



Operator Manual

Our energy working for you.™



Generator Set with PowerCommand® Control PCC2100

GGPA (Spec A)

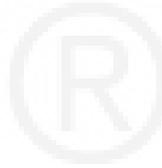
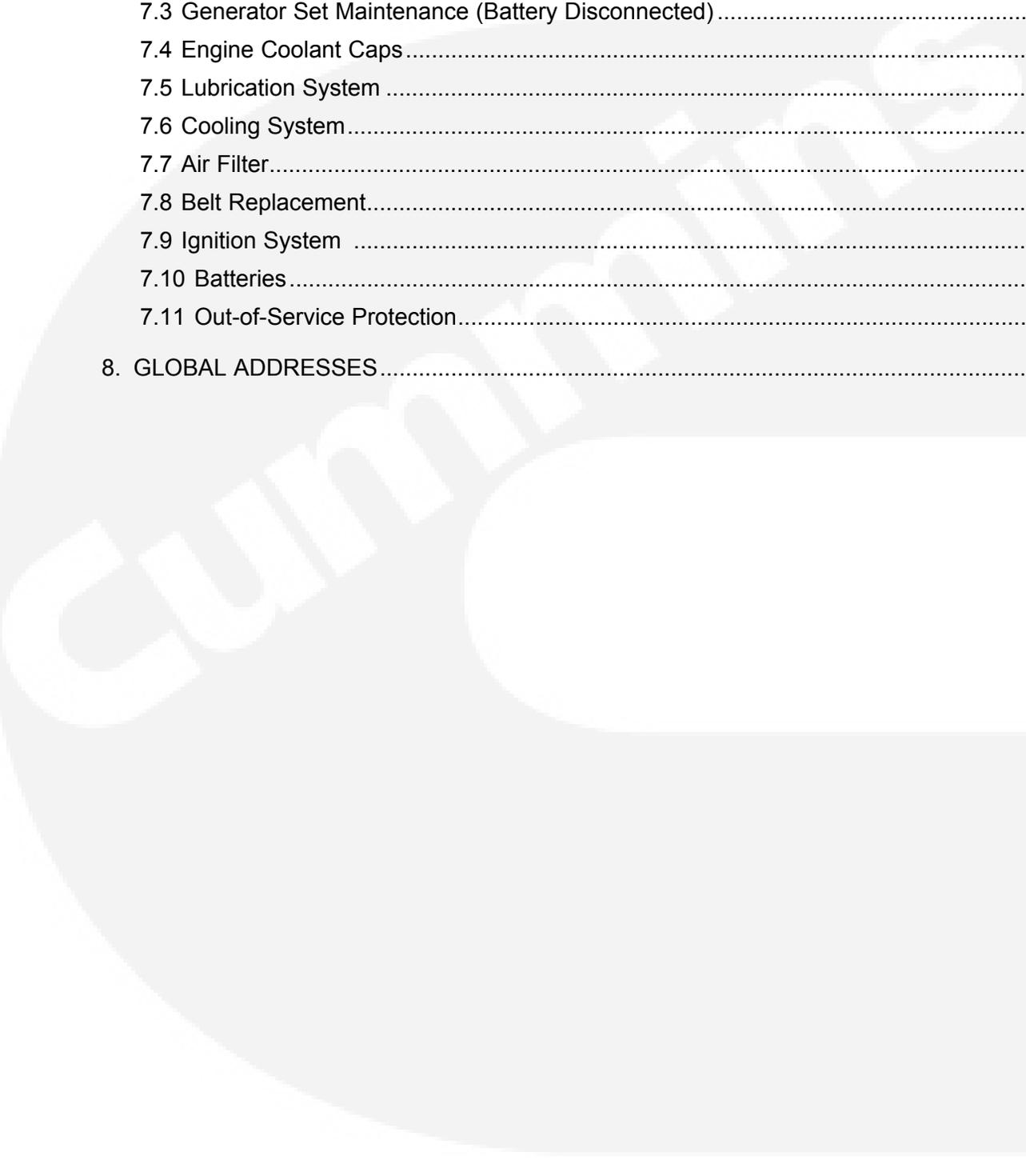
GGPB (Spec A)

GGPC (Spec A)

Table of Contents

1. IMPORTANT SAFETY INSTRUCTIONS	1
1.1 Warning, Caution and Note Styles Used In This Manual	1
1.2 General Information	1
1.3 Generator Set Safety Code	2
1.4 Electrical Shock Can Cause Severe Personal Injury Or Death.....	3
1.5 Fuel And Fumes Are Flammable.....	4
1.6 Exhaust Gases Are Deadly.....	4
2. INTRODUCTION.....	7
2.1 About This Manual.....	7
2.2 Schedule of Abbreviations	7
2.3 Related Literature	8
2.4 After Sales Services.....	9
3. GENERATOR SET SPECIFICATIONS.....	11
4. CONTROL SYSTEM - PCC 2100.....	13
4.1 Control System Description	13
4.2 Control Panel Power On/Off Modes	14
4.3 Front Panel	15
4.4 Control Menus.....	19
5. OPERATION - PCC 2100	39
5.1 Safety.....	39
5.2 Starting	39
5.3 Stopping.....	44
5.4 Operating Recommendations	45
6. TROUBLESHOOTING	47
6.1 Control Unit.....	47
6.2 Safety Considerations.....	47
6.3 Fault Finding	48
6.4 Status Indicators	48
6.5 Line Circuit Breaker (Optional)	49
6.6 Control and Diagnostics via Network or Personal Laptop Computer	49
6.7 Fault/Status Codes	50

7. MAINTENANCE	59
7.1 Maintenance General Overview.....	60
7.2 Generator Set Inspection	62
7.3 Generator Set Maintenance (Battery Disconnected)	63
7.4 Engine Coolant Caps	64
7.5 Lubrication System	67
7.6 Cooling System.....	68
7.7 Air Filter.....	72
7.8 Belt Replacement.....	73
7.9 Ignition System	75
7.10 Batteries.....	76
7.11 Out-of-Service Protection.....	77
8. GLOBAL ADDRESSES.....	79



1 Important Safety Instructions

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

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

1.1 Warning, Caution and Note Styles Used In This Manual

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



DANGER: Warns of a hazard that will result in severe personal injury or death.



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 with specific generator sets. In the event that this manual has been supplied in isolation please refer to other Cummins Power Generation literature, in particular the Health and Safety manual and contact your authorized distributor.



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

1.2.1 General Safety Precautions

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first. To prevent severe scalding, let engine cool down before removing coolant pressure cap. Turn cap slowly, and do not open it fully until the pressure has been relieved.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline (if applicable to your product), take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.

- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the engine.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator, turbo charger and exhaust system.

1.3 Generator Set Safety Code

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



WARNING: 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.

1.3.1 Moving Parts Can Cause Severe Personal Injury Or Death

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

1.3.2 Positioning of Generator Set

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

1.4 Electrical Shock Can Cause Severe Personal Injury Or Death

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment. Do not wear jewelry. Jewelry can short out electrical contacts and cause shock or burning.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

1.4.1 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 accepts no responsibility for providing the means of isolation.

1.4.2 Medium Voltage Generator Sets (601 V to 15 kV)

- Medium voltage acts differently than low voltage. Special equipment and training is required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Due to the nature of medium voltage electrical equipment, induced voltage remains even after the equipment is disconnected from the power source. Plan the time for maintenance with authorized personnel so that the equipment can be de-energized and safely grounded.

1.5 Fuel And Fumes Are Flammable

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

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Natural gas is lighter than air, and will tend to gather under hoods. Propane is heavier than air, and will tend to gather in sumps or low areas. NFPA code requires all persons handling propane to be trained and qualified.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

1.5.1 Spillage

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

1.5.2 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. 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.

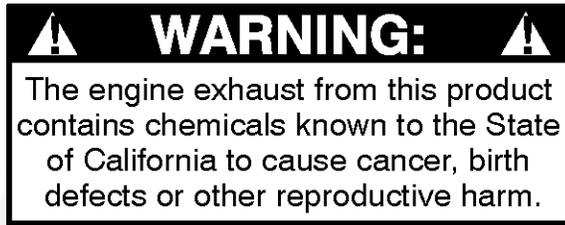
1.5.3 Do Not Operate in Flammable and Explosive Environments

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

1.6 Exhaust Gases Are Deadly

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

- Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.



1.6.1 Exhaust Precautions



WARNING: Hot exhaust gas can cause burns resulting in severe personal injury.

The exhaust outlet may be sited at the top of the generator 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.

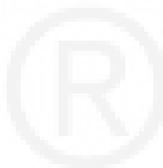


WARNING: Contaminated insulation is a fire risk which can result in severe personal injury.

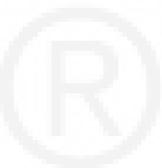
The exhaust pipes may have some insulating covers fitted. If these covers become contaminated by fuel or oil they must be replaced before the generator set is run.

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

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



This page is intentionally blank.



2 Introduction

2.1 About This Manual

The purpose of this manual is to provide the users with sound, general information. It is for guidance and assistance with recommendations for correct and safe procedures. Cummins Power Generation (CPG) 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 policy of continuous development and improvement, information may change at any time without notice. The users should therefore make sure that before commencing any work, they have the latest information available.

Users 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 authorized distributor for further installation information. It is essential that the utmost care is taken with the application, installation and operation of any engine due to their potentially hazardous nature. Careful reference should also be made to other Cummins Power Generation literature. A generator set must be operated and maintained properly if you are to expect safe and reliable operation.

Should you require further assistance contact your authorized distributor.

2.2 Schedule of Abbreviations

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

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

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
AC	Alternating Current	LCT	Low Coolant Temperature
AMP	AMP, Inc., part of Tyco Electronics	LED	Light-emitting Diode
ASTM	American Society for Testing and Materials (ASTM International)	Mil Std	Military Standard
ATS	Automatic Transfer Switch	NC	Not Connected Normally Closed
AVR	Automatic Voltage Regulator	NFPA	National Fire Protection Agency
AWG	American Wire Gauge	NO	Normally Open
CAN	Controlled Area Network	NWF	Network Failure
CB	Circuit Breaker	OEM	Original Equipment Manufacturer
CE	Conformite` Europeenne	OOR	Out of Range
CGT	Cummins Generator Technologies	OORH ORH	Out of Range High

CT	Current Transformer	OORL ORL	Out of Range Low
DC	Direct Current	PB	Push Button
ECM	Engine Control Module	PC	Personal Computer
ECS	Engine Control System	PCC	PowerCommand® Controller
EMI	Electromagnetic interference	PGI	Power Generation Interface
EN	European Standard	PGN	Parameter Group Number
EPS	Engine Protection System	PI	Proportional/Integral
E-Stop	Emergency Stop	PID	Proportional/Integral/Derivative
FAE	Full Authority Electronic	PLC	Programmable Logic Controller
FMI	Failure Mode Identifier	PMG	Permanent Magnet Generator
FSO	Fuel Shutoff	PT	Potential Transformer
Genset	Generator Set	PTC	Power Transfer Control
GCP	Generator Control Panel	PWM	Pulse-width Modulation
GND	Ground	RFI	Radio Frequency Interference
HMI	Human-machine Interface	RH	Relative Humidity
IC	Integrated Circuit	RMS	Root Mean Square
ISO	International Organization for Standardization	RTU	Remote Terminal Unit
LBNG	Lean-burn Natural Gas	SAE	Society of Automotive Engineers
LCD	Liquid Crystal Display	SPN	Suspect Parameter Number
LCL	Low Coolant Level	SW_B+	Switched B+
		UL	Underwriters Laboratories

2.3 Related Literature

Before any attempt is made to operate the generator set, the Operator should take time to read all of the manuals supplied with the generator set, and to familiarize themselves with Warnings and Operating Procedures.



CAUTION: *A generator set must be operated and maintained properly if you are to expect safe and reliable operation.*

The relevant publications appropriate to your generator set are also available:

- Operator Manual (A030G173)
- Service Manual (A030G174)
- Engine Service Manual (A030M990)
- *Specification and Data Sheet* (For engineering data specific to the generator set)
- Application Manual T-030, *Liquid Cooled Generator Sets* (For application information)
- Parts Manual (A030F464)



NOTE: **Read the warranty statement provided with the genset for US Environmental Protection Agency (EPA) restrictions on servicing specific components.**

Contact your authorized distributor.

2.4 After Sales Services

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

2.4.1 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 year-round assistance 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 authorized distributor.

2.4.2 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 authorized 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 authorized distributor.

2.4.2.1 Warranty Limitations

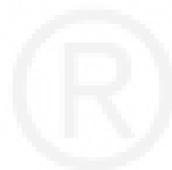
Cummins Power Generation is not responsible for the repair or replacement of Product required because of normal wear; accident; misuse; abuse; improper installation; lack of maintenance; unauthorized modifications; improper storage; negligence; improper or contaminated fuel; or the use of parts that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

2.4.3 How to Obtain Service

When the generator set requires servicing, contact your nearest Cummins Power Generation distributor. To contact your local Cummins Power Generation distributor refer to the [Global Addresses](#) section contained within this document. When contacting your distributor, always supply the complete Model, Specification, and Serial Number as shown on the nameplate.



This page is intentionally blank.



3 Generator Set Specifications

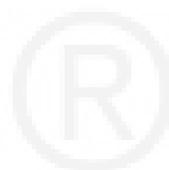
TABLE 1. SPECIFICATIONS

MODELS	GGPA/GGPB/GGPC
Engine Onan Modified GM V-8	GM 5.0 L
Generator kW Rating	See generator set nameplate for rating information.
Engine Fuel Connection Inlet/Outlet Thread Size	Refer to Generator Outline Drawing
Fuel or a combination of two fuels	Propane (Liquid or Vapor) Natural Gas
Fuel Flow (Inlet Pressure) Minimum: NG/LPG Maximum: NG/LPG Vapor Withdrawal LPG Liquid Withdrawal	7.0 inch H ₂ O (1.7 KPa) 13.6 inch H ₂ O (3.4 kPa) 312 psi (2,153 kPa)
Exhaust Connection Backpressure (Max. Allowed)	3 inch NPT 20 inch WC (5.0 kPa)
Electrical System Starting Voltage Battery Charing Alternator (Max. Rating)	12 Volts DC 37 A
Cooling System Capacity with Standard Radiator	6.9 Gallons (26.1 L)
Lubricating System Oil Capacity with Filters	5.75 Quarts (5.5 L)
Tune-up Specifications Spark Plug Gap	0.030 inch (0.762 mm)
Battery Ground Required Battery Voltage Group Number CCA (minimum) Cold Soak @ 0° F (-18° C)	Negative 12 Volts DC 31 625

TABLE 2. FUEL CONSUMPTION (STANDBY/PRIME/60 HZ) AT FULL LOAD

Model	GGPA	GGPB	GGPC
Standby cfh (m3/hr)			
LPG (Vapor or Liquir)	204 (5.8)	225 (6.4)	270.2 (7.7)
Natural Gas	528 (14.9)	590 (16.7)	646 (18.3)

This page is intentionally blank.



4 Control System - PCC 2100

4.1 Control System Description

This manual covers the PowerCommand® Control 2100 (PCC2100) control module for single generator sets. All indicators, control switches/buttons and digital display are located on the face of the control panel as illustrated in [Figure 1](#).

The main control panel and its associated equipment are located in the Control Housing, which is mounted at the rear of the generator set. A Load Terminal Box may be mounted on either the left or right side of the housing, as required for the site.

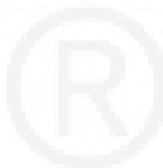
The PCC2100 is a microprocessor-based control for generator sets. It provides fuel control and engine speed governing, main alternator voltage output regulation, and complete generator set control and monitoring. The control also monitors the health of the engine, alternator and auxiliary systems continuously, and will affect an Automatic Shutdown if a serious fault occurs.

The PCC2100 operates in conjunction with an array of sensors and senders located on the engine, alternator and auxiliary systems. Data is passed between components over a digital data link.

An important function of the control system is to continuously monitor the generator set for faults. If a fault occurs during engine running, the control will provide an indication for the operator and, if the fault is serious, affect an automatic, fully programmed, shutdown. There are two fault level signals generated by the PCC2100. These two fault levels are:

1. **Warning:** signals an imminent or non-critical engine fault. The PCC2100 provides an indication only for this condition.
2. **Shutdown:** signals a potentially critical fault for the engine. The PCC2100 will automatically take the engine off-load and shut it down immediately, without a cool-down run.

The control systems operate on 12 or 24VDC battery power. Data backup is taken care of by a small rechargeable battery installed within the PCC2100 enclosure. Auxiliary equipment operates on LV AC power.



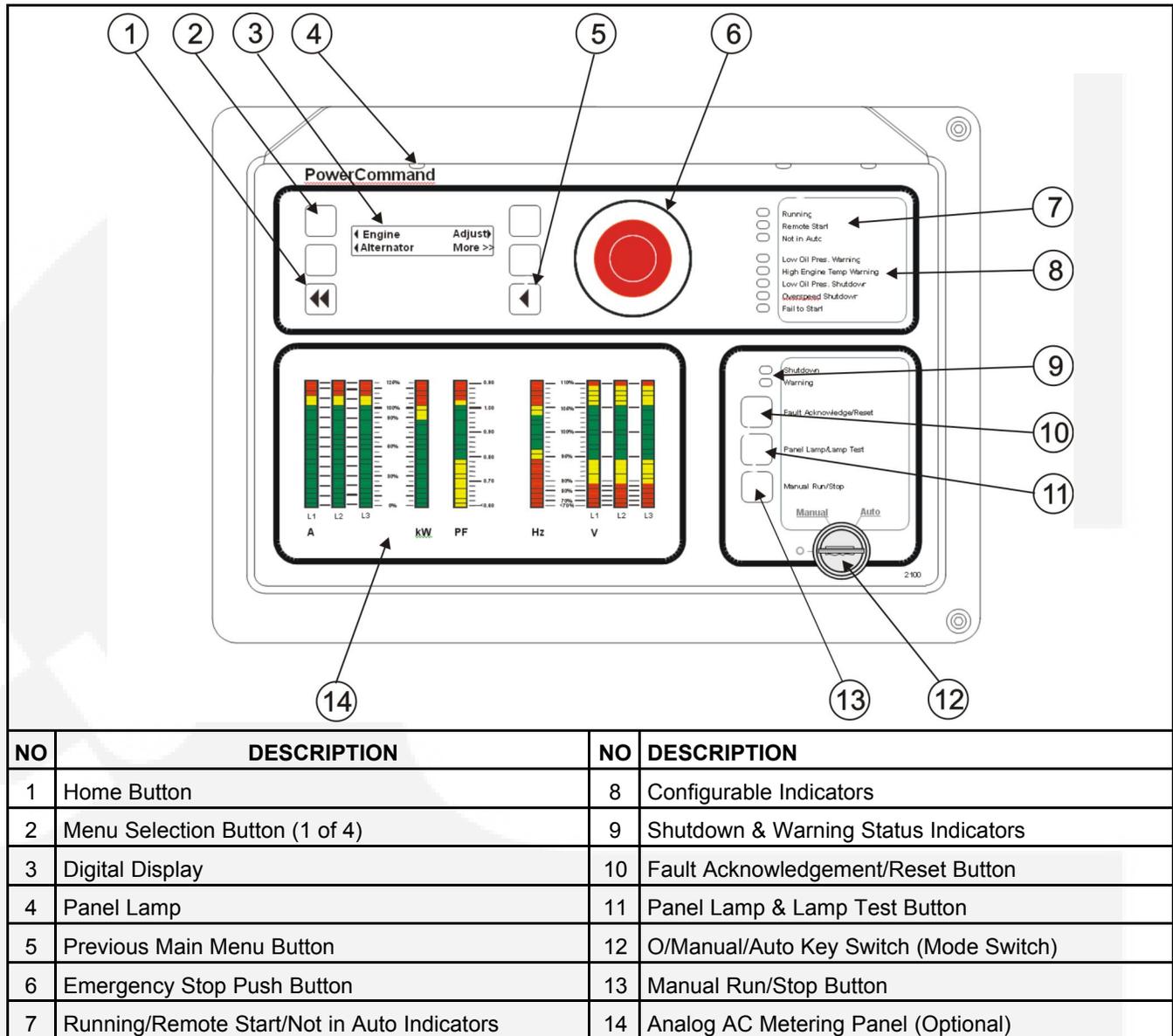


FIGURE 1. FRONT PANEL

4.2 Control Panel Power On/Off Modes

The power on/off modes of the control panel and operating software are Power On, Screen Saver, and Sleep/Awake.

