in Battle Short mode – used to bypass several fault shutdowns for generator set operation during emergencies.
C	1246	Warning	GENERIC ENGINE FAULT	 1246	Engine control fault code not recognised by the PowerCommand®1.1 control.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  ^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					









CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
E	1311	Configurable	Customer Fault Input 1	 1311	The nature of the fault is an optional customer selection.
E	1312	Configurable	Customer Fault Input 2	 1312	The nature of the fault is an optional customer selection.
E	1317	Configurable	Customer Fault Input 3	 1317	The nature of the fault is an optional customer selection.
E	1318	Configurable	Customer Fault Input 4	 1318	The nature of the fault is an optional generator set input.
B	1416*	Warning	FAIL TO SHUTDOWN	 1416	Indicates that a shutdown fault is active, but is being bypassed by Battle Short.
A	1417	Shutdown	FAILURE TO POWER DOWN	 1417	Indicates the control is powered up after attempting to go to sleep.
D	1433	Shutdown	LOCAL EMERGENCY STOP	 1433	Indicates a Local Emergency Stop has been activated.
D	1434	Shutdown	REMOTE EMERGENCY STOP	 1434	Indicates a Remote Emergency Stop has been activated.
D	1435**	Warning	LOW COOLANT TEMP	 1435	Indicates that the engine coolant temperature is below the adjusted setpoint. This may indicate that the coolant heater is not operating or is not circulating coolant.
D	1438	Shutdown	FAIL TO CRANK	 1438	The generator set has failed to sense rotation for two start attempts. This indicates a possible fault with the control, speed sensing, or the starting system.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					

CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
D	1442**	Warning	WEAK BATTERY	 1442	Indicates that the generator set battery voltage is below battery thresholds during cranking.
A	1446**	Shutdown	HIGH AC VOLTAGE	 1446	Indicates that one or more measured AC output voltages have exceeded the threshold for longer than a specified time limit. The threshold and time limits are 130% of nominal for zero seconds or 110% of nominal for ten seconds.
A	1447**	Shutdown	LOW AC VOLTAGE	 1447	Indicates that the measured AC output voltage is below the threshold for longer than a specified time limit. The threshold and time limits are 85% of nominal for ten seconds.
A	1448**	Shutdown	UNDER FREQUENCY	Hz ↓ 1448	Indicates that the alternator frequency is 6 Hertz under the nominal frequency.
A	1449**	Shutdown	OVER FREQUENCY	Hz ↑ 1449	Indicates that the alternator frequency is 6 Hertz above the nominal frequency.
A	1469**	Shutdown	SPEED HZ MATCH	$N \neq \text{HZ}$ 1469	Indicates that measured engine speed and measured alternator AC output frequency do not agree.
B	1471**	Warning	HIGH AC CURRENT	 1471	Indicates that the alternator output current (one or more phases) has exceeded safe operating limits.
A	1472**	Shutdown	HIGH AC CURRENT	 1472	Indicates that the alternator output current (one or more phases) has exceeded the alternator's current rating.
C	1845	Warning	WATER IN FUEL OOR HIGH	 1845	Indicates the water in fuel sensor is out of range (OOR), high.
C	1846	Warning	WATER IN FUEL OOR LOW	 1846	Indicates the water in fuel sensor is out of range (OOR), low.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  ^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					

CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
D	1852	Warning	WATER IN FUEL	 1852	Indicates that the water in fuel is above normal and has reached the warning trip point.
E	1853	Configurable	Annunciator Fault 2	 1853	The nature of the annunciator fault is an optional customer selection.
E	1854	Configurable	Annunciator Fault 3	 1854	The nature of the annunciator fault is an optional customer selection.
E	1855	Configurable	Annunciator Fault 1	 1855	The nature of the annunciator fault is an optional customer selection.
E	1944	Warning	ANNUNCIATOR OUTPUT CONFIGURATION ERROR	 1944	Indicates a mismatch in the configuration of one of the annunciator relay outputs.
D	1965 <sup>^</sup>	Warning	EXHAUST TEMPERATURE OOR	 1965	Indicates the exhaust temperature sensor is out of range (OOR), high or low. (Aux 101 I/O option).
B	1992	Warning	ENGINE OVERSPEED	 1992	Indicates that the engine has exceeded normal operating speed. The default thresholds are 1725 RPM (50Hz) or 2075 RPM (60Hz). (ECM fault code).
C	2224 <sup>^</sup>	Warning	FUEL LEVEL OOR	 2224	Indicates the fuel level sensor is out of range (OOR), high or low. (Aux 101 I/O option).
A	2335	Shutdown	EXCITATION FAULT	 2335	Indicates that a loss of voltage or frequency sensing from the generator has occurred.
C	2398 <sup>^</sup>	Warning	AMBIENT TEMPERATURE OOR	 2398	Indicates the ambient temperature sensor is out of range (OOR), high or low. (Aux 101 I/O option).
C	2542 <sup>^</sup>	Warning	VOLTAGE BIAS OOR	 2542	Indicates the voltage bias circuit output is out of range (OOR), high or low. (Aux 101 I/O option).
A	2545	Shutdown	KEYSWITCH RESET REQUIRED	 2545	Indicates a datalink failure. Communications are lost between the PowerCommand®1.1 control and the engine control module.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  <sup>^</sup> These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					

CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
E	2619^	Diagnostic	AUX 101 ANALOG INPUT 1	 2619	The nature of the Base I/O Module event is an optional customer selection. (Aux 101 I/O Module option). Each event function can be programmed (using InPower service tool or access to the Setup menu), as follows: a) Change display name using up to 32 characters b) Select active low or high input.
E	2621^	Diagnostic	AUX 101 ANALOG INPUT 2	 2621	See code 2619
E	2622^	Diagnostic	AUX 101 ANALOG INPUT 3	 2622	See code 2619
E	2623^	Diagnostic	AUX 101 ANALOG INPUT 4	 2623	See code 2619
E	2624^	Diagnostic	AUX 101 ANALOG INPUT 5	 2624	See code 2619
E	2625^	Diagnostic	AUX 101 ANALOG INPUT 6	 2625	See code 2619
E	2626^	Diagnostic	AUX 101 ANALOG INPUT 7	 2626	See code 2619
E	2627^	Diagnostic	AUX 101 ANALOG INPUT 8	 2627	See code 2619
E	2628^	Diagnostic	AUX 102 DIGITAL INPUT 9	 2628	The nature of the Aux I/O Module event is an optional customer selection. (Aux 102 I/O Module option). Each event function can be programmed (using InPower service tool or access to the Setup menu), as follows: a) Change display name using up to 32 characters b) Select active low or high input.
E	2629^	Diagnostic	AUX 102 DIGITAL INPUT 10	 2629	See code 2628
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  ^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					

CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
E	2631 <sup>^</sup>	Diagnostic	AUX 102 DIGITAL INPUT 11	 2631	See code 2628
E	2632 <sup>^</sup>	Diagnostic	AUX 102 DIGITAL INPUT 12	 2632	See code 2628
A	2676	Shutdown	ALTERNATOR FREQUENCY CONFLICT	HZ≠HZ 2676	Indicates the measured alternator line frequency and measured alternator excitation frequency do not agree.
A	2677	Shutdown	FAIL TO STOP	 2677	The generator set continues to run after receiving a stop command from the controller.
B	2678 <sup>**</sup>	Warning	CHARGER FAILURE	 2678	Indicates the battery charging alternator has not reached an acceptable voltage range within the selected time period (default is 120 seconds). This warning is also displayed if your alternator is a type that does not support the control's charging alternator logic functionality. If this occurs, this warning can be disabled if the Charging Alt. Enable setting is set to "No".
C	2693 <sup>^</sup>	Warning	SPEED BIAS OOR	 2693	Indicates the speed bias circuit output is out of range (OOR), high or low. (Aux 101 I/O Module option).
C	2694 <sup>^</sup>	Warning	ALTERNATOR RTD OOR	 2694	Indicates the alternator RTD sensor is out of range (OOR), high or low. (Aux 101 I/O Module option).
A	2696 <sup>^</sup>	Shutdown	ALTERNATOR RTD TEMP HIGH	 2696	Indicates the alternator temperature is above normal and has reached the shutdown trip point. (I/O Module option).
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.  ** Any values listed in the Description column for these faults are default values.  <sup>^</sup> These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					

