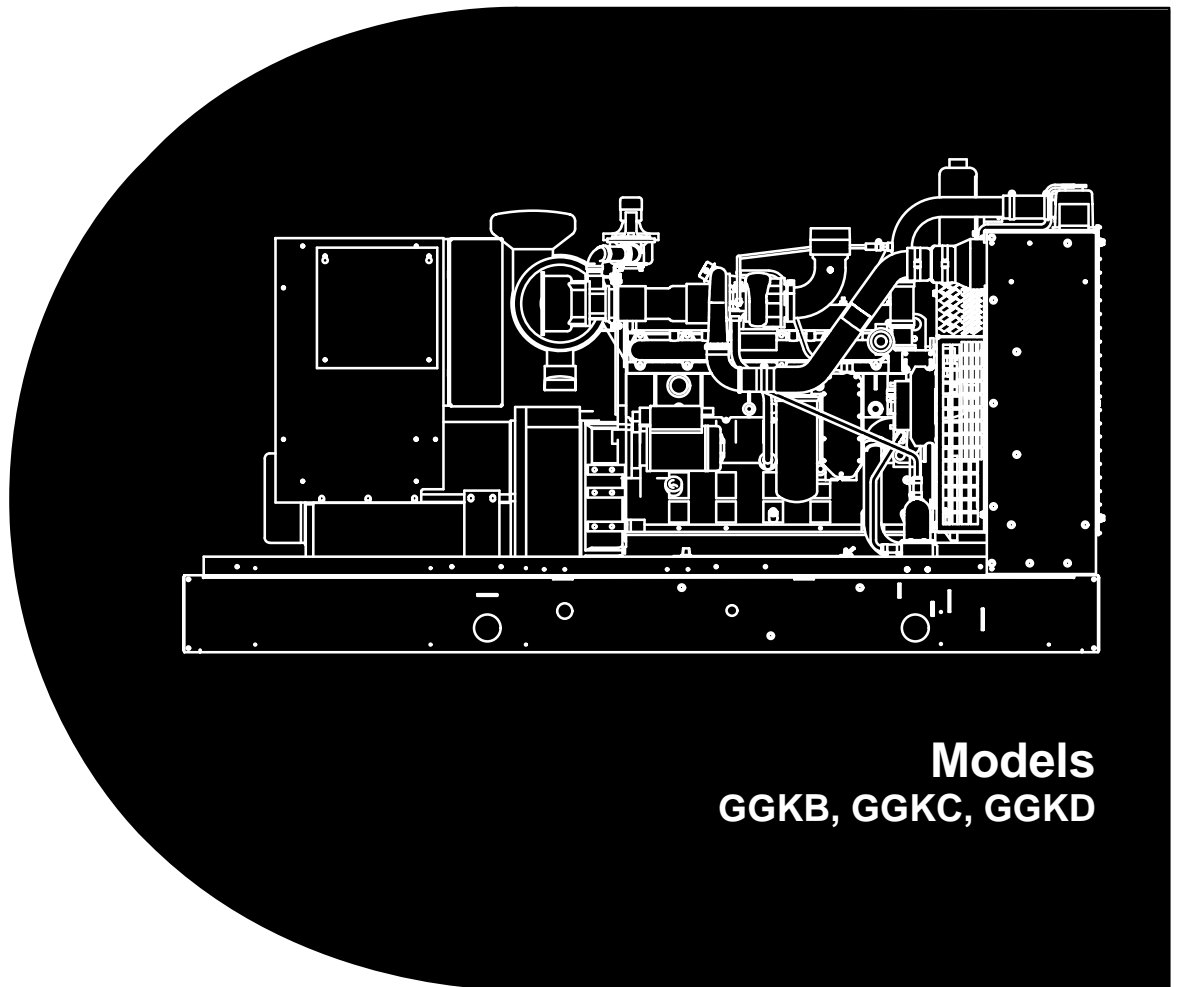


Operator's Manual

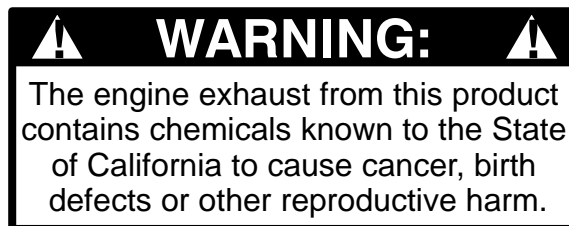
PowerCommand[®] Control
3100 Series
Generator Sets