4.2.1 Power On Mode

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

4.2.2 Screen Saver Mode

Power to the graphical display will be removed after 10 minutes (generator set not running or running). The 10 minute timer resets and begins after each control panel action (any button or switch selection) or signal received by the operating software. The bottom LEDs of the Analog AC Metering Panel (bar graphs) may stay On during Screen Saver mode, indicating that the operating software is active (Awake mode).

When a "Warning" signal (for example, low coolant temp) is sensed by the control will display the warning message. The control will remain active until the Fault Acknowledge button is pressed to clear the warning message and start the 10 minute timer.

4.2.3 Sleep/Awake Mode

In the Sleep mode, the control's operating software is inactive and the LEDs and the digital display on the control panel are all off. Sleep mode is a feature used to reduce battery power consumption when the control is not being used and the O/Manual/Auto switch is in the O position.

When all conditions are met (i.e., no unacknowledged faults and O/Manual/Auto switch is in the O position) the Sleep mode is activated.

The operating software is initialized and the digital display and control panel LEDs are turned on in response to moving/pressing the following control panel switch/buttons:

- Off/Manual/Auto switch
- Emergency Stop button
- Fault Acknowledge/Reset button
- Panel Lamp/Lamp Test button

To activate the control and view the menu display without starting the generator set, press the Fault Acknowledge or Panel Lamp button or move the mode switch from O to Manual.

The InPower™ service tool is required to enable or disable the Sleep mode. When shipped from the factory, Sleep mode is disabled. When disabled, the operating software will always remain active (Awake mode). If network and/or power transfer control (PTC) feature is installed, the sleep mode is not available.



NOTE: The InPower service tool is required to select the desired mode. Contact an authorized service center for assistance.

4.3 Front Panel

The front panel contains the following components:

4.3.1 Digital Display

This two-line, 20-characters per line alphanumeric display is used to view menus of the menu-driven operating system. Refer to the menu trees later in this section. The display is also used to show warning and shutdown messages.

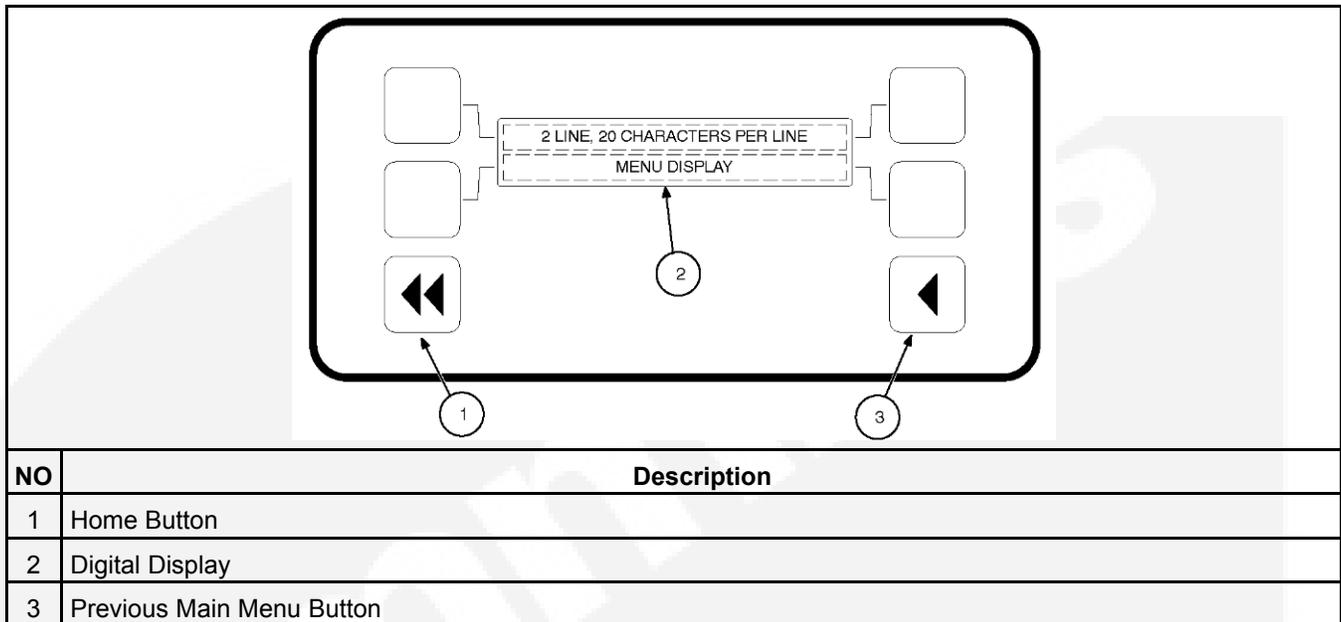


FIGURE 2. DIGITAL DISPLAY AND MENU SELECTION BUTTON

4.3.2 Display Menu Selection Button

Four momentary buttons—two on each side of the digital display window—are used to step through the various menu options and to adjust generator set parameters. A green triangle (◀ or ▶), arrow (↑, ↓, ←, or →), >>, or plus/minus sign (+ or –) in the digital display adjacent to the button is shown when the button can be used (button is "active").

- In the digital display for main menus, the ◀ or ▶ symbols indicate that pressing the adjacent button causes the operating program to go to the selected submenu (e.g., Engine Menu).
- In the digital display, the More>> symbol indicates that pressing the adjacent button causes the operating program to go to the next main menu.
- In the digital display, the ↑ or ↓ symbols indicate that pressing the adjacent button causes the operating program to go to the next or previous submenu, as shown in the menu diagrams. Only the ↓ symbol is displayed in the first submenu. Only the ↑ is displayed in the last submenu. Both symbols are displayed in the rest of the submenus.
- In the digital display, the plus or minus symbols (+ or –) indicate that pressing the adjacent button can be used to change a parameter or value shown on the display.

When there is a choice of two parameters, one parameter is associated with the + symbol and the other is associated with the – symbol.

When changing values, pressing the button adjacent to the + symbol increases the value and pressing the button adjacent to the – symbol decreases the value. Only one numeric character of a field can be changed at a time.

- In the digital display, the ← or → symbol indicates that pressing the adjacent button causes the operating program to move the cursor to the next numeric character. The selected numeric character can then be changed by pressing the buttons adjacent to the + and – symbols. Only the → symbol is displayed when the cursor is on the first character of a field that can be changed. Only the ← is displayed when the cursor is on the last character. Both symbols are displayed when the cursor is on any other character.
- After adjusting values/parameters, pressing the ► symbol results in the changes being saved. **If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.**

4.3.3 Home Button

Press this button (◀◀) to view the Home Menu. Refer to the menu trees that appear later in the manual.

4.3.4 Previous Main Menu Button

Press this button (◀) to view the previous Main Menu. All main menus include both types of green triangles (◀ and ▶). Refer to the menu trees later in this manual.



NOTE: The up and down arrows (↑ and ↓) are used to navigate between the submenus.

4.3.5 Emergency Stop Button

Push this button in for emergency shutdown of the generator set. This will stop the generator set immediately and prevent starting of the set from any location (local and remote).

To reset:

1. Pull the button and allow it to pop out.
2. Turn the O/Manual/Auto switch to O (Off).
3. Press the front panel Fault Acknowledge/Reset button.
4. Select Manual or Auto, as required.



NOTE: Emergency Stop shutdown can be reset only at the PCC front panel.

4.3.6 Running Indicator

This green lamp is lit whenever the generator (local or remote) is running.

4.3.7 Remote Start Indicator

This green lamp indicates the control is receiving a remote run signal. When flashing, indicates a load demand stop mode.

4.3.8 Not in Auto

This red lamp is flashes continuously when the O/Manual/Auto switch is not in the Auto position.



NOTE: If the switch is in the Auto position and the lamp is still flashing, service is required.

4.3.9 Analog AC Metering Panel (Option)

This panel simultaneously displays 3-phase line to line AC volts and current, kW, power factor and frequency.

The meter panel is composed of a series of LEDs, that are configured in bar graphs for each function. The LEDs are color coded, with green indicating normal range values, amber for warning levels and red for shutdown conditions.

Scales for each function are in % of nominal values. Resolution is 1% for values close to nominal, and increases at values further than nominal.

4.3.10 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 turning the O/Manual/Auto switch to the O position, and pressing the Fault Acknowledge button. The generator set cannot be started when this lamp is on.

Dependent upon the specific fault that occurs, the engine may or may not shut down immediately. A fault that could cause engine damage, causes an immediate engine shutdown (bypasses engine cool-down sequence). All other faults would allow the engine to run during the cool-down sequence before engine shutdown. In this case, the Shutdown Status indicator blinks during the cool-down period.

4.3.11 Warning Status Indicator

This yellow lamp is lit whenever the control detects a warning condition. After the condition is corrected, warning indicators can be reset by pressing the Fault Acknowledge button. (It is **not** necessary to stop the generator set if the fault becomes inactive during genset operation.) In auto mode, warning indicators can also be reset by cycling the remote reset input after the condition is corrected.

Some warnings remain active after the condition is corrected and the control reset button is pressed. This will require the genset to be shutdown to reset the warning indicator.

4.3.12 Fault Acknowledgement/Reset Button

Press this button to acknowledge warning and shutdown messages after the fault has been corrected. Pressing this button clears the fault from the current fault list.

To acknowledge a Warning message, the O/Manual/Auto switch can be in any position. (It is not necessary to stop the generator set to acknowledge an inactive Warning condition.) To acknowledge a shutdown message with this button, the O/Manual/Auto switch must be in the O position.

4.3.13 Panel Lamp and Lamp (LED) Test Button

Press this button to turn the control panel lamps on or off. The lights will shut off after about ten minutes. Press and hold this button to test all front panel LEDs and meters. The meters will light one bar at a time.

4.3.14 Manual Run/Stop Button

This button starts and stops the set locally and will bypass Time Delay to Start and Stop sequences. The O/Manual/Auto switch must be in the Manual position to enable this button.

4.3.15 O/Manual/Auto Switch

Manual position enables the use of the switch panel Manual Run/Stop button.

Auto position enables start/stop control of the engine from a remote location. (Disable the use of the switch panel Manual Run/Stop button.)

O (off) position prevents the starting of the set (local or remote).



NOTE: If moved to the O position during set operation, this will cause an immediate engine shutdown (bypasses cool-down timers). Hot shutdowns should be avoided to prolong the reliability of the generator set. Hot shutdowns are logged by the system software.

4.3.16 Configurable Indicators

The following configurable indicators (default values shown) can be changed with the InPower service tool. The configurable items are: change generator event and LED color (green, yellow or red), and enable/disable indicator.

The InPower service tool is required to select the desired settings. Contact an authorized service center for assistance.

4.3.17 Low Oil Pressure Warning Indicator

This yellow lamp indicates the oil pressure is lower than the normal range of operation.

4.3.18 High Engine Temperature Warning Indicator

This yellow lamp indicates the engine temperature is higher than the normal range of operation.

4.3.19 Low Oil Pressure Shutdown Indicator

This red lamp indicates the engine has shut down because of low oil pressure.

4.3.20 Overspeed Shutdown Indicator

This red lamp indicates the engine has shut down because of excessive speed.

4.3.21 Fail to Start Indicator

This red lamp indicates the engine failed to start.

4.4 Control Menus

4.4.1 Main Menus

[Figure 3](#) shows the three major main menus available to the user. When viewing a submenu, you can press the previous main menu button at any time to view its main menu.

As shown in the illustration, each main menu can branch into one of four directions. Press the button next to "More>>" in the display to view the next Main menu. Main Menu 1 is redisplayed when you press the button next to "More>>" in the Main Menu 3 display.

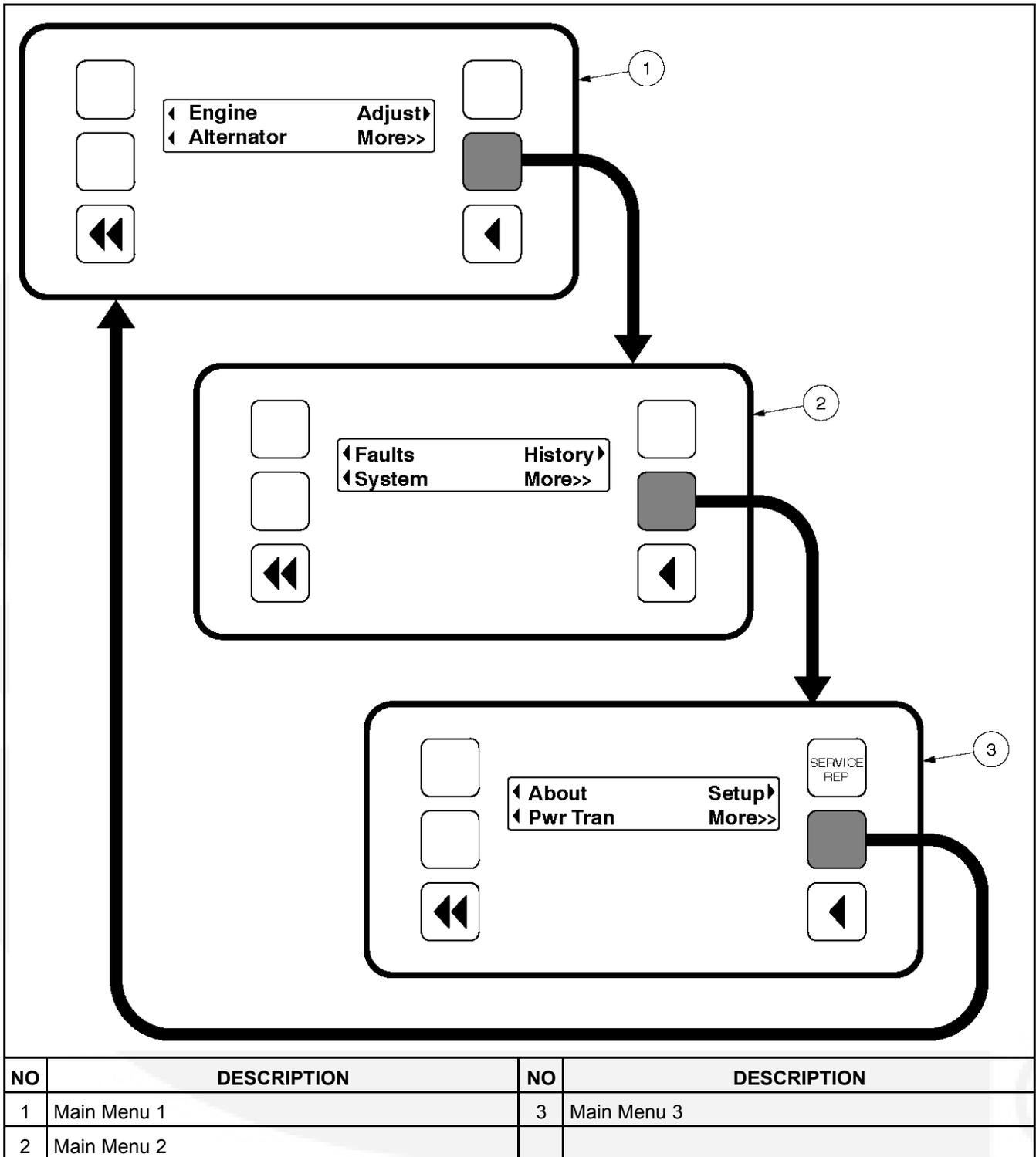


FIGURE 3. MAIN MENUS

4.4.1.1 Main Menu 1

Main Menu 1 is also the Home menu. When viewing any of the other main menus or any submenu, you can press the home button to view this menu.

To display engine parameters, such as coolant temperature, oil pressure, oil temperature, etc., press the button next to the word "Engine" in the display. Refer to the Engine menu diagram.

To display alternator parameters, such as line-to-line voltage, line-to-neutral voltage, amperage, frequency, etc., press the button next to the word "Alternator" in the display. Turn to the Alternator menu diagram.

To adjust generator parameters, such as idle start, voltage, frequency, start delay, and stop delay, press the button next to the word "Adjust" in the display. Turn to the Adjust menu diagram.

To view one of the other main menus, press the button next to "More>>" in the display.

4.4.1.2 Main Menu 2

To display system faults, press the button next to the word "Faults" in the display. Up to 20 of the most recent/current faults can be displayed. Refer to the Faults menu diagram.

To view network system parameters, such as on the automatic transfer switch (ATS), Master, or Genset system, press the button next to the word "System" in the display. Refer to the System menu diagram.

To display historical engine parameters such as number of starts, engine hours, control hours, kilowatt hours, and genset duty cycle, press the button next to the word "History" in the display. Refer to the History menu diagram.

To view one of the other main menus, press the button next to "More>>" in the display.

4.4.1.3 Main Menu 3

To view parameters on the generator, such as model, standby rating, and software version, press the button next to the word "About" in the display. Refer to the About menu diagram.

To view power transfer parameters, such as source power, frequency, generator, utility, and active transfer timer, press the button next to the word "Pwr Tran" in the display. Refer to the Power Transfer Menu

Main Menu 3 also includes a link to the Setup menus. These menus can be viewed but changes to these menus are restricted to service personnel with the appropriate access code.

To view one of the other main menus, press the button next to "More>>" in the display.

4.4.2 Adjusting Default Settings

The Controller Configuration Menu can be used to adjust the following default settings:

- Language - Select from available loaded languages
- Temperature Units - Fahrenheit or Centigrade
- Fluid Pressure Units - kPA or PSI

For more information on adjusting these settings, turn to the Controller Configuration menu diagram.