CTG	CODE	LAMP	DISPLAYED MESSAGE/SYMBOLS		DESCRIPTION
			TEXT VERSION	SYMBOLIC VERSION	
C	2729 <sup>^</sup>	Warning	I/O MODULE LOST	 2729	Indicates an intermittent datalink between the I/O module and the control board. (Aux 101 I/O Module option).
C	2731	Shutdown	I/O MODULE LOST	 2731	Indicates the datalink between the I/O module and the control board is lost. (Aux 101 I/O Module option).
A	2897	Shutdown	FACTORY BLOCK CORRUPT	 2897	Indicates a fatal software error occurred in the PowerCommand®1.1 control.
A	2898	Warning	PERIODIC/FAULT CORRUPT	 2898	Indicates that either the periodic data file or the fault history file has been corrupted. Remove and re-apply power to the control to clear the fault. (Periodic and/or fault history data will be lost after re-setting the control).
A	2899	Shutdown	USER BLOCK CORRUPT	 2899	Indicates a fatal software error occurred in the PowerCommand®1.1 control.
A	2911	Shutdown	TRIM BLOCK CORRUPT	 2911	Indicates a fatal software error occurred in the PowerCommand®1.1 control.
D	2964	Warning	INTAKE MANIFOLD TEMPERATURE HIGH	 2964	Indicates engine has begun to overheat (intake manifold temperature has risen to an unacceptable level). Increase in load or higher ambient temperature may cause Intake Manifold Temp High (code 155) shutdown.
A	2972 <sup>**</sup>	Shutdown	FIELD OVERLOAD	 2972	Indicates that the Field Voltage has been above 70V for eight seconds.
<p>* For more information on these events, refer to the Battle Short Mode description in Section 4.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p><sup>^</sup> These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>					



## 7.6.1 Customer Input Faults

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

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

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

Table 4 Troubleshooting Procedures for Fault Codes

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>143</b> <b>Warning</b> <b>PRE-LOW OIL PRESSURE</b>	Indicates engine oil pressure has dropped below the warning trip point. If generator is powering critical loads and cannot be shut down, wait until next shutdown period and then follow the fault code 415 procedure.
CODE: LAMP: MESSAGE:	<b>146</b> <b>Warning</b> <b>PRE-HIGH COOL TEMP</b>	Indicates engine is operating near cooling system capacity. Increase in load or higher ambient temperature may cause High Coolant Temp (151) shutdown. Review fault code 151 correction list for other possible causes.
CODE: LAMP: MESSAGE:	<b>151</b> <b>Shutdown</b> <b>HIGH COOLANT TEMP</b>	Indicates engine has overheated (coolant temperature has risen above the shutdown trip point). Allow engine to cool down completely before proceeding with the following checks: a) Look for possible coolant leakage points and repair if necessary. Check coolant level and replenish if low b) Check for obstructions to cooling airflow and correct as necessary c) Check fan belt and repair or tighten if necessary d) Check blower fan and circulation pumps on remote radiator installations e) Reset control and restart after locating and correcting problem.
CODE: LAMP: MESSAGE:	<b>155</b> <b>Shutdown</b> <b>INTAKE MANIFOLD TEMP HIGH</b>	Indicates engine has overheated (intake manifold temperature has risen above the shutdown trip point). Large load or high ambient temperature may be the cause. Review fault code 151 correction list for other possible causes.
CODE: LAMP: MESSAGE:	<b>197</b> <b>Warning</b> <b>COOLANT LEVEL LOW</b>	Indicates engine coolant level has fallen below the trip point. If generator is powering critical loads and cannot be shut down, wait until next shutdown period. If engine can be stopped allow engine to cool down completely before proceeding: a) Look for possible coolant leakage points and repair if necessary. Check coolant level and replenish if low b) Reset control and restart after locating and correcting problem.

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>359</b> <b>Shutdown</b> <b>Fail to Start</b>	Indicates possible fuel system or air induction problem. (Engine cranks but fails to start). Allow engine to cool down completely before proceeding with the following checks: a) Check for empty fuel tank, fuel leaks, or blocked fuel lines and correct as required b) Check for dirty fuel filter and replace if necessary c) Check for dirty or blocked air filter and replace if necessary d) Reset control and restart after correcting the problem.
CODE: LAMP: MESSAGE:	<b>415</b> <b>Shutdown</b> <b>LOW OIL PRESSURE</b>	Indicates engine oil pressure has dropped below the shutdown trip point. Allow engine to cool down completely before proceeding with the following checks: a) Check the oil level, lines and filters b) If the oil system is OK but the oil level is low, replenish c) Reset control and restart after locating and correcting problem.
CODE: LAMP: MESSAGE:	<b>441</b> <b>Warning</b> <b>LOW BAT VOLTAGE</b>	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation will occur. If engine can be stopped allow engine to cool down completely before proceeding: a) Poor battery cable connections. Clean the battery cable terminals and tighten all connections b) Check battery charge voltage float level if applicable (raise float level) c) Discharged or defective battery Check the battery charger fuse Recharge or replace the battery.
CODE: LAMP: MESSAGE:	<b>442</b> <b>Warning</b> <b>HIGH BAT VOLTAGE</b>	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur. If engine can be stopped allow engine to cool down completely before proceeding: a) Poor battery cable connections. Clean the battery cable terminals and tighten all connections b) Check battery charge float level if applicable (lower float level).
CODE: LAMP: MESSAGE:	<b>488</b> <b>Shutdown</b> <b>INTAKE MANIFOLD TEMP HIGH</b>	Indicates engine has overheated (intake manifold temperature has risen above the shutdown trip point). Large load or high ambient temperature may be the cause. Review fault code 151 correction list for other possible causes.