Models
GGKB, GGKC, GGKD

Table of Contents

SECTION	TITLE	PAGE
	IMPORTANT SAFETY INSTRUCTIONS	iii
1	INTRODUCTION	
	General	1-1
	How to Obtain Service	1-1
2	SPECIFICATIONS	2-1
3	OPERATION	
	General	3-1
	Prestart Checks	3-1
	PCC Power On/Standby Mode	3-2
	Front Panel	3-4
	Starting	3-5
	Stopping	3-6
	Customer Inputs	3-6
	Menu Display and Switches	3-7
	Main Menu	3-8
	Engine Menu	3-10
	Gen Menu	3-12
	Adjust Menu	3-16
	Version Menu	3-18
4	TROUBLESHOOTING	
	Safety Considerations	4-1
	Status Indicators	4-2
	Resetting the Control	4-2
	Warning and Shutdown Codes	4-3
	Troubleshooting Charts	4-4
	Oil Pressure Warning/Shutdown Limits	4-10



SECTION	TITLE	PAGE
5	MAINTENANCE	
	General	5-1
	Maintenance Schedule	5-2
	Generator Set Inspection	5-3
	Generator Set Maintenance (Battery Disconnected)	5-5
	Lubrication System	5-6
	Oil and Filter Change	5-6
	Batteries	5-7
	Cooling System	5-8
	Drive Belt	5-9
	Ignition System	5-9
	Out-Of-Service Protection	5-9
6	OPERATING RECOMMENDATIONS	
	No-Load Operation	6-1
	Exercise Period	6-1
	Low Operating Temperature	6-1
	High Operating Temperature	6-1

IMPORTANT SAFETY INSTRUCTIONS

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

Before operating the generator set (genset), read the Operator's Manual and become familiar with it 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.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

⚠ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

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.

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.

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. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

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.
- 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.

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.
- 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, 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 breathe 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.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

GENERAL

This manual covers models produced under the Cummins®/Onan® and Cummins Power Generation brand names.

Each operator should read this manual before operating the set for the first time. A generator set (genset) must be operated and maintained properly if you are to expect safe, reliable and quiet operation. The manual includes a troubleshooting guide and a maintenance schedule.

The engine manual is included with the genset. Where there is conflicting information, this manual takes precedence over the engine manual.

⚠ 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 the safety precautions on page iii and carefully observe all instructions and precautions in this manual.*

HOW TO OBTAIN SERVICE

When the generator set requires servicing, contact your nearest Cummins Power Generation distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

To contact your local Cummins Power Generation distributor in the United States or Canada, call 1-800-888-6626 (this automated service utilizes touch-tone phones only). By selecting Option 1 (press 1), you will be automatically connected to the distributor nearest you.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS-ELECTRIC or
ELECTRICAL PRODUCTS

For outside North America, call Cummins Power Generation, 1-763-574-5000, 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday. Or, send a fax to Cummins Power Generation using the fax number 1-763-574-8087.

When contacting your distributor, always supply the complete Model, Specification, and Serial Number as shown on the generator set nameplate.

⚠ 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.