4.4.3 System Messages

A system message pop-up screen is displayed when the event it is displaying becomes active. These pop-up screens remain displayed until pre-empted by another pop-up screen or until any display button is pressed. Once a button is pressed, the previous menu is redisplayed. To return to an active pop-up screen from the previous menu, select the following menu:

- *Engine* to redisplay Time Delay Idle
- *Faults* to redisplay Faults

Pop-up screens are displayed for the following:

- Faults
- Power Transfer Control timer
- Time Delay - Start, Stop, and Idle

An example of a Time Delay Idle pop-up screen is shown in [Figure 4](#). A countdown, in seconds, is included in the display.

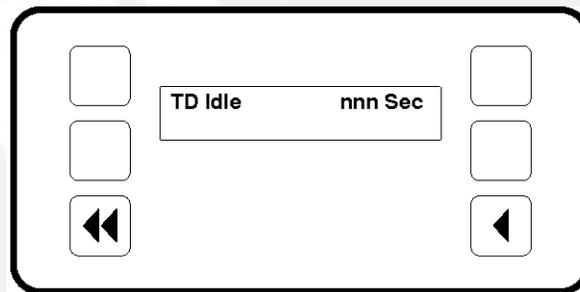


FIGURE 4. TIME DELAY IDLE POP-UP SCREEN

4.4.4 Controller Configuration Menu

[Figure 5](#) shows a block representation of the Controller Configuration menus. These menus are used to change the default language, temperature units, and pressure units to be displayed in menus.

To view the first Controller Configuration menu, make sure Main Menu 1 is displayed and simultaneously press the Home Menu and Previous Main Menu buttons.

As shown in the diagram, the Controller Configuration menu has three submenus.

Press the buttons next to the up and down arrows in the digital display to navigate between the menus.

Press the button next to the ► symbol in the display until the + and - symbols are displayed.

Press the button next to the + or – symbol to select the desired option.

After selecting option, pressing the ► symbol results in the changes being saved. If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

- **Language Selected submenu:** Used to select desired language (default = English).
- **Temperature Units submenu:** Used to select Fahrenheit or Centigrade for temperature readings.

- **Fluid Pressure Units submenu:** Used to select PSI or kPA for pressure readings.

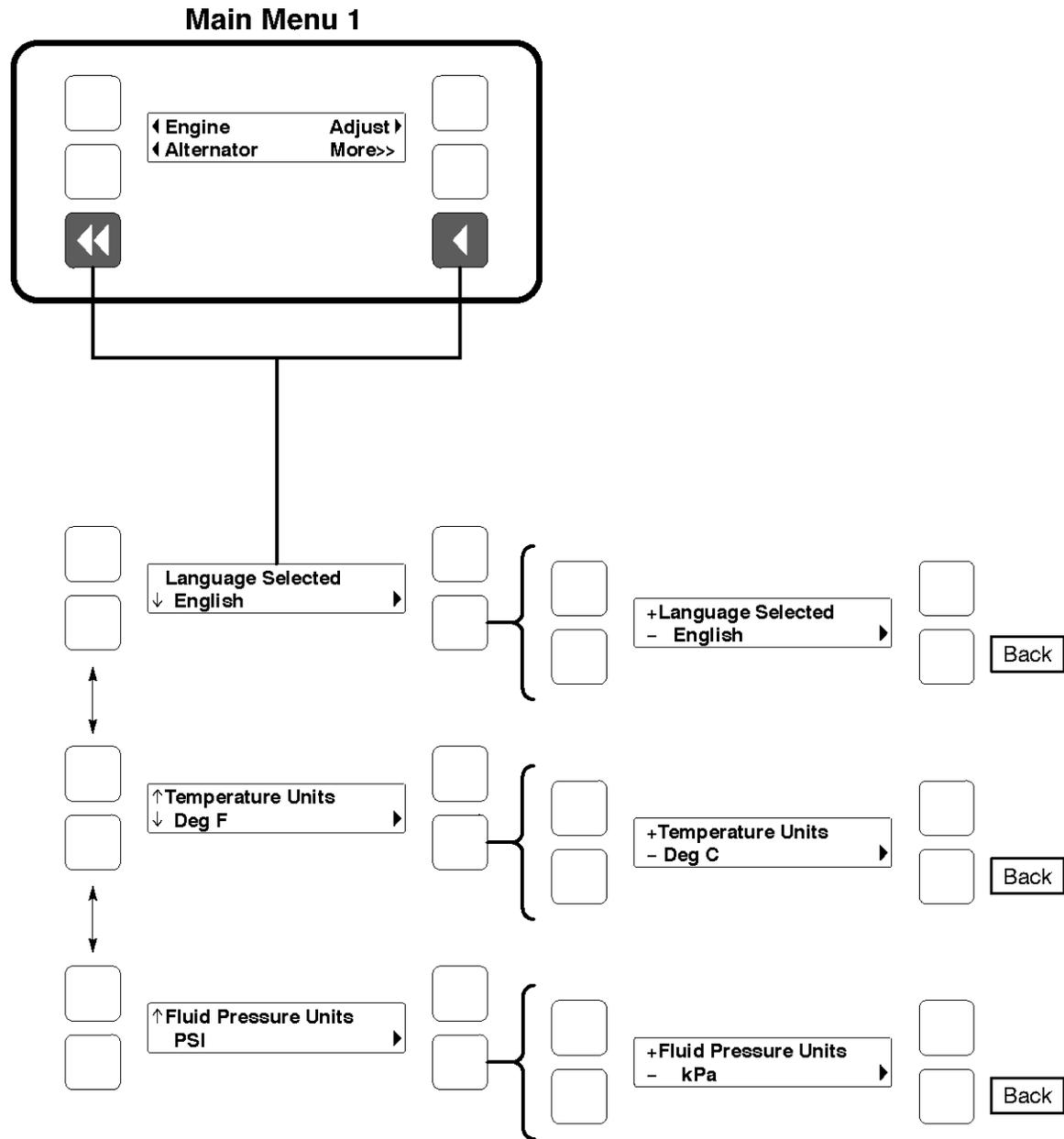


FIGURE 5. CONTROLLER CONFIGURATION MENU

4.4.5 Engine Menu

[Figure 6](#) shows a block representation of the Engine menu. If you press the button next to the word "Engine" in the display, the first Engine submenu is displayed.

As shown in the diagram, the Engine menu has seven submenus. The data in the submenus will vary according to the type and number of sensors provided with the engine.

Press the buttons next to the  and  symbols in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

- **Coolant Temperature submenu:** This submenu displays the engine coolant temperature which can be viewed in degrees Fahrenheit or Centigrade (see the [Controller Configuration Menu](#)).
- **Oil Pressure submenu:** This submenu displays the engine oil pressure which can be viewed in PSI or kPA (see the [Controller Configuration Menu](#)).
- **Oil Temperature submenu (Only available on some models):** This submenu displays the engine oil temperature which can be viewed in degrees Fahrenheit or Centigrade (see the [Controller Configuration Menu](#)).
- **Engine Speed submenu:** This submenu displays the engine RPM.
- **Battery Voltage submenu:** This submenu displays the engine battery voltage.
- **Governor Duty Cycle submenu:** This submenu displays the governor duty cycle (drive) levels in percentage of maximum.
- **Active Time Delay submenu:** This submenu displays the time delay that is currently active: warm-up, cool down, start or stop delays.

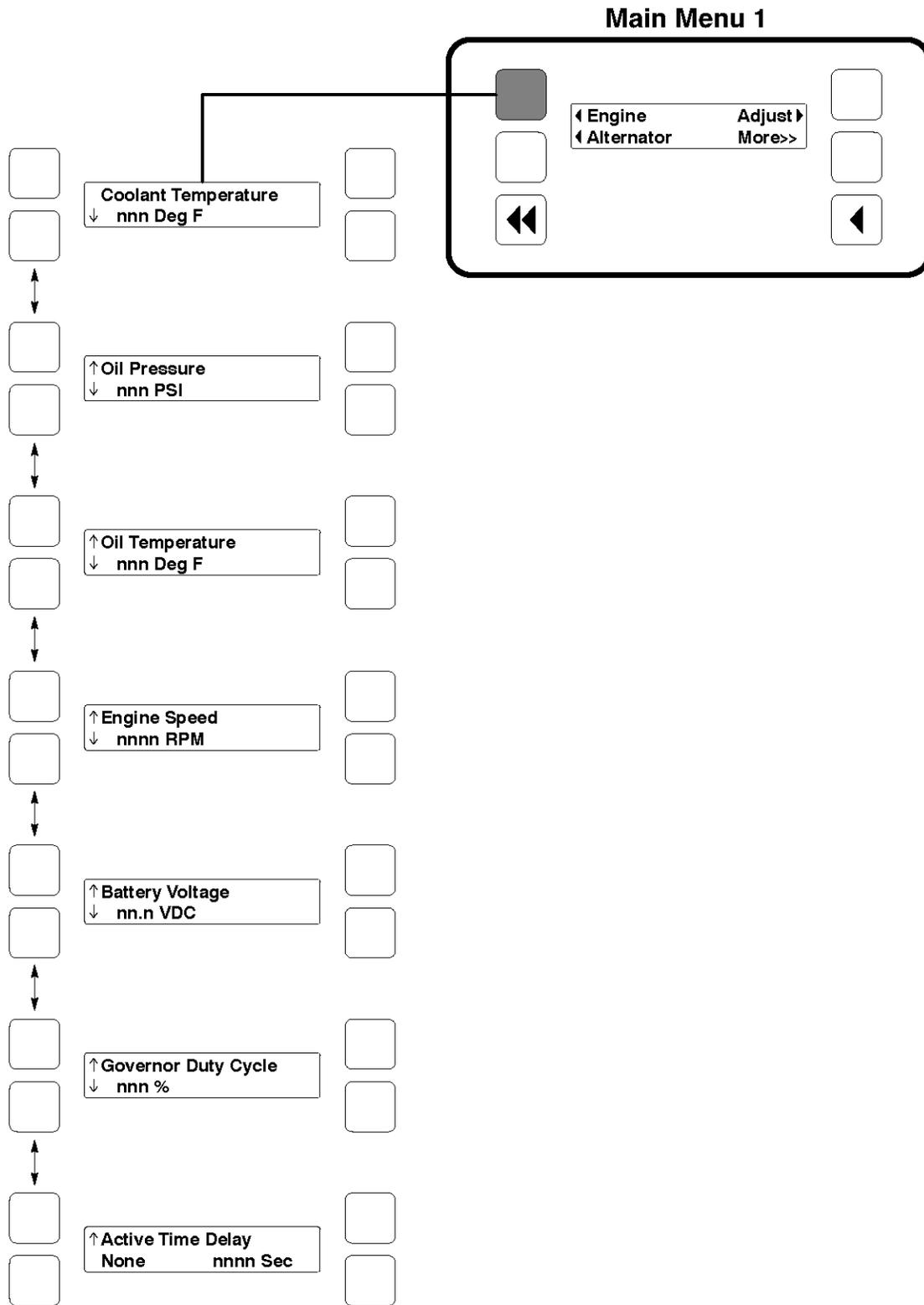


FIGURE 6. ENGINE MENU

4.4.6 Alternator Menu

Figure 7 shows a block representation of the Alternator menu. If you press the button next to the word "Alternator" in the display, the first Alternator submenu is displayed.

As shown in the diagram, the Alternator menu has eleven submenus.

Press the buttons next to the ↑ and ↓ arrows in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

- **Line-to-Line Voltage submenu:** The voltages Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively. (Single phase - L1 to L2 only.)
- **Line-to-Neutral Voltage submenu:** Note that the Line-to -Neutral menu will not be displayed for a 3 phase/3 wire system. Single phase - L1 to N and L2 to N.
- **Amps submenu:** All phases. (Single phase - L1 and L2 only.)
- **Frequency submenu:** Generator set output frequency.
- **Total Real Power submenu:** This submenu displays the total amount of real power output, in kilowatts (kW).
- **Real Power submenu:** This submenu displays the amount of real power output for L1, L2, and L3, in kilowatts (kW). (Single phase - L1 and L2 only.)
- **Total Apparent Power submenu:** This submenu displays the total amount of apparent power output, in kilovolt amps (kVA).
- **Apparent Power submenu:** This submenu displays the amount of apparent power output for L1, L2, and L3, in kilovolt amps (kVA). (Single phase - L1 and L2 only.)
- **Total Power Factor submenu:** This submenu displays the power factor with leading/lagging indication.
The PF reading will contain an asterisk if the power factor is leading (for example, Total PF 0.9).*
- **Power Factor submenu:** This submenu displays a power factor value for L1, L2, and L3. (Single phase - L1 and L2 only.)
The PF reading will contain an asterisk if the power factor is leading (for example, PF L1 0.9).*
- **AVR Duty Cycle submenu:** This submenu displays the voltage regulator (drive) level in percentage of maximum. (Where maximum is 100% Duty Cycle, software clamps Duty Cycle maximum to 60% for PMG and 90% for shunt.)

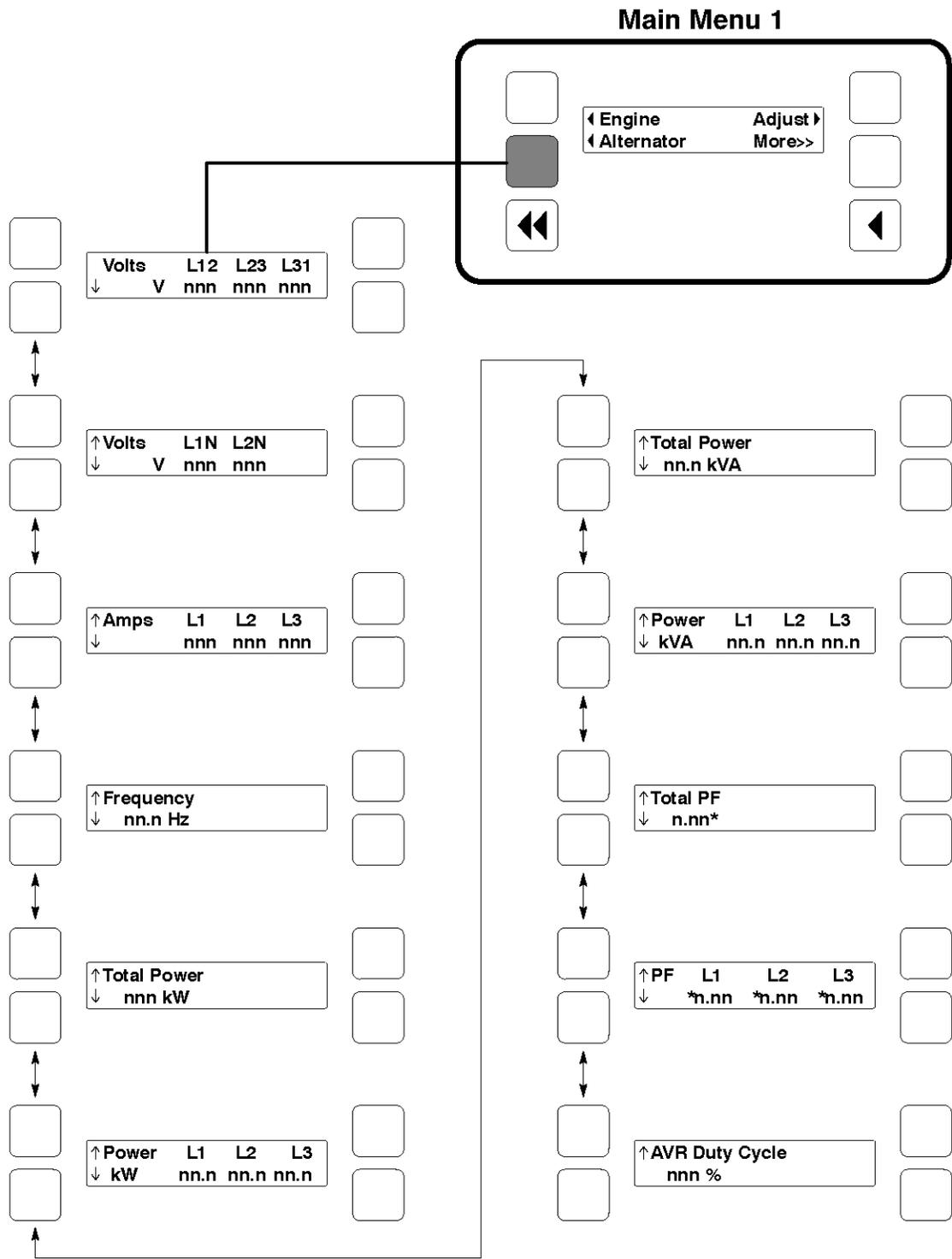


FIGURE 7. ALTERNATOR MENU

4.4.7 Adjust Menu

Figure 8 shows a block representation of the Adjust menu. If you press the button next to the word "Adjust" in the display, the first Adjust submenu is displayed.

As shown in the diagram, the Adjust menu has five submenus. Each submenu includes a parameter or value that can be changed.

Press the buttons next to the ↑ and ↓ arrows in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

Adjusting Values/Parameters:

1. Press the button next to the ► symbol in the display until the + and - symbols are displayed.
2. If necessary, press the button next to the symbols to move to the numeric character you wish to change.
3. Press the button next to the + symbol to increase the value or select parameter; press the button next to the – symbol to decrease the value or select parameter.
4. After adjusting values/selecting parameters, pressing the ► symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ► symbol).

If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

- **Voltage Adjust submenu:** Voltage can be adjusted to 5 percent of the nominal voltage. For example, if genset output voltage is 208 volts, the voltage can be adjusted from 198 to 218 volts.
If the displayed value is greater or less than the allowed (5%) range, the control will not except the entry and will return to the previous setting. Retry by entering a smaller change in one volt increments.
- **Frequency Adjust submenu:** Frequency can be adjusted to 5 percent of the nominal frequency. For example, if the genset frequency is 60.0 Hz, the frequency can be adjusted from 57.0 to 63.0 Hz.
- **Start Delay submenu:** Start Delay can be set from 0 to 300 seconds (default = 0). (Enter 1 or more to enable.) This function is bypassed during a manual start/stop sequence.
- **Stop Delay submenu:** Stop Delay can be set from 0 to 600 seconds (default = 0). (Enter 1 or more to enable.) This function is bypassed during a manual start/stop sequence and engine shutdown faults.
- **Rated To Idle (Beginning Version 2.303):** Rated To Idle delay can be set from 0 to 10 seconds (default = 0). (Enter 1 or more to enable.) Entering a non-zero delay will cause the genset to delay the transition to Cooldown At Idle.
- **Idle Start submenu (Only available on some models):** Idle Start can be enabled or disabled (default = Disable). This function is only enabled when the genset is started in manual mode. Idle Start can also be enabled while the set is running in manual mode. (Auto/remote start is not affected by this setting.)

Enabling Idle Start will cause the genset to run in idle mode until Idle Start is disabled. A warning is displayed if genset is left in idle more than 10 minutes. Long periods of engine idling can eventually affect engine performance and may void engine warranty.