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>1117</b> <b>Warning</b> <b>ECM POWER LOST</b>	Indicates that 'Keyswitch' to the ECM was NOT removed for 30 seconds before removing battery power to the ECM (removing battery cable). To reset: a) Press the Off button and press Emergency Stop button and wait for 30 seconds b) Re-set Emergency Stop and select operating mode (manual or remote).
CODE: LAMP: MESSAGE:	<b>1131</b> <b>Warning</b> <b>BATTLE SHORT ACTIVE</b>	Indicates that the control is in Battle Short mode – used to bypass several fault shutdowns therefore allowing generator set operation during emergencies.
CODE: LAMP: MESSAGE:	<b>1311, 1312, 1317, 1318</b> <b>Configurable</b> <b>CONFIGURABLE INPUT 1, 2, 3, 4</b>	The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using InPower service tool or access to Setup menu), as follows: a) Event , Warning or Shutdown level if Function Select = Fault Input b) Change display name using up to 32 characters
CODE: LAMP: MESSAGE:	<b>1416</b> <b>Warning</b> <b>FAIL TO SHUTDOWN</b>	The generator set continues to run after receiving a shutdown command from the controller. The Battle Short feature is enabled – this is used to bypass several critical fault shutdowns therefore allowing generator set operation during emergencies.
CODE: LAMP: MESSAGE:	<b>1433/1434</b> <b>Shutdown</b> <b>E-STOP - LOCAL</b> <b>E-STOP - REMOTE</b>	Indicates local or remote Emergency Stop. Emergency Stop shutdown status can be reset only at the local control panel. After locating and correcting problem, reset the local/remote Emergency Stop button as follows: a) De-activate (disable) emergency stop button b) Press the O (Off) button c) Select the desired operating mode (manual or remote).

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>1435</b> <b>Warning</b> <b>LOW COOLANT TEMP</b>	Indicates engine coolant heater is not operating or is not circulating coolant. If engine can be stopped allow engine to cool down completely before proceeding with the following checks: a) The coolant heater not connected to power supply. Check for blown fuse or disconnected heater cable and correct as required b) Look for possible coolant leaks and repair as required Check for low coolant level and replenish if required.  Set is not operating. Warning occurs when engine coolant temperature is 21°C (70°F) or lower. <b>NOTE: In applications where the ambient temperature falls below 4°C (40°F), Low Coolant Temp may be indicated even though the coolant heaters are operating.</b>
CODE: LAMP: MESSAGE:	<b>1438</b> <b>Shutdown</b> <b>FAIL TO CRANK</b>	Indicates a possible fault with control, speed sensing, or starting system. See code 441 for corrective action.
CODE: LAMP: MESSAGE:	<b>1442</b> <b>Warning</b> <b>WEAK BATTERY</b>	Indicates that during cranking, the battery voltage is at, or below, the weak battery warning trip point for a time greater than, or equal to, the weak battery set time. See code 441 for corrective action
CODE: LAMP: MESSAGE:	<b>1448</b> <b>Shutdown</b> <b>UNDER FREQUENCY</b>	Indicates that the generator set frequency has dropped below 90% of nominal for approximately ten seconds. Allow engine to cool down completely before proceeding with the following checks: a) Check the fuel supply b) Check the air intake supply c) Check the load and correct any overload.
CODE: LAMP: MESSAGE:	<b>1852</b> <b>Warning</b> <b>WATER IN FUEL</b>	Indicates that the water in the fuel is above normal and has reached the warning trip point. If engine can be stopped allow engine to cool down completely before proceeding with the following checks: a) Check fuel in tank (local or remote) b) Drain and re-fill if necessary c) Be aware of all Health and Safety, and environmental issues if draining tank.
CODE: LAMP: MESSAGE:	<b>2964</b> <b>Warning</b> <b>HIGH INTAKE MANIFOLD TEMP</b>	Indicates engine is operating near system capacity. Increase in load or high ambient temperature may cause High Intake Manifold Temperature (155) shutdown. If engine can be stopped allow engine to cool down completely before proceeding with the following checks: Review fault code 151 correction list for other possible causes.



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