THIS PAGE LEFT INTENTIONALLY BLANK

2. Specifications

MODEL	GGKB	GGKC	GGKD
Engine Cummins Natural Gas Series	GTA8.3-G1	GTA8.3-G2	GTA8.3-G2
Generator kW Rating	See Genset Nameplate for rating information.		
Fuel Types	Natural Gas Propane	Natural Gas Propane	Natural Gas
Exhaust Connection Backpressure (Max. Allowed)	4 inch NPT 27.0 inch H ₂ O (6.7 kPA)		
Electrical System Starting Voltage Battery Charging Alternator (Max. Rating)	12 Volts DC 63 A		
Cooling System Capacity with Standard Radiator	6.8 Gal (25.7 L)		
Lubricating System Oil Capacity with Filters Standby Prime	20 Qts (18.9L) 36 Qts (34 L)		
Tune-up Specifications Spark Plug Gap	0.020 (0.51 mm)		
Battery Ground Required Battery Voltage Group Number CCA (minimum) Cold Soak @ 0° F (-18° C)	Negative 12 Volts DC 4D 1,080		

FUEL CONSUMPTION (STANDBY/FULL LOAD/60HZ)

MODEL	GGKB	GGKC	GGKD
chf (m3/hr)			
LPG (Vapor or Liquid)	836.0 (23.7)	948.0 (26.8)	
Natural Gas	1746.0 (49.4)	1980.0 (56)	1914.0 (54.2)

THIS PAGE LEFT INTENTIONALLY BLANK

3. Operation

GENERAL

The following describes the function and operation of the PowerCommand® 3100 Control (PCC). All indicators, displays, meters and control switches are located on the face of the control panel as illustrated in Figure 3-1.

This section covers prestart checks, starting and stopping and operating the generator set. Each operator should read through this entire section before attempting to start the set. It is essential that the operator be completely familiar with the set and the PCC control. Refer to *Section 6* for operating recommendations.

PRESTART CHECKS

Before starting, be sure the following checks have been made and the unit is ready for operation.

Lubrication

Check the engine oil level. Keep the oil level near as possible to the dipstick high mark without overfilling.

Coolant

Check the coolant recovery tank level. Refer to *Cooling System* In Section 5 of this manual.

Fuel

Open all manual shutoff valves in the fuel supply system.

Exhaust

Check to make sure entire exhaust system is tight, that no combustible materials are near system, and gases are discharged away from building openings.

EXHAUST GAS IS DEADLY!

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 can 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 THE 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.

PCC POWER ON / STANDBY MODE

The control panel can be set to function in one of the following modes; Power On or Standby.

To select the alternate mode, refer to the Installation manual.

Power On Mode: In this mode, power is continuously supplied to the control panel. The control's operating software and control panel LED's/display will remain active.

Standby Mode: In this mode, the control's operating software is inactive and the LED's and displays on the front panel are all off. The operating software is initialized and the front panel is turned on in response to one of the following:

- moving the Run/Off/Auto switch to the Run position,
- pressing the Self Test button,
- a remote start input signal (generator set in Auto mode), or

- any one of several "wake-up" signals from external switches.

The wake up signals are:

Low Engine Coolant Level
Low Engine Coolant Temperature
Low Fuel
Customer Fault Inputs 2 and 3
Run Selected on Run/Off Auto Switch
Remote Start Signal in Auto Mode
Emergency Stop

With the switch set to Standby mode, pressing the Self Test button will allow you to activate and view the menu displays without starting the generator set. If no menu selections are made, a software timer will shut down the power after 30 seconds.

When left in the Standby Mode, and a "Warning" signal is sensed by the PCC (for example, low coolant temp), the control will wake-up and display the warning message. The control will remain active until the warning condition is corrected and the Reset button is pressed to clear the warning message.