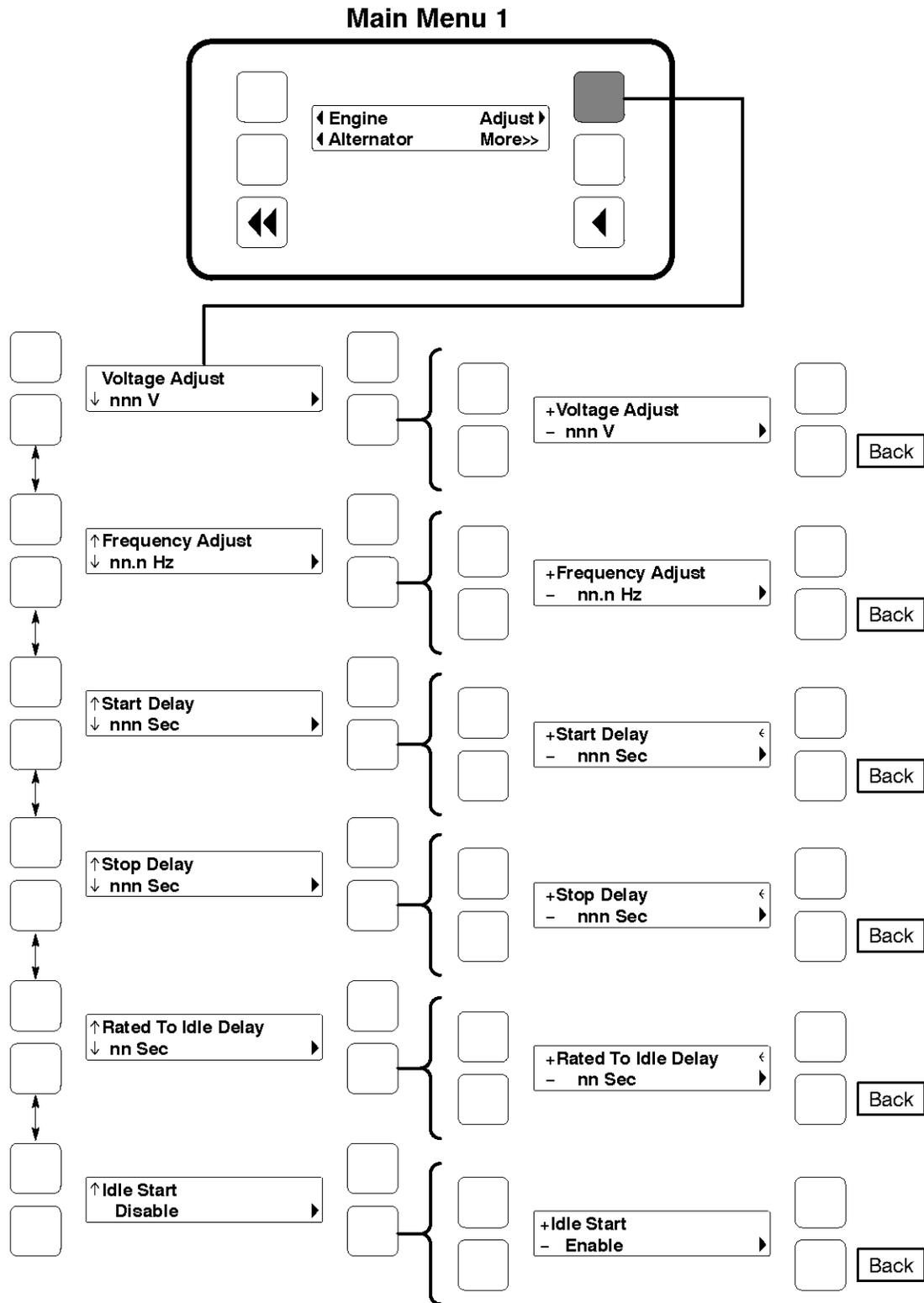


FIGURE 8. ADJUST MENU

4.4.8 Faults Menu

Figure 9 shows a block representation of the Faults menu. Up to 20 of the most recent faults can be viewed. An example of how a fault code is displayed is shown in Figure 10.

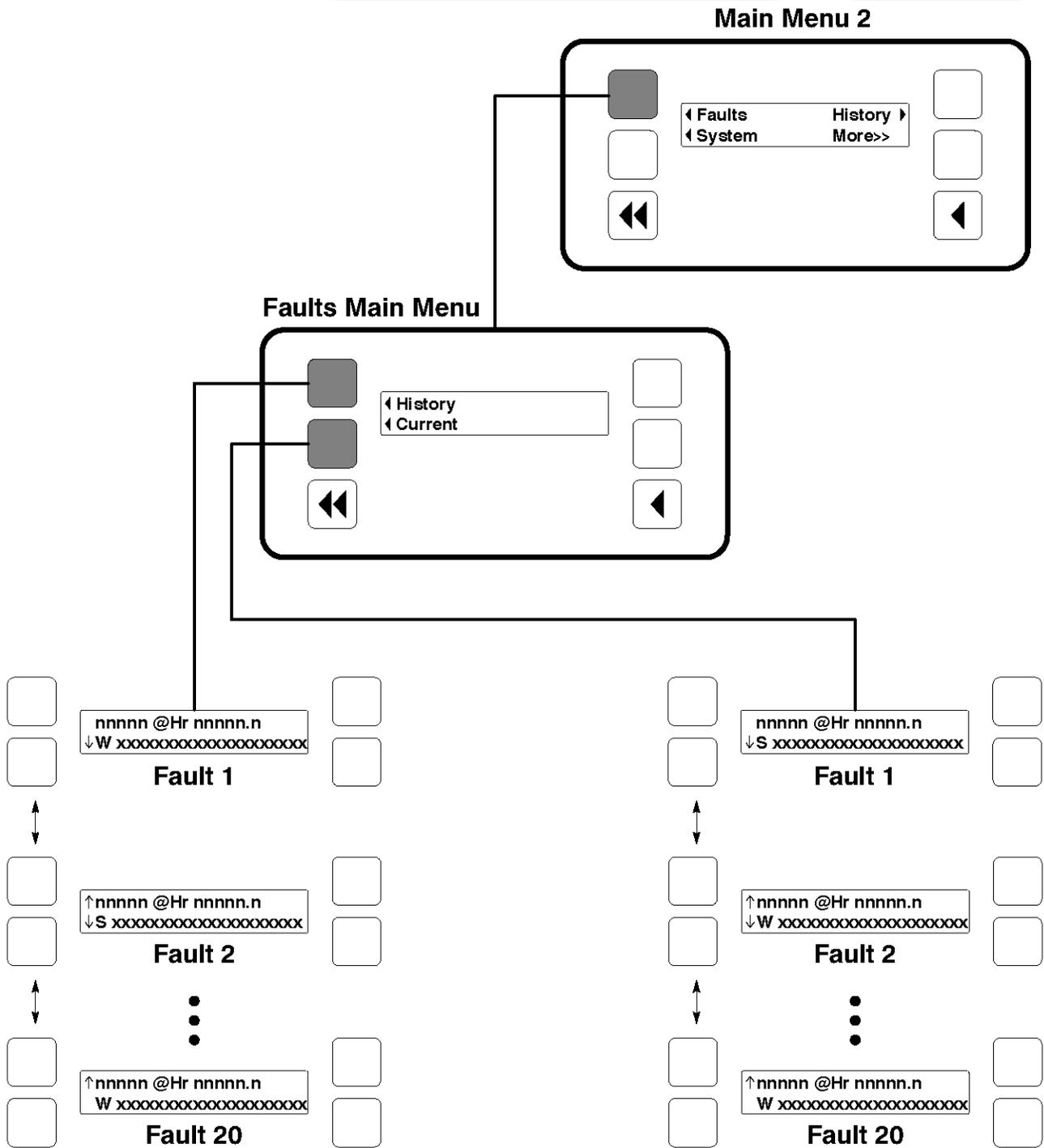


FIGURE 9. FAULTS MENU

The available menus are dependent on the number of faults that have occurred.

- If there are no faults, the ◀ symbol next to the word "Faults" is not displayed and no Fault menus are available.
- If more than one fault has occurred, press the button next to the word "Fault" in the screen display to view the Faults Main Menu. As shown in the diagram, the Faults Main Menu has two submenus. Press the Previous Main Menu button to return to the Faults Main Menu. Press the Previous Main Menu button a second time to return to Main Menu 2.

Press the Home button at any time to return to Main Menu 1.

- **History submenu:** From the Faults Main Menu, press the button next to the word "History" in the display to view up to twenty of the most recent acknowledged faults. Press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the Previous Main Menu button to return to the Faults Main Menu.
- **Current Fault submenu:** From the Faults Main Menu, press the button next to the word "Current" in the display to view up to twenty of the most recent unacknowledged faults. Press the Previous Main Menu button to return to the Faults Main Menu.

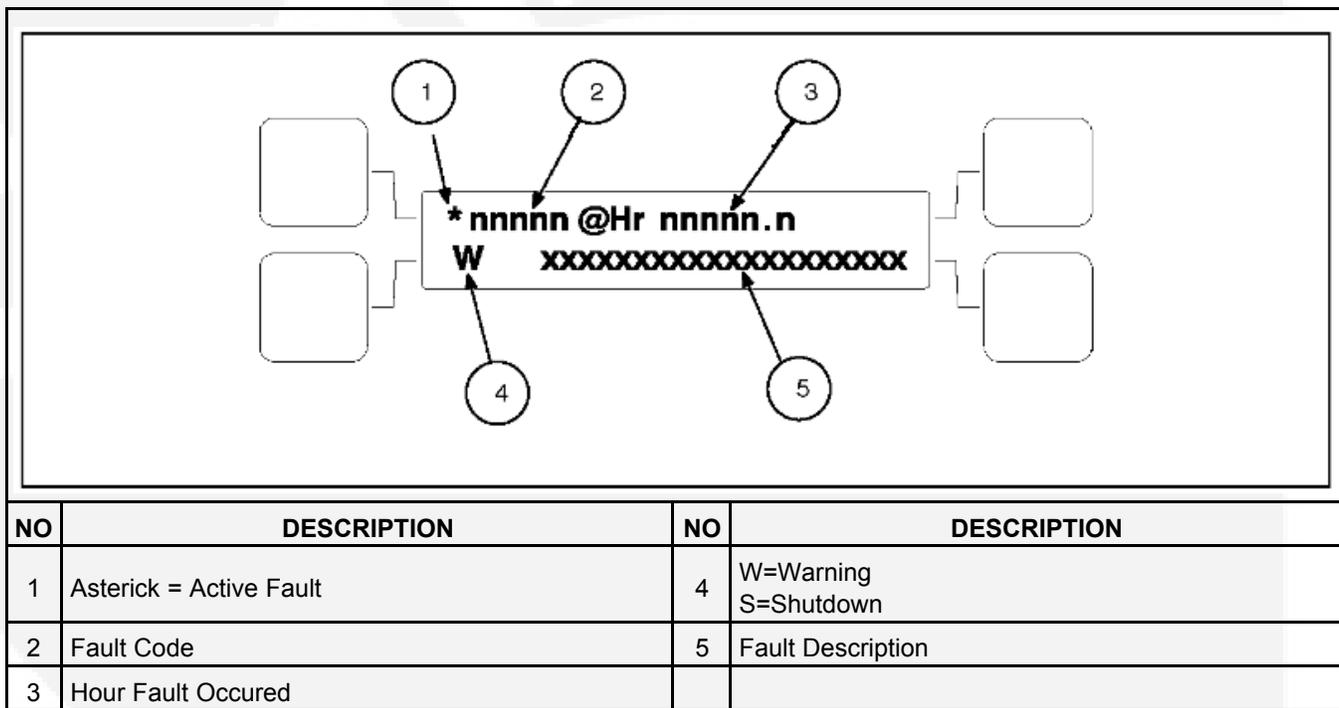


FIGURE 10. HISTORY/CURRENT FAULT SUBMENU

4.4.9 System Menu

[Figure 11](#) shows a block representation of the System menu. If you press the button next to the word "System" in the display, the System Main Menu is displayed. This menu is displayed only if the network communications module (NCM) feature is installed. The System Main Menu allows you to view the status and load of other PCC equipment connected on a common network with the PCC 2100 control.

As shown in the diagram, the System Main Menu has three submenus.

When viewing ATS and Genset System submenus, press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the Previous Main Menu button to return to the System Main Menu. Press the Previous Main Menu button a second time to return to Main Menu 2. Press the Home button to return to Main Menu 1.

- **ATS System submenus:** From the System Main Menu, press the button next to the word "ATS" in the display to view the first of up to 16 ATS System submenus. An ATS system must be available in the network to display this submenu.

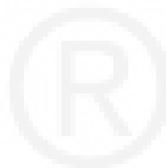
The ATS submenu allows viewing of the transfer switch name (configured with InPower), kW load (if monitored by the ATS system), status (e.g., not in auto), and source connected and availability (ON = source connected, OK = source available, or NA = source not available).

- **Master System submenu:** From the System Main Menu, press the button next to the word "Master" in the display to view the Master System submenu. A master controller must be available in the network to display this submenu.

The master submenu allows viewing of the master controller name (configured with InPower), kW load and operational state.

- **Genset System submenus:** From the System Main Menu, press the button next to the word "Genset" in the display to view the first of up to 16 Genset System submenus. One genset must be available in the network to display this submenu.

The genset submenu allows viewing of the genset name (configured with InPower), kW load and operational state.



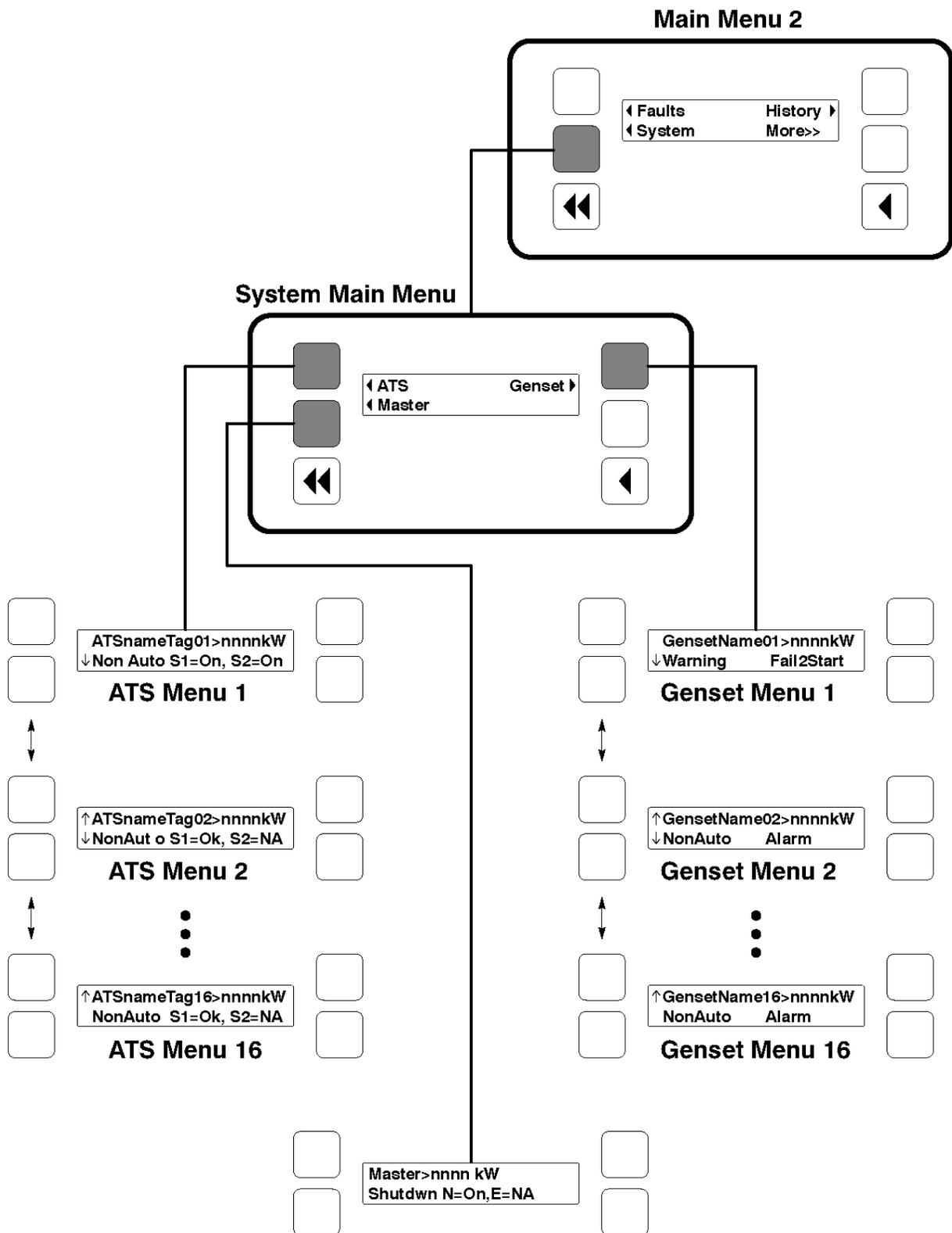


FIGURE 11. SYSTEM MENU

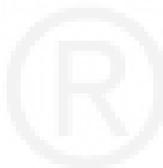
4.4.10 History Menu

Figure 12 shows a block representation of the History menu. If you press the button next to the word "History" in the display, the first History submenu is displayed.

As shown in the diagram, the History menu has five submenus. This information is stored in non-volatile memory and will not be deleted due to loss of battery power.

Press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the the Previous Main Menu button to return to Main Menu 2. Press the Home button to return to Main Menu 1.

- **Number of Starts submenu:** This submenu shows the number of engine starts.
- **Engine Hours submenu:** This submenu shows the number of operating hours for the engine.
- **Control Hours submenu:** This submenu shows the number of operating hours for the control.
- **Kilowatt Hours submenu:** This submenu shows the number of kilowatt (kW) or megawatt (MW) hours.
- **Genset Duty Cycle submenu:** This submenu shows the percent of genset operating hours that are less than 30 percent of rated load and percent of hours that are greater than 90 percent.



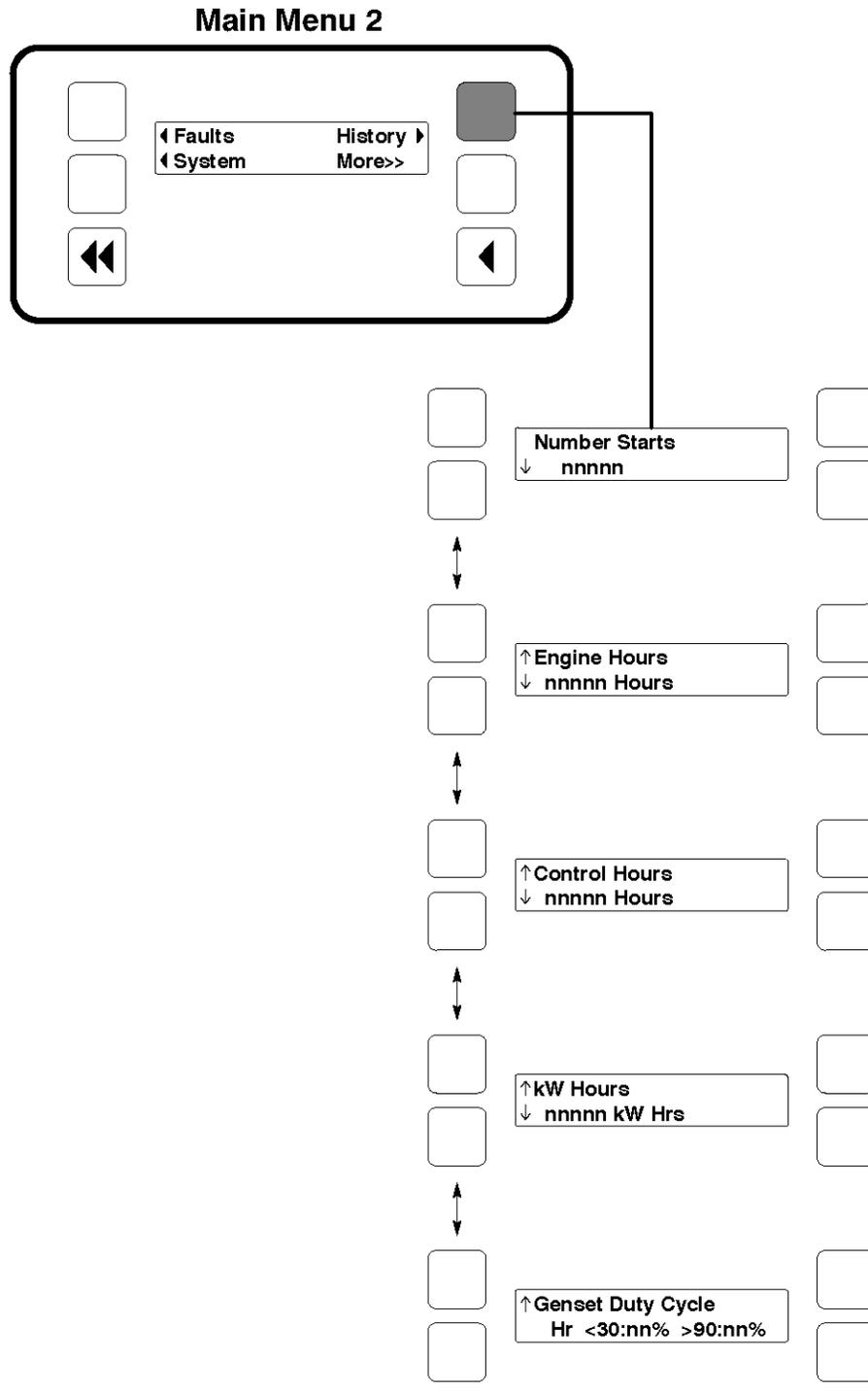


FIGURE 12. HISTORY MENU

4.4.11 About Menu

Figure 13 shows a block representation of the About menu. If you press the button next to the word "About" in the display, the first About submenu is displayed.

As shown in the diagram, the About menu has three submenus.

Press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the the Previous Main Menu button to return to Main Menu 3. Press the Home button to return to Main Menu 1.

- **Model submenu:** This submenu shows the genset model.
- **Rating submenu:** This submenu shows the rating (Standby or Prime and number of kilowatts (kW)).
- **Software Version submenu:** This submenu shows the software version level. This information is required to service the generator set.

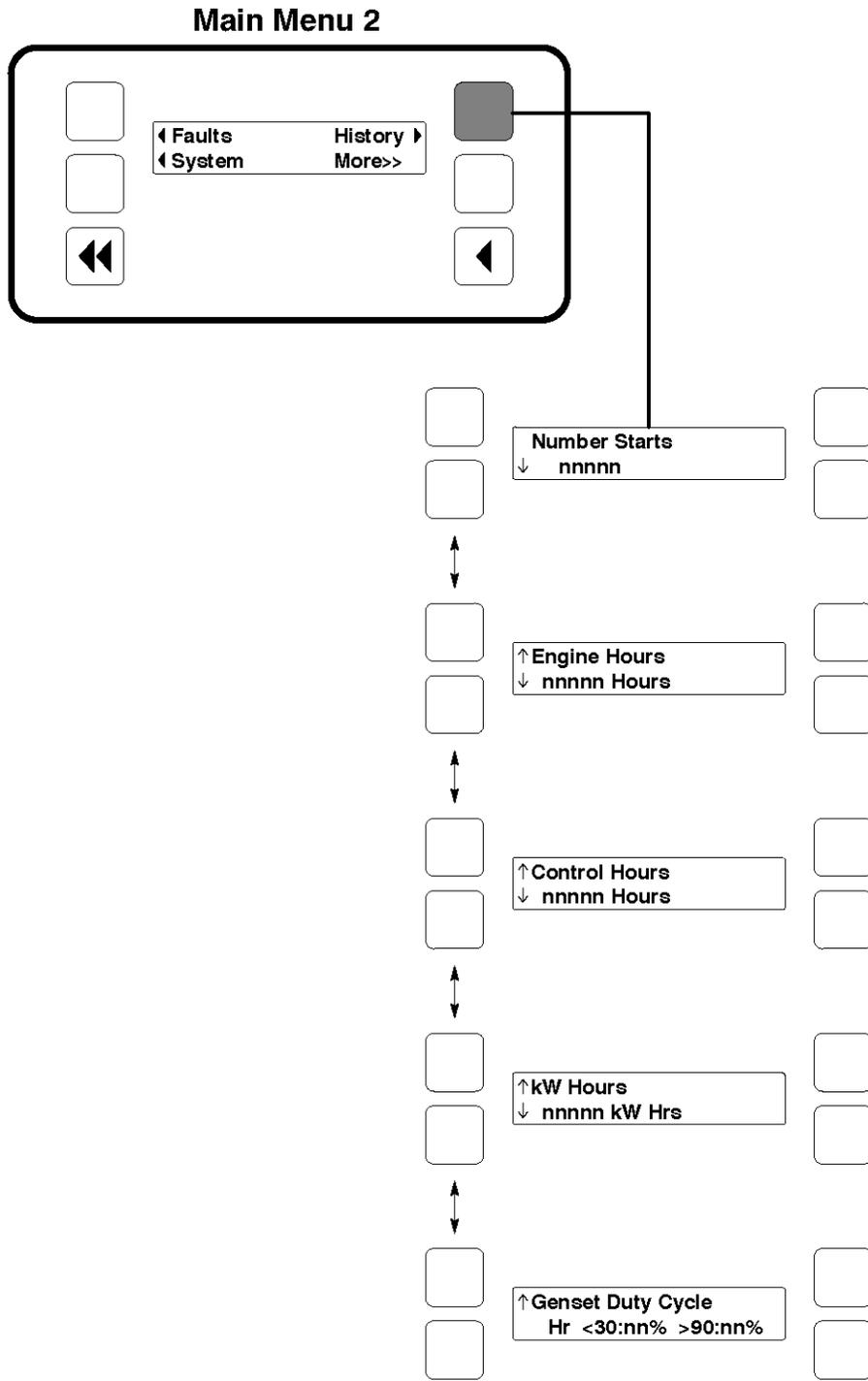
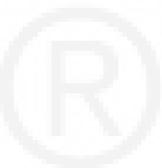


FIGURE 13. ABOUT MENU

This page is intentionally blank.



5 Operation - PCC 2100

5.1 Safety

Only trained and experienced personnel should carry out generator set operations. Before operating the system, the operator should become familiar with **[IMPORTANT SAFETY INSTRUCTIONS](#)**, together with the Health and Safety manual. Observe all of the WARNINGS and CAUTIONS at all times.



WARNING: *Before operating the generator set become familiar with the equipment and how it is operated (including all controls, manually operated valves and alarm devices). Safe and efficient operation can ONLY BE achieved if the 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.*



WARNING: *Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include:*

- *Dizziness*
- *Nausea*
- *Headache*
- *Weakness and sleepiness*
- *Throbbing in temples*
- *Muscular twitching*
- *Vomiting*
- *Inability to think coherently*

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

5.2 Starting

The following headings cover the systems used to start the generator set.

Before starting the generator set, make sure that the exhaust and fuel fitting are tight and properly positioned and that proper maintenance has been performed.

5.2.1 Starting - Safety Consideration



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 energized, possibly for the first time. Furthermore, equipment that does not form part of the generator set installation may become electrically charged. Only authorized and competent personnel should carry out this work.*



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.*

5.2.2 Operator's Pre-start Checks



WARNING: *Windings of high voltage, 601 to 15,000 volts, generator sets must be dry before the generator set is operated. Failure to make sure dry windings before start-up may result in catastrophic failure, severe personal injury and death.*

- Fuel Supply - Make sure 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. Make sure 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 set is running, or is stationary but hot. Hot coolant is under pressure in the radiator system. Contact with hot coolant can result in severe burns. Always allow it to cool before releasing the pressure and removing the cap.*



CAUTION: *It is essential that Cummins Power Generation'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 authorized distributor for the correct anti-freeze specifications and concentration for your operating conditions.*



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.**

- Cooling Air Inlet / Outlets - Make sure that the cooling air inlets/outlets are unobstructed.

- Exhaust Outlet - Make sure 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. Make sure that there are no leaks and that all fittings are tight.
- Batteries – Make sure that the batteries are charged, that the electrolyte is at the correct level and that all connections are correct.
- Auxiliary AC Supplies - Make sure that all auxiliary equipment is receiving power from the customer's supply.
- Emergency Stop/Fire Detection Equipment - Make sure that all related equipment is fully operational.

5.2.3 Starting at the Control Panel (Manual Mode)

Turn the O/Manual/Auto switch to the Manual position and press the Manual Run/Stop button. This will activate the engine control system and the starting system. The starter will begin cranking and, after a few seconds, the engine will start and the starter will disconnect.



NOTE: The InPower service tool is required to enable/disable the warm-up at idle feature and to adjust the time-out. When shipped from the factory, this feature is disabled.

When the switch is in the Manual position, the control will complete the warm-up at idle feature if enabled. When the coolant reaches operating temperature or the warm-up time at idle time delay (0–300 seconds) is reached, whichever occurs first, the generator set will ramp to the rated speed and voltage.

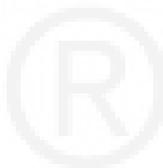
When the switch is in the Manual position, the generator set can be operated in the idle mode (used for maintenance, troubleshooting, etc.). Refer to [Adjust Menu](#) to enable/disable the idle feature.

If the engine does not start, the starter will disengage after a specified period of time and the control will indicate an overcrank shutdown.

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

To change the cycle number, and the crank and rest times, contact an authorized service center for assistance.

To clear a Fail to Start shutdown, place the O/Manual/Auto switch in the O position and press the Fault Acknowledge/Reset button. Wait two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to the Troubleshooting section.



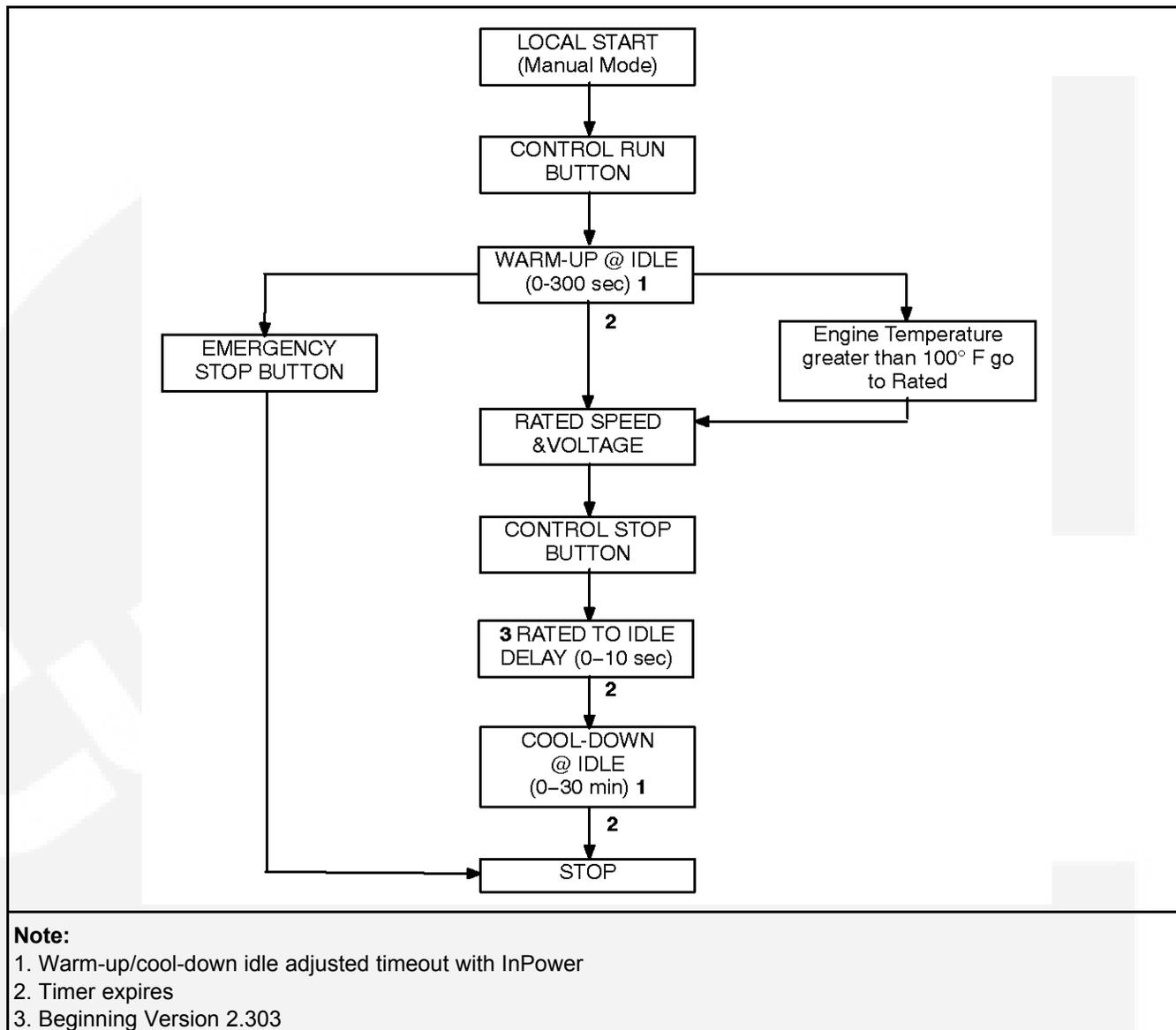


FIGURE 14. STARTING AT THE CONTROL PANEL (MANUAL MODE)

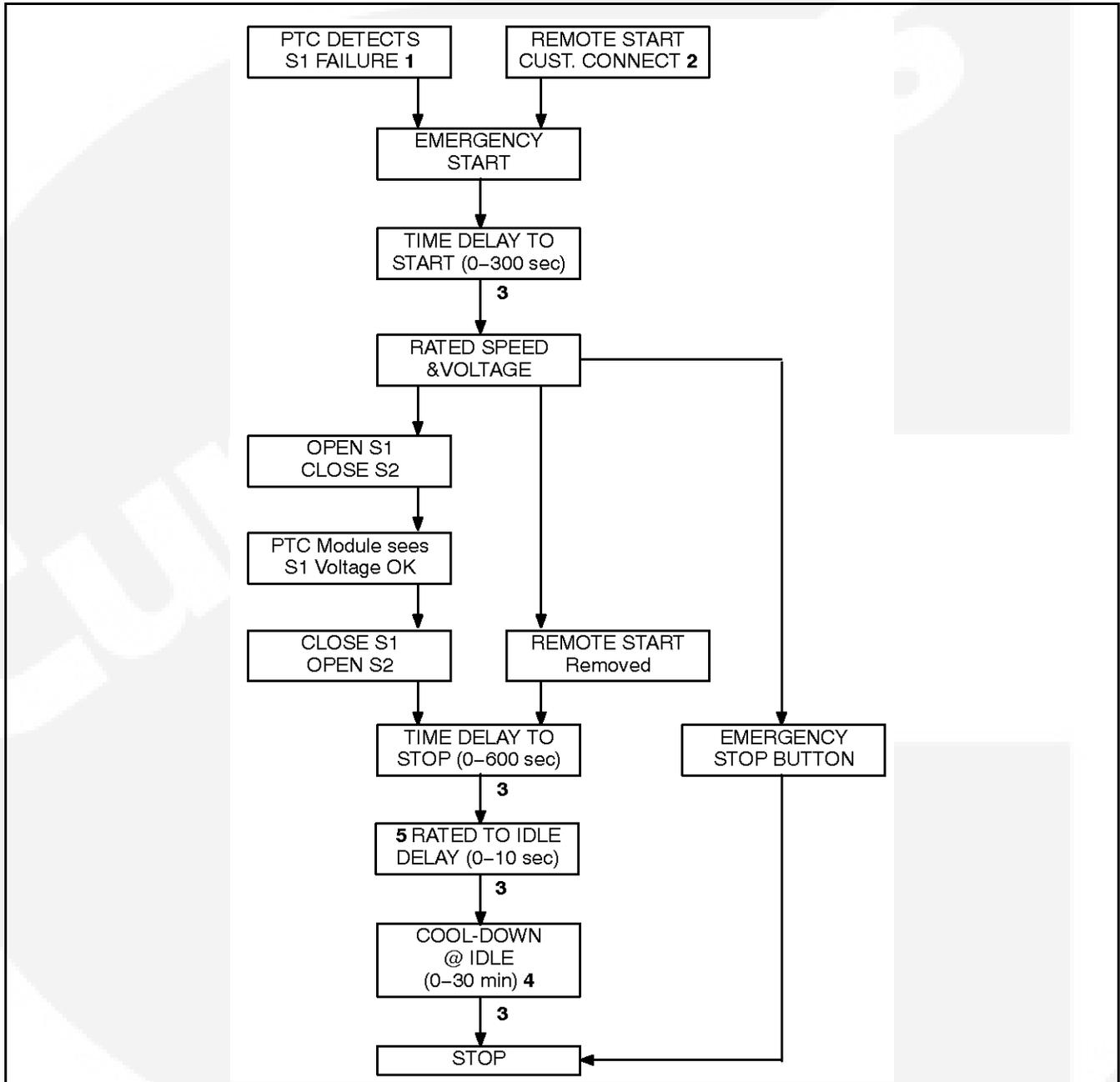
5.2.4 Starting From a Remote Location (Remote Start Signal) - Auto Mode

Place the O/Manual/Auto switch in the Auto position. This allows the generator set to be started from a remote switch or device (e.g., transfer switch or optional PTC module).

In response to the Remote Start or the control detects the loss of S1 voltage (PTC option installed), the control lights the Remote Start indicator and initiates the starting sequence, shown in the figure below.

When the switch is in the Auto position, the control will complete the time delay to start.