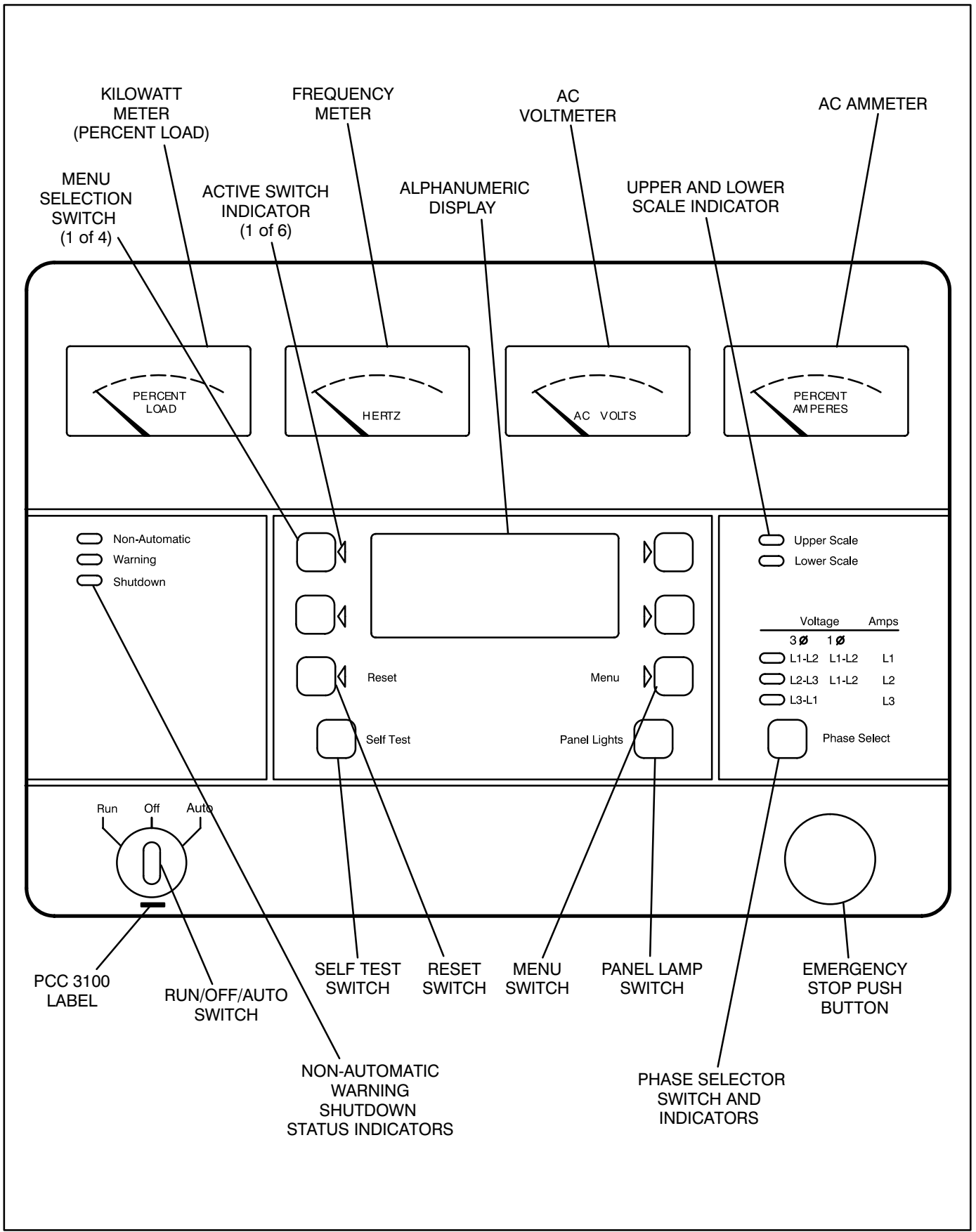


FIGURE 3-1. FRONT PANEL (PCC 3100)

FRONT PANEL

Figure 3-1 shows the features of the front panel.

AC Voltmeter: Dual scale instrument indicates AC voltage. Measurement scale in use is shown on scale indicator lamp.

AC Ammeter: Indicates current output in percent of maximum rated current.

Kilowatt Meter: Indicates 3-phase AC power output as percent of rated load.

Frequency Meter: Indicates generator output frequency in hertz.

Upper and Lower Scale Indicator Lamps: Indicate AC voltmeter scale.

Digital Display: This two-line, 16-character per line alphanumeric display is used in the menu-driven operating system, in conjunction with the display menu selection switches and the Menu switch. Refer to the menu trees later in this section. The display is also used to show warning and shutdown messages.

Display Menu Selection Switches: Four momentary switches—two on each side of the digital display window—are used to step through the various menu options and to adjust generator set parameters. The green arrow adjacent to the switch is lit when the switch can be used (switch is “active”).

Menu Switch: Press this switch to return the digital display to the MAIN MENU. Refer to the menu trees later in this section.

Reset Switch: Press this switch to reset warning and shutdown messages after the condition has been corrected. To reset a shutdown message with the Reset switch, the Run/Off/Auto switch must be in the Off position.

In Auto mode, shutdown faults can be reset by removing the remote start input and then cycling the remote reset input.

Self Test Switch: Press and hold this switch to light all front panel LEDs and cycle through all shutdown and warning messages.

Panel Lights Switch: Press this switch to turn control panel illumination on and off. The illumination will shut off after about eight minutes.

Phase Selector Switch and Indicators: Press this momentary switch to select phases of generator output to be measured by AC voltmeter and ammeter. LEDs indicate the selected phase.

Run/Off/Auto Switch: This switch starts and stops the set locally, or enables start/stop control of the engine from a remote location. (Ground to start.)

Emergency Stop Button: Push the switch in for emergency shutdown of the engine.

To reset:

Pull the button out or turn the switch clockwise (button with arrow) and allow it to pop out. Move the Run/Off/Auto switch to Off.

Press the front panel Reset switch.

Select Run or Auto, as required.

Non-Automatic Status Indicator: This red lamp flashes continuously when the Run/Off/Auto switch is not in the Auto position.

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 Reset switch. (It is **not** necessary to stop the generator set.) In auto mode, warning indicators can also be reset by cycling the remote reset input after the condition is corrected.

Shutdown Status Indicator: This red lamp is lit whenever the control detects a shutdown condition. After the condition is corrected, shutdown indicators can be reset by turning the Run/Off/Auto switch to the Off position, and pressing the Reset switch. In auto mode, shutdown faults can be reset by removing the remote start input and then cycling the remote reset input.

Emergency Stop shutdown status (Code 102) can be reset only at the PCC front panel.

STARTING

The following sections cover the three systems used to start the generator set.

Before starting the generator set, make sure that exhaust and fuel fittings are tight and properly positioned and that proper maintenance has been performed. See *Prestart Checks* in this section.

Starting at Control Panel

Move the Run/Off/Auto switch to the Run position. 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.

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

Generator sets with the cycle cranking option selected will alternately crank and rest for 3, 4, or 5 cycles. The crank times and rest times can be individually preset for 7 to 20 seconds.

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

Generator sets with the cycle cranking option **not** selected will crank continuously for up to 75 seconds before disengaging the starter.

To clear an overcrank shutdown, place the Run/Off/Auto switch in the Off position and momentarily press the Reset switch. 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.

Starting from Remote Location

Place the Run/Off/Auto switch in the Auto position. This allows the generator set to be started from a remote switch.

The operating software is initialized in response to a remote run signal. Closing the remote switch initiates the starting sequence described in the previous section.

Starter cranking will begin after the start time delay timer (0–300 seconds) has timed out. Refer to Time Delay Start in the Adjust menu.

Automatic Starting from ATS

Place the Run/Off/Auto switch in the Auto position if an automatic transfer switch (ATS) is used. The operating software is initialized in response to a remote run signal from the transfer switch. This allows the transfer switch to start the generator set if a power outage occurs and stop it when the power returns.

Starter cranking will begin after the start time delay timer (0–300 seconds) has timed out. Refer to Time Delay Start in the Adjust menu.