Refer to the [Adjust submenu](#) in this section to enable and change the time delay start/stop settings.



Note:

- 1. PTC feature installed only.
- 2. PTC feature not installed.
- 3. Timer exercise.
- 4. Cool-down adjusted timeout with InPower.
- 5. Beginning Version 2.303

FIGURE 15. STARTING FROM A REMOTE LOCATION (REMOTE START SIGNAL) - AUTO MODE

5.2.5 Cold Starting With Loads

In accordance with NFPA 110, Cummins Power Generation recommends installing standby generator sets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is above 40° F (45° C). NFPA also requires that the engine jacket water coolant be maintained at a minimum of 90° F (32° C) and, for most applications, accept the emergency load in 10 seconds or less. Although most Cummins Power Generation generator sets will start in temperatures down to -25° F (-32° C) when equipped with engine jacket water coolant heaters, it might take more than 10 seconds to warm the engine up before a load can be applied when ambient temperatures are below 405F (45C).

The Engine Cold (Code 1435) message, in conjunction with illumination of the Warning LED, is provided to meet the requirements of NFPA 110. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 70° F (21° C). In applications where the ambient temperature falls below 40° F (4° C), a cold engine may be indicated even though the coolant heaters are connected. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

5.3 Stopping

5.3.1 Emergency Stop

The emergency stop button is located near the center of the upper part of the control panel. Push the button in for an emergency stop. The red Shutdown status LED is lit and the emergency stop message is displayed.

To reset:

1. Pull the emergency stop button out.
2. Turn the O/Manual/Auto switch to O.
3. Press the front panel Fault Acknowledge/ Reset button.
4. Select Manual or Auto, as required.

Emergency Stop shutdown status can be reset only at the operator control panel.

5.3.2 Stopping at Control Panel (Manual Mode)

If the set was started at the control panel (O/Manual/Auto switch in the Manual position), pressing the Manual Run/Stop button causes the set to complete its normal (Local Start) shutdown sequence.

The set stops after the cool-down at idle timer (0 to 30 minutes) has timed out.



NOTE: The InPower service tool is required to enable/disable the Cool-down At Idle feature. Contact an authorized service center for assistance.

Turning the O/Manual/Auto switch to the O position causes an immediate engine shutdown (bypasses Cool-down At Idle). If possible, this hot shutdown should be avoided to help prolong the reliability of the engine.

5.3.3 Stopping from Remote Location (Remote Stop Signal) - Auto Mode

If the control receives a remote stop signal or the control detects the return of S1 voltage (PTC option installed), the set completes its normal shutdown sequence. (The remote stop signal is actually the removal of the remote start signal to the control.)

The set stops after completing the Time Delay To Stop (0 to 600 seconds) and the cool-down at idle (0-30 minutes).

Refer to the [Adjust submenu](#) to enable and change the Time Delay To Stop setting. The InPower service tool is required to enable/disable the Cool-down At Idle feature. Contact an authorized service center for assistance.

5.4 Operating Recommendations

5.4.1 Break-In

Drain and replace the crankcase oil after the first 50 hours of operation on new generator sets. Refer to the Maintenance section of this manual for the recommended procedures.

5.4.2 No-Load Operation

Periods of no 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 bank of at least 30 percent of nameplate rating.

5.4.3 Exercise Period

Generator sets on standby duty 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 generator set at least once a month for a minimum of 30 minutes, under not less than 30 percent of the nameplate rating.

5.4.4 Low Operating Temperature

Use a coolant heater if a separate source of power is available. The optional heater 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.



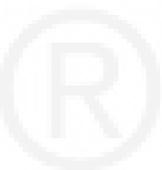
CAUTION: *To avoid damage to the heater, be sure the cooling system is full before applying power to the heater.*

5.4.5 HIGH OPERATING TEMPERATURE

Refer to the genset nameplate or the *Specification/Data Sheet* for the maximum ambient operating temperature, if applicable.



This page is intentionally blank.



6 Troubleshooting

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. 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.

6.1 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](#), and suggests possible causes of the fault.



NOTE: Displayed error codes that are not listed in [Warning and Shutdown Fault Codes/Messages](#) will require an authorized service representative to correct the fault. Contact your authorized distributor for assistance.

6.2 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 [IMPORTANT SAFETY INSTRUCTIONS](#) and observe all instructions and precautions throughout this manual, the Operator's engine specific manual, and the Health and Safety manual.

The installation of a generator set can be designed for remote starting. When troubleshooting a generator set that is shutdown make sure that the set cannot be accidentally re-started.



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 cables. Failure to do so can result in voltage spikes high enough to damage the DC control circuits of the generator set.*



WARNING: *Ventilate the battery area before working on or near the battery. Wear goggles. Stop the generator set and disconnect the battery charger before disconnecting the battery cables. 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 cables (negative (-) first).

6.3 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 your authorized distributor for assistance.

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

- All switches and controls are in their correct positions
- 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 [IMPORTANT SAFETY INSTRUCTIONS](#) of this manual together with the Health and Safety manual.

6.4 Status Indicators

6.4.1 Running Indicator

This green lamp is lit whenever the generator (local or remote) is running.

6.4.2 Remote Start Indicator

This green lamp indicates the control is receiving a remote run signal. When flashing, indicates a load demand stop mode.

6.4.3 Not in Auto

This red lamp is flashes continuously when the O/Manual/Auto switch is not in the Auto position.



NOTE: If the switch is in the Auto position and the lamp is still flashing, service is required.

6.4.4 Configurable Indicators

The following configurable indicators (default values shown) can be changed with the InPower service tool. The configurable items are: change generator event and LED color (green, yellow or red), and enable/disable indicator.

The InPower service tool is required to select the desired settings. Contact an authorized service center for assistance.

6.4.5 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 turning the O/Manual/Auto switch to the O position, and pressing the Fault Acknowledge button. The generator set cannot be started when this lamp is on.

Dependent upon the specific fault that occurs, the engine may or may not shut down immediately. A fault that could cause engine damage, causes an immediate engine shutdown (bypasses engine cool-down sequence). All other faults would allow the engine to run during the cool-down sequence before engine shutdown. In this case, the Shutdown Status indicator blinks during the cool-down period.

6.4.6 Warning Status Indicator

This yellow lamp is lit whenever the control detects a warning condition. After the condition is corrected, warning indicators can be reset by pressing the Fault Acknowledge button. (It is **not** necessary to stop the generator set if the fault becomes inactive during genset operation.) In auto mode, warning indicators can also be reset by cycling the remote reset input after the condition is corrected.

Some warnings remain active after the condition is corrected and the control reset button is pressed. This will require the genset to be shutdown to reset the warning indicator.

6.5 Line Circuit Breaker (Optional)

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

6.6 Control and Diagnostics via Network or Personal Laptop Computer

See your authorized Cummins Power Generation dealer regarding software, hardware and network requirements for control and diagnostics via network or personal computer.

6.7 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 the Fault Codes table 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.

6.7.1 Fault Messages

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

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

6.7.2 Fault Acknowledgement

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

Faults are re-announced if they are detected again after being acknowledged. Refer to [Fault Acknowledgement/Reset Button](#).

6.7.3 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.

6.7.4 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.

6.7.5 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).



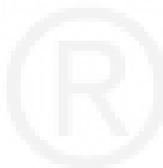
CAUTION: *Continued operation may void generator set warranty if damage occurs that relates to this fault condition.*

6.7.6 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 Customer Input Faults.

6.7.7 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.



6.7.8 PCC 2100 Fault Codes Table

CTG	CODE	LAMP	DISPLAYED
A	121	Shtdn	Speed Signal Lost
C	135	Wrng	Oil Pressure Sensor H
C	141	Wrng	Oil Pressure Sensor L
D	143	Wrng	Pre-Low Oil Pres
C	144	Wrng	Coolant Sensor High
C	145	Wrng	Coolant Sensor Low
D	146	Wrng	Pre-High Coolant Temp
D	151	Shtdn	High Coolant Temp
D	197	Wrng	Low Coolant Level
A	234	Shtdn	Overspeed
D	235	Shtdn	Low Coolant Leve
D	359	Shtdn	Fail To Start
D	415	Shtdn	Low Oil Pressure
D	441	Wrng	Low Bat Voltage
D	442	Wrng	High Bat Voltage
A	1123	Shtdn	Shutdown After BS
E	1124	Wrng	Delayed Shutdown
E	1131	Wrng	Battle Sh Active
E	1311	Shtdn/Wrng	Customer Input #1
E	1312	Shtdn/Wrng	Customer Input #2
E	1313-1316	Shtdn/Wrng	Network Fault 1 through 4
E	1317	Shtdn/Wrng	Customer Input #3
B	1318	Wrng	Service Engine
A	1334	Shtdn	Crit Scaler OR
B	1335	Wrng	Noncrit Scaler OR
C	1416	Wrng	Failt to Shutdown
D	1417	Wrng	Pwr Down Error
D	1433	Shtdn	Emergency Stop
D	1434	Shtdn	Remote E-stop
D	1435	Wrng	Low Coolant Temp
D	1438	Shtdn	Fail to Crank
D	1442	Wrng	Weak Battery
D	1443	Shtdn	Battery Failed
B	1444	Wrng	kW Overload

A	1445	Shtdn	Short Circuit
A	1446	Shtdn	High AC Voltage
A	1447	Shtdn	Low AC Voltage
D	1448	Shtdn	Under Frequency
A	1449	Wrng	Over Frequency
A	1452	Wrng	Gen CB Not Close
A	1453	Wrng	Gen CB Not Open
A	1459	Shtdn	Reverse Power
A	1461	Shtdn	Loss of Field
C	1466	Wrng	Modem Failure
C	1468	Wrng	Network Error
A	1469	Shtdn	Speed/Hz Match
B	1477	Wrng	Over Current
A	1472	Shtdn	Over Current
E	2323-2326	Shtdn/Wrng	Network Fault 5 through 8
B	2327	Wrng	PTC Fault
E	2329	Wrng	Low S1 Frequency
E	2331	Wrng	Low S1 Voltage
A	2335	Shtdn	Excitation Fault
A	2336	Shtdn	Memory Error
C	2337	Wrng	Pwr Tran Disabled
C	2338	Wrng	Pwr Tran Failure
E	2339	Wrng	Pwr Down Enabled
B	2341	Wrng	High Control Temp
E	2342	Wrng	Too Long in Idle (10 min)
E	2358	Wrng	High S1 Voltage
E	2396	Wrng	S1 CB Not Close
E	2397	Wrng	S1 CB Not Open
C	2966	Wrng	PTC Timeout
C	2967	Wrng	Governor Fault
C	2968	Wrng	AVR Fault
C	2969	Wrng	LON Failure
A	2972	Shtdn	Field Overload

FIGURE 16. FAULT CODES TABLE FOR PCC 2100

6.7.9 Warning and Shutdown Codes



WARNING: Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and mechanical hazards should perform service procedures. Review safety precautions.

6.7.9.1 Code 143 - Pre-Low Oil Pres

Corrective Action: Indicates engine oil pressure has dropped to an unacceptable level. If generator is powering critical loads and cannot be shut down, wait until next shutdown period and then follow code **415** procedure.

6.7.9.2 Code 146 - Pre-High Cool Tmp

Corrective Action: Indicates engine has begun to overheat (coolant temperature has risen to an unacceptable level. If generator is powering non-critical and critical loads and cannot be shut down, use the following:

1. Reduce load if possible by turning off non-critical loads.
2. Check air inlets and outlets and remove any obstructions to airflow.

If engine can be stopped, follow code **151** procedure.

6.7.9.3 Code151 - High Coolant Temp Alarm

Corrective Action: 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:

1. Check coolant level and replenish if low. Look for coolant leaks and repair if necessary.
2. Check for obstructions to cooling airflow and correct as necessary.
3. Check fan belt and repair or tighten if necessary.
4. Check blower fan and circulation pumps on remote radiator installations.
5. Reset control and restart after locating and correcting problem.

6.7.9.4 Code 197 - Low Coolant Level

Corrective Action: Indicates engine coolant level has fallen to an unacceptable level. If generator is powering critical loads and cannot be shut down, wait until next shutdown period, then follow **235 Coolant Level Alarm** procedure. If engine can be stopped, follow **235** procedure.

6.7.9.5 Code 235 - Low Coolant Level

Corrective Action: Indicates engine coolant level has fallen below the alarm trip point. Allow engine to cool down completely before proceeding.

1. Check coolant level sight glass at LTA top tank.Replenish if low.
2. Look for possible coolant leakage points and repair if necessary.
3. Reset control and restart after locating and correcting problem.

6.7.9.6 Code 359 - Fail To Start

Corrective Action: Indicates possible fuel system problem. (Engine cranks but fails to start)

1. Open any closed fuel shutoff valve.
2. Check for dirty or plugged air filter and replace if necessary (see Maintenance section).
3. Gaseous fuel delivery to the set is inadequate. Contact an authorized service center for service.

4. Reset the control and restart after correcting the problem.

6.7.9.7 Code 415 - Low Oil Pressure

Corrective Action: Indicates engine oil pressure has dropped below the shutdown trip point. Check oil level, lines and filters. If oil system is OK but oil level is low, replenish. Reset control and restart.

6.7.9.8 Code 441 - Low Bat Voltage

Corrective Action: Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation will occur.

1. Discharged or defective battery. Check the battery charger fuse. Recharge or replace the battery.
2. Poor battery cable connections. Clean the battery cable terminals and tighten all connections.
3. Check battery charge voltage float level if applicable (raise float level).

6.7.9.9 Code 442 - High Bat Voltage

Corrective Action: Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur. Check float level on battery charger if applicable (lower float level).

6.7.9.10 Code 1311, 1312, 1317 - Customer Input #1-#3

Corrective Action: The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, Low Starting Hydraulic Pressure, Low Starting Air Pressure, etc.

Each of the fault functions can be programmed (using service tool), as follows:

- Enable/disable input (Default: enable)
- Status, Warning or Shutdown (Default: #1-None, #2 and #3-Warning)
- Active closed or open (Default: closed [ground])
- Change display name using up to 19 characters (Default: #1- Customer Fault 1, #2-Ground Fault, #3-Low Fuel)

6.7.9.11 Code 1318 - Service Engine Fault

Corrective Action: Indicates that emissions criteria might not be met due to one of the following:

- Engine running in open loop,
- Lean mixture
- Rich mixture
- Failed fuel system component

6.7.9.12 Code 1417 - Power Down Error

Corrective Action: Indicates that the control can not power down due to some unknown condition. Possible drain on battery. Contact an authorized service center for service.

6.7.9.13 Code 1433 - Emergency Stop

Corrective Action: Indicates local Emergency Stop. To reset the local/remote Emergency Stop button:

1. Pull the button out.
2. Move the O/Manual/Auto switch to O.
3. Press the front panel Fault Acknowledge/Reset button.
4. Select Manual or Auto, as required.

6.7.9.14 Code 1434 - Remote E-Stop

Corrective Action: Indicates remote Emergency Stop. See code 1433 to reset.

6.7.9.15 Code 1435 - Low Coolant Temp

Set is not operating. Warning occurs when engine coolant temperature is 70° F (21° C) or lower.



NOTE: In applications where the ambient temperature falls below 40° F (4° C), Low Coolant Temp may be indicated even though the coolant heaters are operating.

Corrective Action: Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions:

1. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required.
2. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required.

6.7.9.16 Code 1438 - Fail To Crank

Indicates possible fault with control, speed sensing or starting system. See code **441** for corrective action.

6.7.9.17 Code 1442 - Weak Battery

Corrective Action: 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.

6.7.9.18 Code 1443 - Battery Failed

Corrective Action: Dead battery - engine will not start. See code **441** for corrective action.

6.7.9.19 Code 1448 - Under Frequency

Corrective Action: Indicates possible fuel system problem or overload condition.

1. Check for dirty or plugged air filter and replace if necessary (see Maintenance section).
2. Check operation by disconnecting load and restarting generator set.
3. Fuel system requires adjustment. Contact an authorized service center for service.
4. Gaseous fuel delivery to the set is inadequate. Contact an authorized service center for service.
5. Reset the control and restart after correcting the problem.

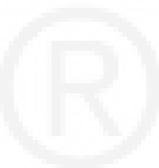
6.7.9.20 Code 2342 - Too Long in Idle

Corrective Action: Indicates genset has been in Idle mode too long (10 minutes maximum).





This page is intentionally blank.



7 Maintenance

Maintenance work, particularly in confined areas, should be carried out by two engineers working together.

Read, understand and comply with all Caution and Warning notes in this section, those contained within **IMPORTANT SAFETY INSTRUCTIONS**, and those contained within the Health and Safety manual. Refer also to the Operator's engine specific manual. 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: Only authorized and qualified maintenance engineers, who are familiar with the equipment and its operation, should carry out maintenance.



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 Set Safety Code**, together with the Health and Safety manual.



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



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 cables (negative [-] first).*

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

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

Make sure 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: 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 all external electrical supplies prior to access of the control panel. 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.*

7.1 Maintenance General Overview

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

[Table 3](#) 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 authorized 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 authorized 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 3](#) to determine the maintenance required and then refer to the sections that follow for the correct service procedures.

Refer also to the engine manual.

TABLE 3. PERIODIC MAINTENANCE TABLE

	Daily or After 8 Hours	Monthly or After 100 Hours	After 100 Hours	After 6 Months or 250 Hours	Yearly or After 500 Hours	2 Years or After 1000 Hrs.
Check general set inspection	■ ¹					
Check Engine oil level	■					
Check coolant level	■					
Check coolant heater(s)	■					
Check air cleaner (normal duty filter)		■ ^{2,3}				

Check all hardware (fittings, clamps, fasteners, etc.)		■				
Check battery electrolyte level		■				
Check generator air outlet		■				
Check radiator hoses for wear and cracks				■ ⁴		
Check exterior of radiator for obstructions				■		
Check engine coolant port caps				■ ¹⁰		
Check drive belt				■ ⁵		
Check AC generator and controls				■		
Check anti-freeze concentration					■	
Inspect Spark plugs					■ ⁶	
Check oxygen sensor					■ ^{7,11}	
Drain and flush radiator						■
Change engine oil and filter (normal duty filter)			■ ^{2,9}			

■¹ – Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with set running and repair any leaks immediately.

■² – Perform more often in extremely duty conditions.

■³ – Replace element after 500 hours.

■⁴ – Replace if hard or brittle.

■⁵ – Visually check belt for evidence of wear or slippage. Replace if hard or brittle.

■⁶ – Replace every 1000 hours.

■⁷ – Must be performed by a qualified mechanic. Contact your authorized services center.

■⁸ – Replace every 8 years or 2000 hours.

■⁹ – Perform at least once a year.

■¹⁰ – Replace after 4 years or 1000 hours.

- 11 – Replace every 1,500 hours (recommended).

7.2 Generator Set Inspection

During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. The following sections cover several areas that should be frequently inspected for continued safe operation.

7.2.1 Exhaust System

With the generator set operating, inspect the entire exhaust system visually and audibly including the exhaust manifold, muffler and exhaust pipe. Check for leaks at all connections, welds, gaskets and joints and also make sure that exhaust pipes are not heating surrounding areas excessively. If any leaks are detected, shut down the generator set and have leaks corrected immediately.