Cold Starting with Loads

In accordance with NFPA 110, Cummins Power Generation recommends installing standby generator sets (life safety systems) equipped with coolant heaters in locations where the minimum ambient temperature is above 40°F (4°C). NFPA also requires that the engine coolant be maintained at a minimum of 90°F (32°C) and for most applications, accept the emergency load in 10 seconds or less. Most generator sets will start in temperatures down to –25°F (–32°C) when equipped with coolant heaters, but it may take more than 10 seconds to warm the engine up before a load can be applied when ambient temperatures are below 40°F (4°C).

The **Low Coolant Temp (Code 210)** message, in conjunction with illumination of the Warning LED, is provided to meet the requirements of NFPA 110. The low coolant temperature sensing logic initiates a warning when the engine coolant temperature falls below 70°F (21°C). In applications where the ambient temperature falls below 40°F (4°C), Low Coolant Temp may be indicated even though the coolant heaters are connected and functioning properly. 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.

STOPPING

Before Stopping

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

Stopping at Control Panel

If the set was started at the set control panel, move the Run/Off/Auto switch to the Off position. The set will stop immediately. The control will respond to “wake up” signals from the external sensing switches when the Run/Off/Auto switch is in the Off position.

Stopping from Remote Location

Move the remote starting switch to the Off position.

The set will stop after the stop time delay timer (0–600 seconds) has timed out. Refer to Time Delay Stop in the Adjust menu.

Automatic Stopping from ATS

If the set was started by an automatic transfer switch, the transfer switch control will send a remote stop signal after the normal power source returns.

The set will stop after the stop time delay timer (0–600 seconds) has timed out. Refer to Time Delay Stop in the Adjust menu.

Emergency Stop (Code 102)

The emergency stop button is located on the lower right side of control panel (Figure 3-1). Push the button in for emergency stop. The red Shutdown status LED will light, and the digital display message will be:

“EMERGENCY STOP
102 – SHUTDOWN”

To reset, pull the button out or turn the switch clockwise (button with arrow) and allow it to pop out. Move the Run/Off/Auto switch to the Off position. Then momentarily push the Reset switch.

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

CUSTOMER INPUTS

Remote Start Input: When the Run/Off/Auto switch is in the Auto position, selecting this input initiates the engine cranking and start sequence.

Remote Reset Input: When the Run/Off/Auto switch is in the Auto position and the remote start switch is open, selecting this input resets any latched shutdown fault (except Emergency Stop, which must be reset at the front panel.)

Engine Idle Input: When the set is operating in the RUN mode, selecting this input causes generator build up to be inhibited and the engine to be governed at 800 RPM. When ground is removed from this input, the set returns to normal speed and voltage.

Engine idle operation is applicable only in the RUN mode. The PCC operating program does not permit engine idle operation when the set is operating in AUTO mode.

When the engine idle function is enabled, the control automatically sets lower oil pressure warning and shutdown trip points to reflect the lower operating speed. When the engine idle function is removed and the set reverts to normal operating speed, the control automatically resets oil pressure warning and shutdown trip points to the normal settings.

Remote Emergency Stop Input: Grounding this input causes an immediate shutdown. Emergency stop must be reset at the front panel.