WARNING: *Inhalation of exhaust gases can result in severe personal injury or death. Be sure deadly exhaust gas is piped outside and away from any windows, doors, vents or other inlets to building and not allowed to accumulate in inhabitable areas.*

7.2.2 Fuel System

Inspect the fuel supply lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and make sure they are not rubbing against anything that could cause breakage. If any leaks are detected, shut off fuel supply valves, shut down generator set and have them corrected immediately.



WARNING: *Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, arcing switch or equipment, pilot light, or other igniter near the fuel system or in areas sharing ventilation.*

7.2.3 AC Electric System

Check the following while the generator set is operating.

7.2.3.1 Frequency Meter

The generator frequency should be stable and the reading should be the same as the nameplate rating.

7.2.3.2 AC Voltmeter

Turn the phase selector switch to each line-to-line phase selection shown on the volts scale (L1-L2, L2-L3, and L3-L1). Read the AC voltmeter using the upper or lower scale as indicated by the scale indicator light. At no load, the line-to-line voltage(s) should be the same as the set nameplate rating.

7.2.3.3 AC Ammeter

Turn the phase selector switch to each phase selection shown on the amps scale (L1, L2 and L3). Read the ammeter using the upper or lower scale as indicated by the scale indicator light. At no load, the current readings should be zero. With a load applied, each line current should be about the same.

7.2.3.4 Fault Lamps

Push the Reset/Lamp switch on the control panel. All indicator lamps should light. Confirm that all of the bulbs are on, then release the switch. Have any bulbs that are burned out replaced.

7.2.4 DC Electrical System

Check the terminals on the batteries for clean and tight connections. Loose or corroded connections create resistance which can hinder starting. Refer to *BATTERIES* later in this section for cleaning and safety precautions.

7.2.5 Engine

Monitor fluid levels and oil pressure and coolant temperatures frequently. 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 are as follows:

- Misfire
- Vibration
- Unusual noises
- Sudden changes in engine operating temperatures or pressures
- Excessive exhaust smoke
- Loss of power
- An increase in oil consumption
- An increase in fuel consumption
- Fuel, oil, or coolant leaks.

7.3 Generator Set Maintenance (Battery Disconnected)



CAUTION: Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Engine performance may be affected (i.e., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. Service personnel may be required to correct fault.



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 trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface. 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.



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



WARNING: Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

When performing the following maintenance procedures, make certain the generator set cannot be accidentally restarted as follows:

1. Press the  button to switch to the **Off** mode.
2. Turn off or remove AC power from the battery charger.
3. Press the emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (-) battery cable from the generator set starting battery.

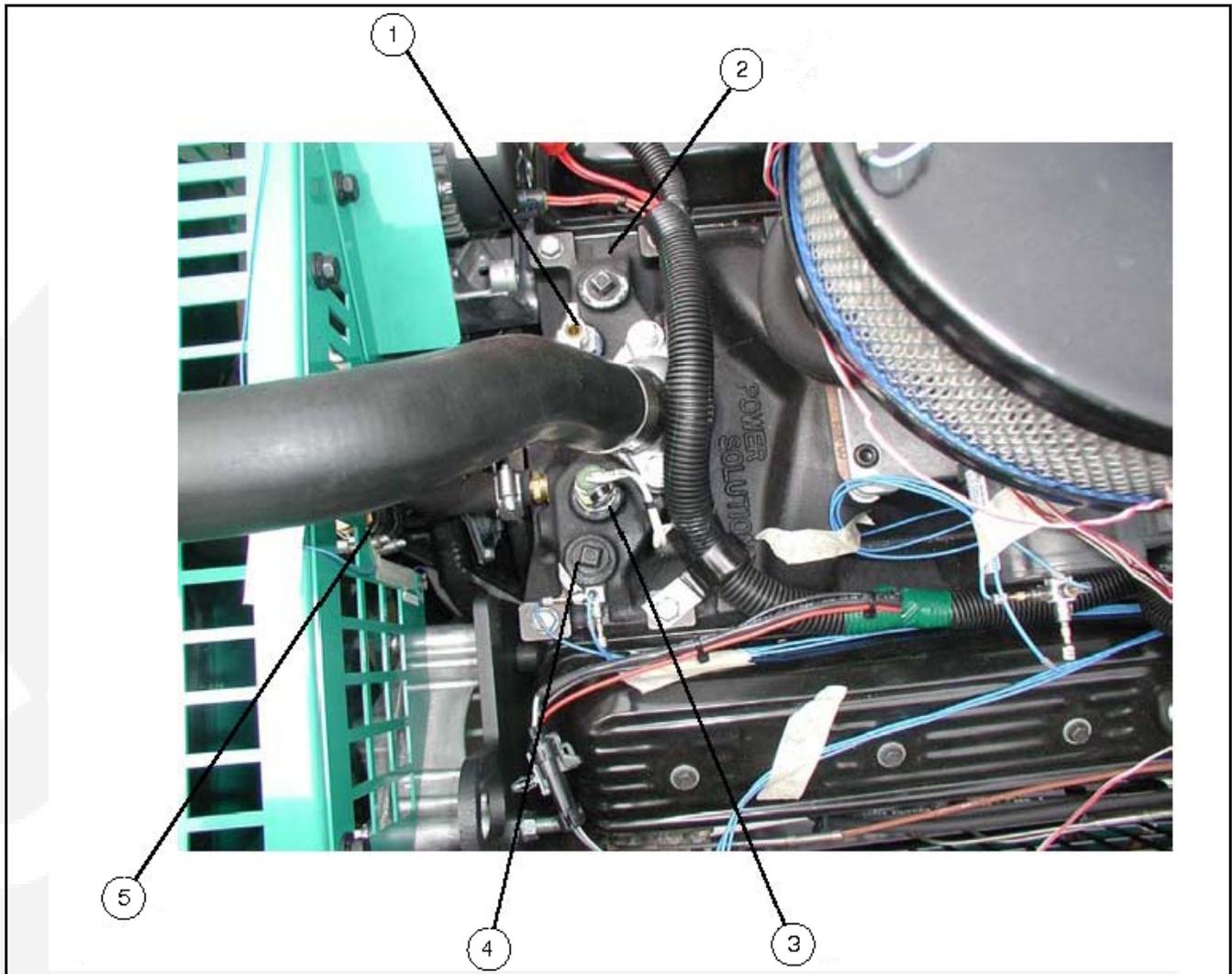
7.3.1 Mechanical Inspection

With the generator set stopped, check for loose belts and fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems are found, have them corrected immediately.

7.4 Engine Coolant Caps

The engine contains caps that are used to cover unused coolant ports. There are two unused coolant ports with plug fittings, 1 port for a temperature sensor, and 1 for a bleeder valve, and another port that is capped with a combination of a hose, 2 clamps, and fittings. These caps should be checked at the intervals specified in the Maintenance Table. If a cap is visibly cracked, brittle, or shows any signs of fatigue, it should be replaced.

The table below provides the cap location and the part numbers. The caps can be purchased through your local certified distributor.



NO	DESCRIPTION (with part no.)	NO	DESCRIPTION (with part no.)
1	Reducer bushing (0505-0018) Bleeder Valve (0504-0003)	4	Coolant port (or used for LP vaporizer)
2	Coolant port	5	Coolant cap (or used for LP vaporizer)
3	Reducer Bushing (0505-0019) Temperature Sensor (0193-0529)		

FIGURE 17. ENGINE COOLANT PORTS - LOCATION A

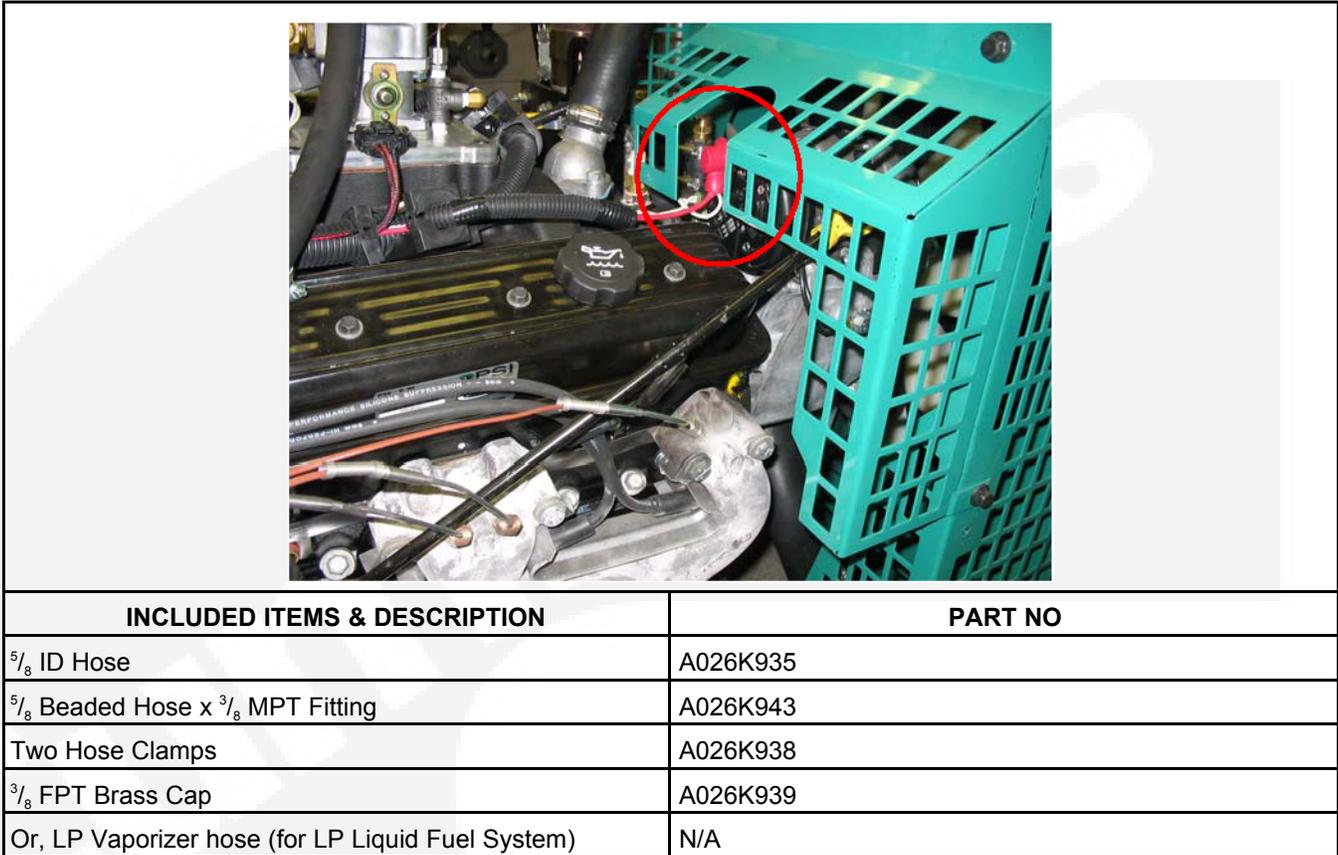


FIGURE 18. ENGINE COOLANT PORTS - LOCATION B



FIGURE 19. LP VAPORIZER ON ENGINE (IF USED)

7.5 Lubrication System



NOTE: Gensets are shipped with oil added. Be sure to check oil level before initial start.

7.5.1 Oil Recommendations

Refer to [Figure 20](#) for the recommended oil viscosity grades at various ambient temperatures. Oils must conform to the American Petroleum Institute (API) classification SJ, SH or SL. When selecting the oil viscosity, pick the grade that is right for the lowest temperature expected. Oil that is too thick can result in a lack of lubrication when the engine is started. SAE 10W-30 is recommended for your engine from 0° F (-18° C) or above. If ambient temperatures are consistently below 0° F (-18° C), SAE 5W-30 is recommended. Turbocharged engines, or engines in high ambient temperature installations, should use SAE 15W-40.

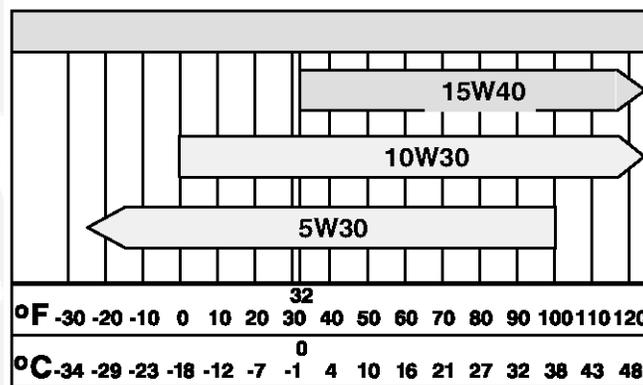


FIGURE 20. OIL VISCOSITY

7.5.2 Engine Oil Level

Check the engine oil level during engine shutdown periods at the intervals specified in the Maintenance Table. The dipstick is stamped with high and low marks to indicate the level of oil in the crankcase. For accurate readings, shut off the engine and wait approximately 15 minutes before checking the oil level. This allows oil in the upper portion of the engine to drain back into the crankcase.



WARNING: Crankcase pressure can blow out hot oil and cause severe burns. Do NOT check oil while the generator set is operating.

Keep the oil level as near as possible to the high mark on the dipstick. Remove the oil fill cap and add oil of the same quality and brand when necessary. Install the oil fill cap after adding oil.



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.

7.5.3 Engine Oil Change



WARNING: State or federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Do not contact oil or breath vapors. Use rubber gloves and wash exposed skin.



WARNING: *Used oil and filters must be disposed of properly to avoid environmental damage and clean-up liability. Check all federal, state and local regulations for disposal requirements.*

Run engine until thoroughly warm before draining oil. Stop the set, place a pan under the drain outlet and remove the oil drain plug or open the drain valve. After the oil is completely drained, replace the drain plug or close the drain valve. Refill with oil of the correct API viscosity grade for the temperature conditions.

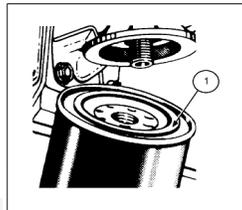


WARNING: *Hot crankcase oil can cause burns if it is spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.*

7.5.4 Oil Filter Change

Spin off oil filter and discard it in accordance with local environmental regulations. Thoroughly clean filter mounting surface. Apply a thin film of oil to filter gasket and install new element. Spin element on by hand until gasket just touches mounting pad and then turn an additional 1/2 to 3/4 turn. Do not overtighten ([Figure 21](#)).

Fill the oil filter with clean lubricating oil. To fill, pour the oil into the center hold of the filter. With oil in crankcase, start engine and check for leaks around filter element. Retighten only as much as necessary to eliminate leaks but do not overtighten.



NO	DESCRIPTION
1	Filter Gasket

FIGURE 21. OIL FILTER

7.6 Cooling System



NOTE: *Gensets are shipped with coolant added. Be sure to check coolant level before initial start.*



CAUTION: *The coolant heater must not be operated while the cooling system is empty or when the engine is running or damage to the heater will occur.*



CAUTION: *Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 120 ° F (50 ° C) before adding coolant.*

7.6.1 Coolant Requirements

Satisfactory engine coolant inhibits corrosion and if necessary protects against freezing. Use a 50/50 coolant solution (50% pure water and 50% antifreeze). If temperatures below -37°F (-38°C) are possible, use a mixture of 65% antifreeze and 35% water. Do not use an antifreeze that contains anti-leak additives.

The water used for engine coolant should be clean, low in mineral content and free of any corrosive chemicals such as chloride, sulfate or acid. Use soft water. Well water often contains lime and other materials which eventually can clog the radiator core and reduce the cooling efficiency and can also cause heater element failure.

7.6.2 Filling the Cooling System



CAUTION: *The engine can overheat and be damaged if coolant is filled improperly.*

Check to make sure that all drain cocks are closed and all hose clamps secure. Open bleeder valve. Remove the radiator pressure cap and slowly fill the cooling system with the recommended coolant. When the coolant begins to flow from the engine bleeder valve, close the valve and continue filling the radiator.



CAUTION: *Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 120°F (50°C) before adding coolant.*

When the engine is first started, remove the pressure cap and monitor the coolant level. As trapped air is expelled from the system, the coolant level may drop and additional coolant must be added. Replace the pressure cap when the coolant level is stable.

7.6.3 Draining and Flushing



WARNING: *Some coolant is toxic. Keep away from children and animals. Follow local environmental regulations for disposal.*

To maintain adequate corrosion protection and remove rust and scale deposits, drain and flush radiator at the recommended interval.



CAUTION: *The heater element will burn out if engine coolant is removed with heater connected to power source.*

Disconnect engine coolant heater from power source (if equipped).

Allow the engine to cool and then remove radiator pressure cap. Open the radiator drain cock and remove the water drain plugs (one on each side of engine). When the coolant is drained, place the end of a water hose into the radiator filler and turn on water supply. Regulate the flow of water into the radiator until it is equal to the outflow from drain openings. Continue flushing until outflow from drains is clear of rust sediment.

If engine is equipped with engine coolant heater, drain coolant by removing hose and clamp from bottom of heater.

Replace the water drain plugs and close the radiator drain cock when flushing is complete. Refill the cooling system with the recommended coolant (refer to [Filling the Cooling System](#)).

With cooling system properly filled and the engine has been run, connect heater plug to receptacle.