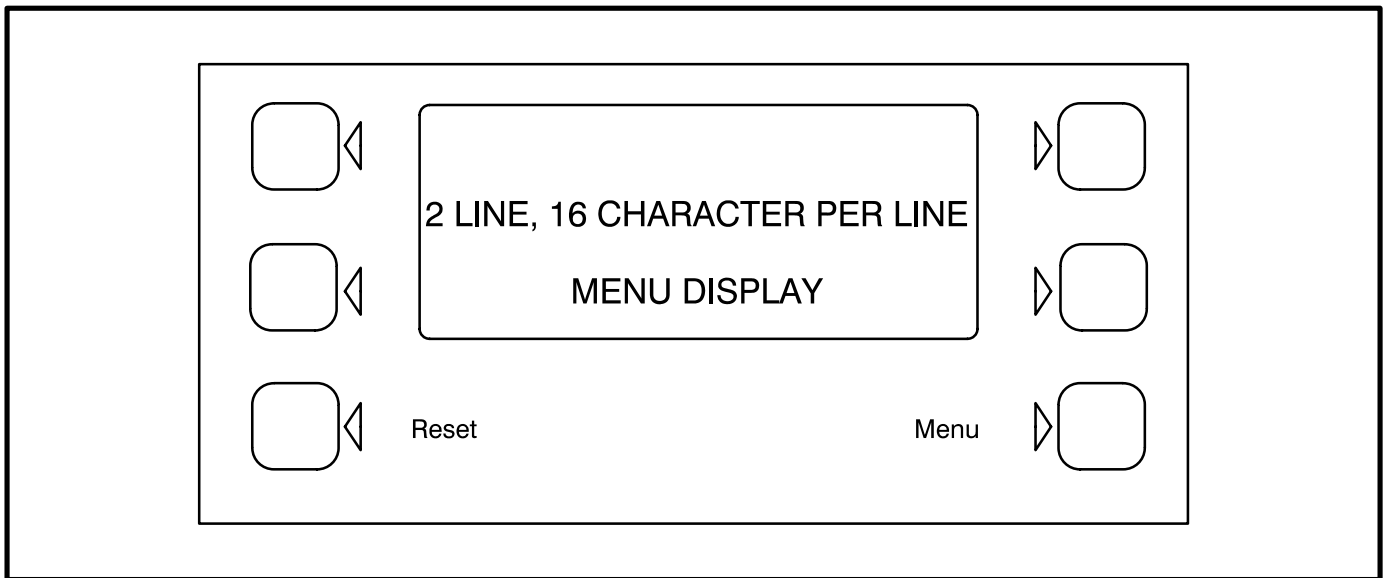


FIGURE 3-2. DIGITAL DISPLAY AND MENU SELECTION SWITCHES

MENU DISPLAY AND SWITCHES

Figure 3-2 shows the digital display and the menu selection switches.

In Standby Mode, to activate and view the menu displays without starting the generator set, press and release the Self Test switch. This will initialize the PCC operating software and permit operation of the menu display panel. If no menu selections are made, a software timer will shut down the display power after 30 seconds. In Power On Mode, power is continuously supplied to the control panel. Display will always remain active.

Digital Display: This two-line, 16-character per line alphanumeric display is used in the menu-driven operating system, in conjunction with the display menu selection switches and the Menu switch.

Display Menu Selection Switches: Four momentary switches—two on each side of the digital display

—are used to step through the various menu options and to adjust generator set parameters. **The green arrow adjacent to the switch is lit when the switch is available for use (is active).**

Menu Switch: Press this momentary switch to return the digital display to the main menu. (Refer to the main menu diagram on the next page.)

Reset Switch: Press this momentary switch to reset warning and shutdown messages after the condition has been corrected.

In the digital display, the “>>” symbol indicates that selecting the adjacent button causes the operating program to branch to the next menu display—as shown in the menu diagrams.

In the digital display, the “<<” symbol indicates that selecting the adjacent button causes the operating program to go back to the previous menu display.

MAIN MENU

The facing page shows the main menu and a block representation of the available submenus.

As shown in the diagram, the main menu can branch into one of four directions.