CAUTION: *The heater element will burn out if power is connected before it is filled with coolant or if straight antifreeze solution is used for coolant. Before connecting power, fill the engine with coolant and run it for a while to circulate coolant through the heater.*

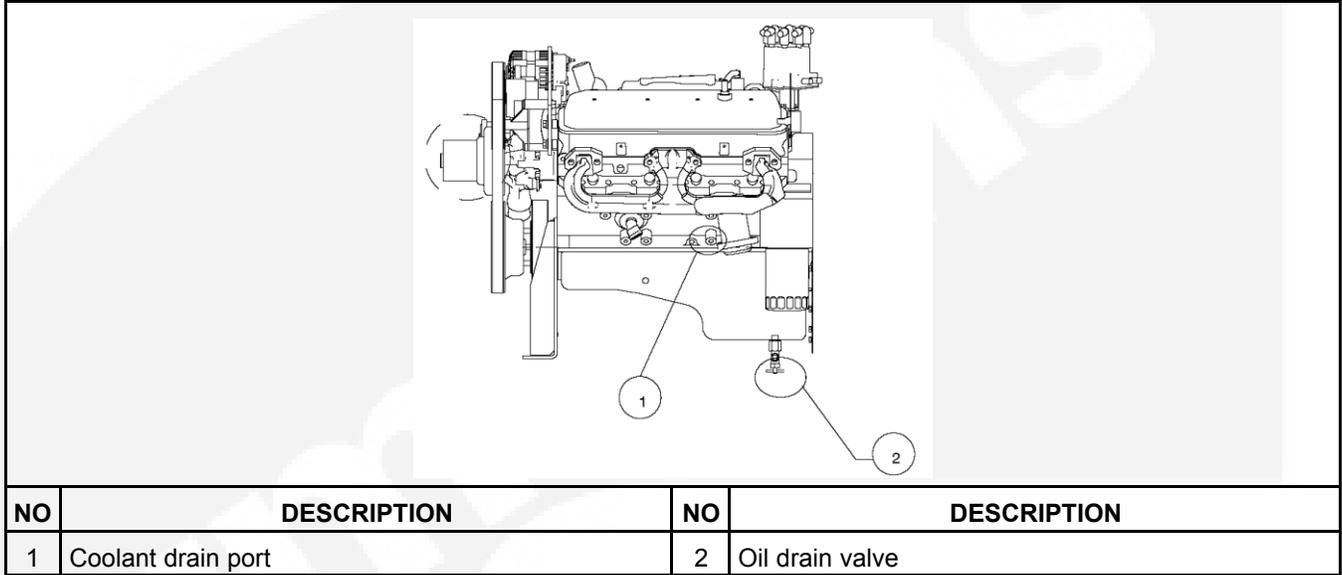


FIGURE 22. DRAIN PORTS LOCATIONS FOR ENGINE OIL AND COOLANT

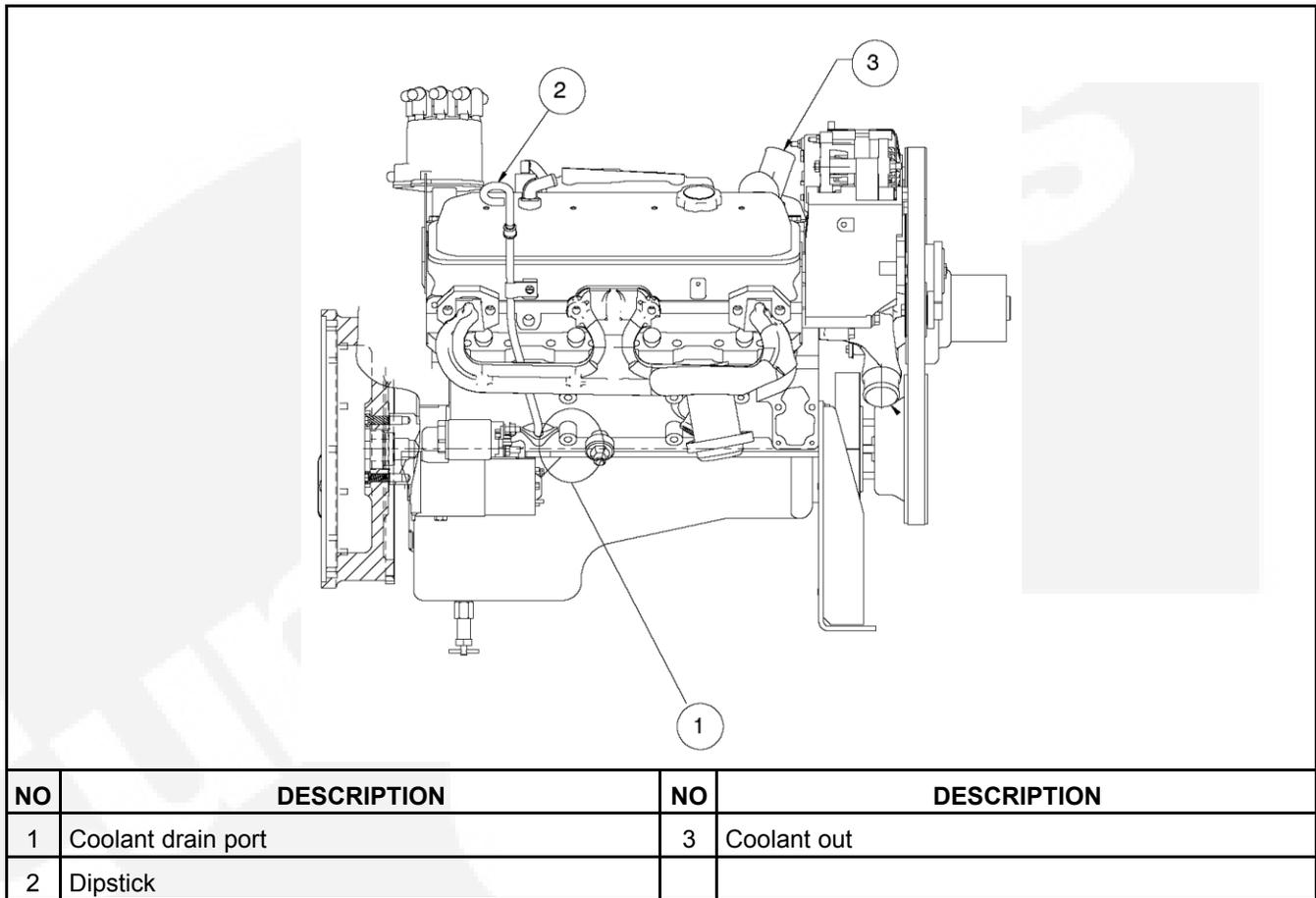


FIGURE 23. COOLANT DRAIN PORT LOCATION ON OPPOSITE SIDE OF ENGINE AND DIPSTICK LOCATION

7.6.4 Coolant Level

Check the coolant recovery tank level. Note the normal level when the engine is cool. Add coolant to the recovery tank to replace the normal loss of coolant.

Refer to the Cummins engine *Owners Manual* for coolant recommendations/specifications.



WARNING: *To prevent severe scalding, let engine cool down before removing coolant pressure cap. Turn cap slowly, and do not open it fully until the pressure has been relieved.*



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 the high engine temperature shutdown system.*

7.6.5 Radiator

Inspect the exterior of the radiator for obstructions. Remove all dirt or foreign material with a soft brush or cloth. Use care to avoid damaging the fins. If available, use low pressure compressed air or stream of water (maximum of 35 psi/242 kPa), in opposite direction of normal air flow to clean radiator. If using water, protect the engine and the generator from over spray.

7.6.6 Coolant Heater

Check the operation of the coolant heater by verifying that hot coolant is being discharged from the outlet hose. **Do not touch outlet hose** - if heater is operational, radiant heat should be felt with hand held close to outlet hose.



WARNING: *Contact with cooling system or engine can result in serious burns. Do not touch cooling system or engine during genset maintenance until they are cool.*

7.7 Air Filter



CAUTION: *Filters should be handled with care to prevent damage. If the filter does become damaged, install recommended replacement part.*

Remove wing nut in center of filter cover. Remove cover and filter. Tap filter on a flat surface to remove dirt. Place a light source inside filter and inspect for air passage. If necessary, apply a low pressure air source (30 psi) to the inside of filter to remove as much dirt as possible. Inspect interior housing. Vacuum clean if dirty or remove housing and wipe clean.



CAUTION: *Do not clean filter housing while still installed. Loose dirt entering intake could damage carburetor or engine.*

Clean air filter every 100 hours of operational time, more often in extremely dusty conditions. Replace air filter after 500 hours of operational time.

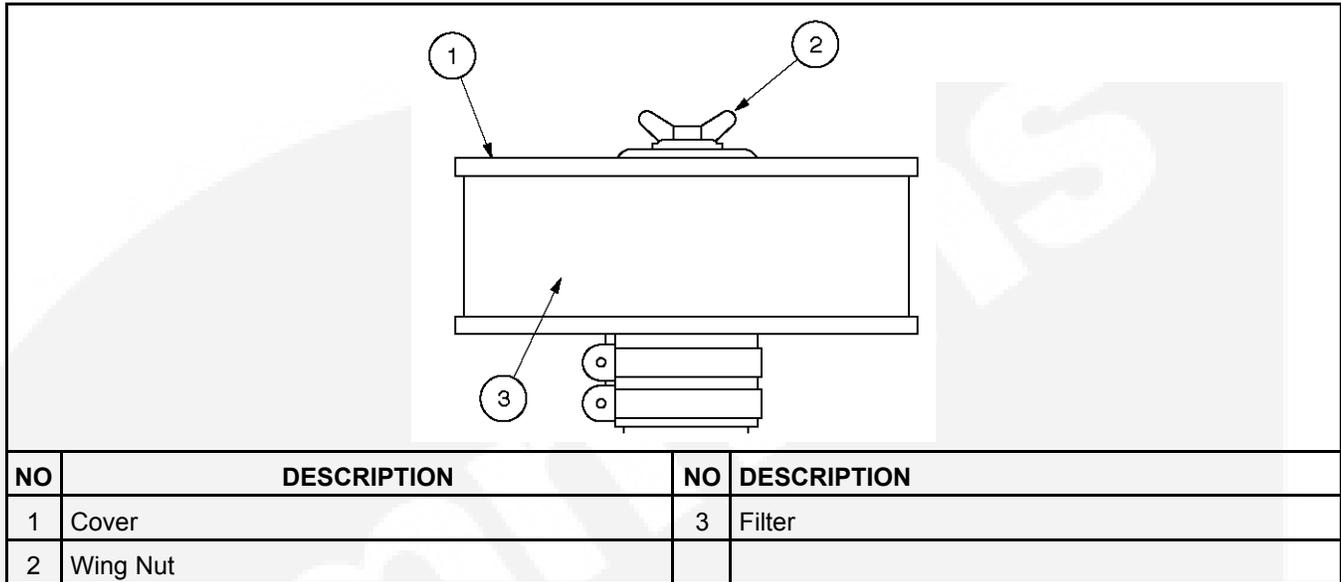


FIGURE 24. AIR FILTER

7.8 Belt Replacement

Belt Removal:

1. Disconnect the negative (-) cable from the battery to prevent accidental starting.



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 trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.



CAUTION: Ventilate battery area before working on or near battery-Wear goggles-Stop genset and disconnect charger before disconnecting battery cables-Disconnect negative (-) cable first and reconnect last.

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



WARNING: Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

2. Remove fan guard (between engine and radiator) to gain access to the serpentine belt.
3. Insert $\frac{3}{8}$ inch male square ratchet or breaker bar into tensioner arm and rotate the ratchet counter clockwise until the spring tension on the belt is relieved. Remove serpentine belt.



WARNING: The belt idle is under tension. Do not allow your hands to get between the belt and pulley. Personal injury will result.

Belt Replacement:

1. Slip in belt onto all pulleys except for the water pump/fan drive pulley.



WARNING: *The belt idle is under tension. Do not allow your hands to get between the belt and pulley. Personal injury will result.*

2. Insert the $\frac{3}{8}$ inch male ratchet or breaker bar into tensioner arm. Rotate the ratchet counter clockwise until the spring tension on the belt is relieved sufficiently to position the belt over the water pump/fan drive pulley. Slowly release spring tension onto belt.

The spring-loaded idle used on this design maintains the correct belt tension.

3. Install fan guard.
4. Connect the negative (-) cable to the battery.
5. Start the generator set and visually check belt for proper alignment with the engine running.



FIGURE 25. BELT REPLACEMENT WITH RATCHET INSERTED IN TENSIONER

7.9 Ignition System

The ignition system consists of a solid state electronic distributor, ignition coil pack, high tension wires, and spark plugs.

Maintenance consists of periodic inspections to detect possible problems and replacement of worn or deteriorated parts. The ignition system must be completely functional or the set may run poorly or be unable to carry full load. Perform the following inspections at recommended intervals.

7.9.1 Spark Plugs

Remove the spark plugs and inspect for damaged or cracked insulators, worn electrodes, or excessive carbon deposits. Replace the spark plug if any of these conditions are noted. Clean those plugs that can be resued and regap to the amount specified in the Specifications section.

Before installing the spark plugs:

- Clean all dirt and grit away from the spark plug seats.
- Lightly lubricate spark plug threads with high temp anti-seize compound

If the spark plugs show any of the following conditions, the engine may require additional service. Contact your authorized service distributor for help.

- Carbon Fouled: overly rich mixture
- Oil Fouled: high oil consumption
- Burned: excessive engine temperature

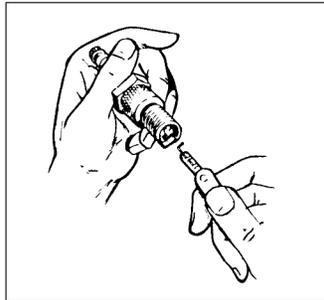


FIGURE 26. GAPING SPARK PLUG

7.9.2 High Tension Wires

Check the spark plug wires for good contact at the ignition coil, distributor, and spark plugs. Terminal connections should be tight and fully seated. All spark plug covers and cable end boots should be in good condition and fit tightly. There should not be any breaks or cracks in the insulation. Replace the wire(s) if any of these conditions are noted

7.9.3 Ignition Coil/Distributor Cap

Clean the top of the spark coil and distributor cap. Check for cracks, carbon tracks, or corrosion in the high tension terminal hole(s). Replace the coil pack or distributor cap if any of these conditions are noted.

7.10 Batteries



CAUTION: Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. Service personnel may be required to correct fault.



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 trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Ventilate battery area before working on or near battery-Wear goggles-Stop genset and disconnect charger before disconnecting battery cables-Disconnect negative (-) cable first and reconnect last.



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

Check the condition of the starting batteries at the interval specified in the Maintenance Table. To prevent dangerous arcing, always disconnect the negative ground cable from the battery before working on any part of the electrical system or the engine. Disregard the sections On Checking Specific Gravity and Checking Electrolyte Level if using a "maintenance-free" battery.

7.10.1 Cleaning Batteries



WARNING: Electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. Do not get the substance in your eyes or contact with skin. Wear goggles and protective, rubber gloves and apron when servicing batteries.

In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN.

Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive.

If corrosion is present around the terminal connections, remove battery cables and wash the terminals with a solution consisting of 1/4 pound of baking soda added to 1 quart of water. (This solution is also used for washing down spilled electrolyte.)

Be sure the vent plugs are tight to prevent cleaning solution from entering the cells.

After cleaning, flush the outside of the battery and surrounding areas with clean water.

Keep the battery terminals clean and tight. After making connections, coat the terminals with a light application of petroleum jelly or non-conductive grease to retard corrosion.

7.10.2 Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell.

Hold the hydrometer vertical and take the reading. Correct the reading by adding four gravity points (0.004) for every ten degrees the electrolyte temperature is above 80° F (27° C). A fully charged battery will have a corrected specific gravity of 1.260. Charge the battery if the reading is below 1.215.

7.10.3 Checking Electrolyte Level



CAUTION: *Do not add water in freezing weather unless the engine will run long enough (two to three hours) to assure a thorough mixing of water and electrolyte.*

Check the level of the electrolyte (acid and water solution) in the batteries at least every 200 hours of operation.

Fill the battery cells to the bottom of the filler neck. If cells are low on water, add distilled water and recharge. If one cell is low, check case for leaks. Keep the battery case clean and dry. An accumulation of moisture will lead to a more rapid discharge and battery failure.

7.10.4 Battery Replacement

Always replace the starting battery with the same number and type (vented, lead acid). Properly dispose of battery in accordance with local environmental agency requirements.



WARNING: *Electrolyte or explosion of battery can cause severe personal injury or death. Do not mutilate or burn the battery in a fire for disposal.*

Damage to case will release electrolyte which is harmful to the skin and eyes and is also toxic. Burning of battery may cause an explosion.

7.10.5 NiCad Batteries

NiCad (nickel-cadmium) battery systems are often specified where extreme high or low ambient temperature is expected because their performance is less affected by temperature extremes than that of lead-acid batteries.

NiCad batteries require special battery chargers in order to bring them to the full-charge level. These chargers must be provided with filter to reduce "charge ripple" which can disrupt engine and generator control systems.

7.11 Out-of-Service Protection

When the set will be stored or removed from operation for an extended period of time, take the following precautions to prevent rust accumulation, corrosion of bearing surfaces within the engine and gum formation in the fuel system. Perform the following procedures as outlined in this manual.

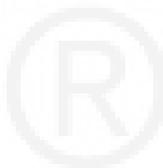
Preparing Set for Storage

1. Exercise the set as described in the operation section until the engine is up to operating temperature.
2. Shut down the engine.
3. Turn off and disconnect battery charger (if equipped).
4. Disconnect the battery (negative cable first) and store in a cool, dry place. Connect the battery to charger every 30 days to maintain it at full charge.
5. Drain the engine oil while still warm and refill with new oil recommended for set. Attach a tag indicating type of oil used.
6. Remove the spark plugs and pour two ounces of rust preventative oil into each spark plug opening. Crank the set for five seconds to distribute the oil on the cylinder walls and then replace the spark plugs.

7. Disconnect engine coolant heater from power source (if equipped).
8. Drain the cooling system including the engine block.
9. Remove the air cleaner and seal off the carburetor air inlet opening and the PVC hose.
10. Plug the exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
11. Clean and wipe entire unit. Coat parts susceptible to rust with a light coat of oil. Cover entire set loosely after engine has cooled down.

Returning Set to Service

1. Remove protective cover.
2. Remove exhaust plugs, seal from carburetor and PVC hose and replace air cleaner.
3. Check oil dipstick to make sure crankcase is full.
4. Refill cooling system.
5. Reconnect the battery (positive cable first) and check specific gravity.
6. Connect the battery charger (if applicable).
7. Connect engine coolant heater to power supply (if applicable).
8. Remove all loads before starting set.
9. Start set and apply load of at least 50% of nameplate rating.
10. Check all gauges for normal readings. Set is now ready for service.

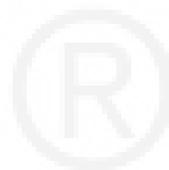


8 Global Addresses

NORTH AMERICA	EMEA, CIS	ASIA PACIFIC
Cummins Power Generation Limited 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Cummins Power Generation Limited Columbus Avenue Manston Park Manston, Ramsgate Kent CT12 5BF United Kingdom	Cummins Power Generation Limited 10 Toh Guan Road #07-01 TT International Tradepark Singapore 608838
Phone 1 763 574 5000 Toll Free 1 800 888 6626 Fax 1 763 574 5298	Phone 44 1843 255000 Fax 44 1843 255902	Phone 65 6417 2388 Fax 65 6417 2399
BRAZIL	CHINA	INDIA
Rua Jati, 310, Cumbica Guarulhos, SP 07180-900 Brazil	8 Wanyuan Street Beijing Economic and Technological Dev. Area Beijing 100176 P.R. China	35A/1/2, Erandawana Pune 411 038 India
Phone 55 11 2186 4195 Fax 55 11 2186 4729	Phone 86 10 6788 2258 Fax 86 10 6788 2285	Phone 91 020 6602 7525 Fax 91 020 6602 8090
LATIN AMERICA	MEXICO	
3350 Southwest 148th Ave. Suite 205 Miramar, FL 33027 USA	Eje 122 No. 200 Zona Industrial San Luis Potosi, S.L.P. 78395 Mexico	
Phone 1 954 431 551 Fax 1 954 433 5797	Phone 52 444 870 6700 Fax 52 444 824 0082	



This page is intentionally blank.



Copyright © 2010 Cummins Power Generation, Inc. All rights reserved.
Cummins, the "C" logo, and "Our energy working for you." are trademarks of
Cummins Inc.