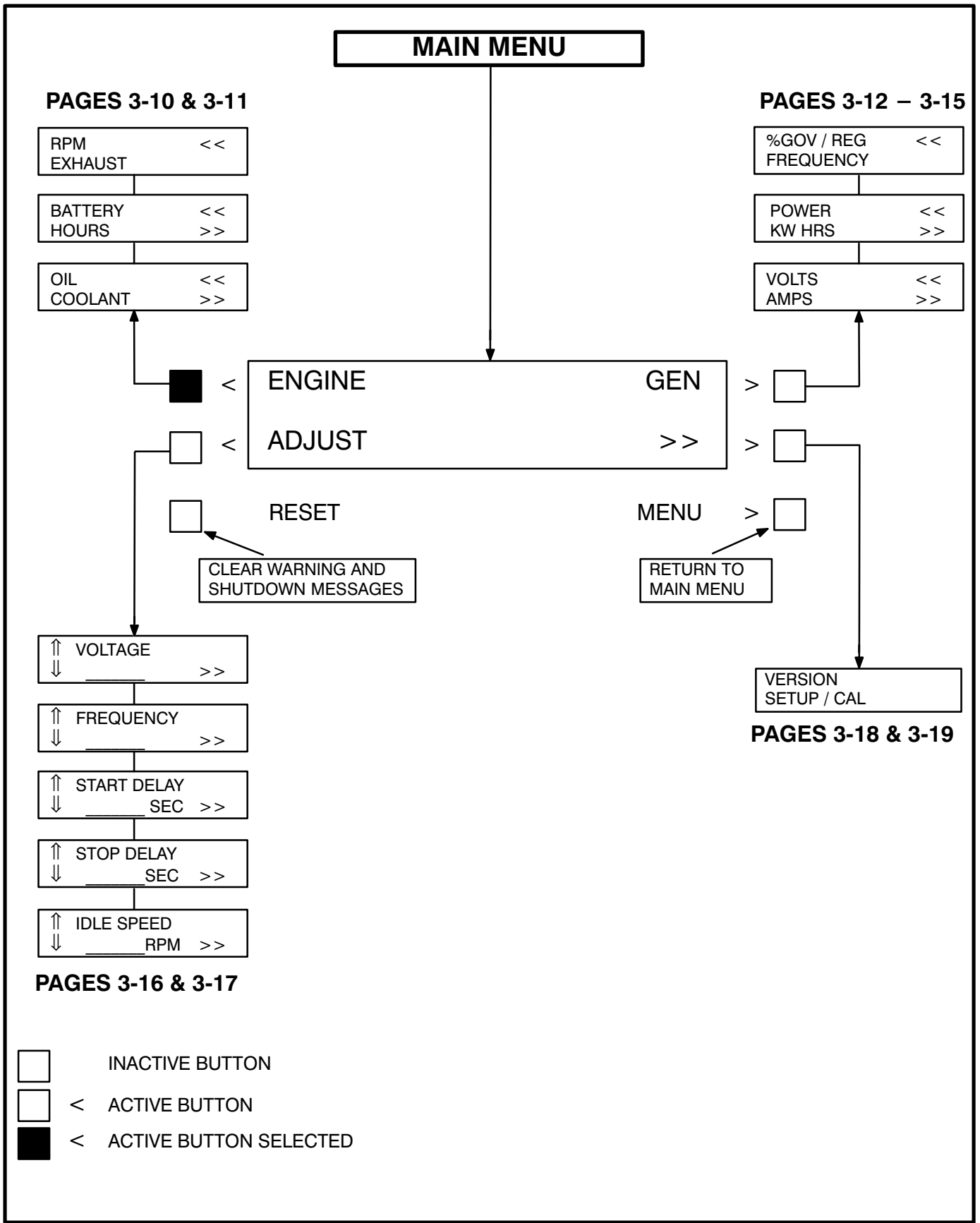
To display engine parameters, such as oil pressure and temperature, water temperature, engine speed (RPM), and exhaust temperature, press the button next to the word "ENGINE" in the display. Turn to the ENGINE menu diagram on page 3-11.

To display generator parameters, such as volts, amps, power (kW), and frequency, press the button

next to the word "GEN" in the display. Turn to the GEN menu diagram on page 3-13.

To adjust output voltage and frequency, or start and stop delays, press the button next to the word "ADJUST" in the display. Turn to the ADJUST menu diagram on page 3-17.

To display the selected generator set model and the resident version software, press the button next to the ">>" in the display. From this selection, you can also review a History file that can record and save up to 20 error messages. Turn to the VERSION menu diagram on page 3-19.



ENGINE MENU

The facing page 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 will appear.

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

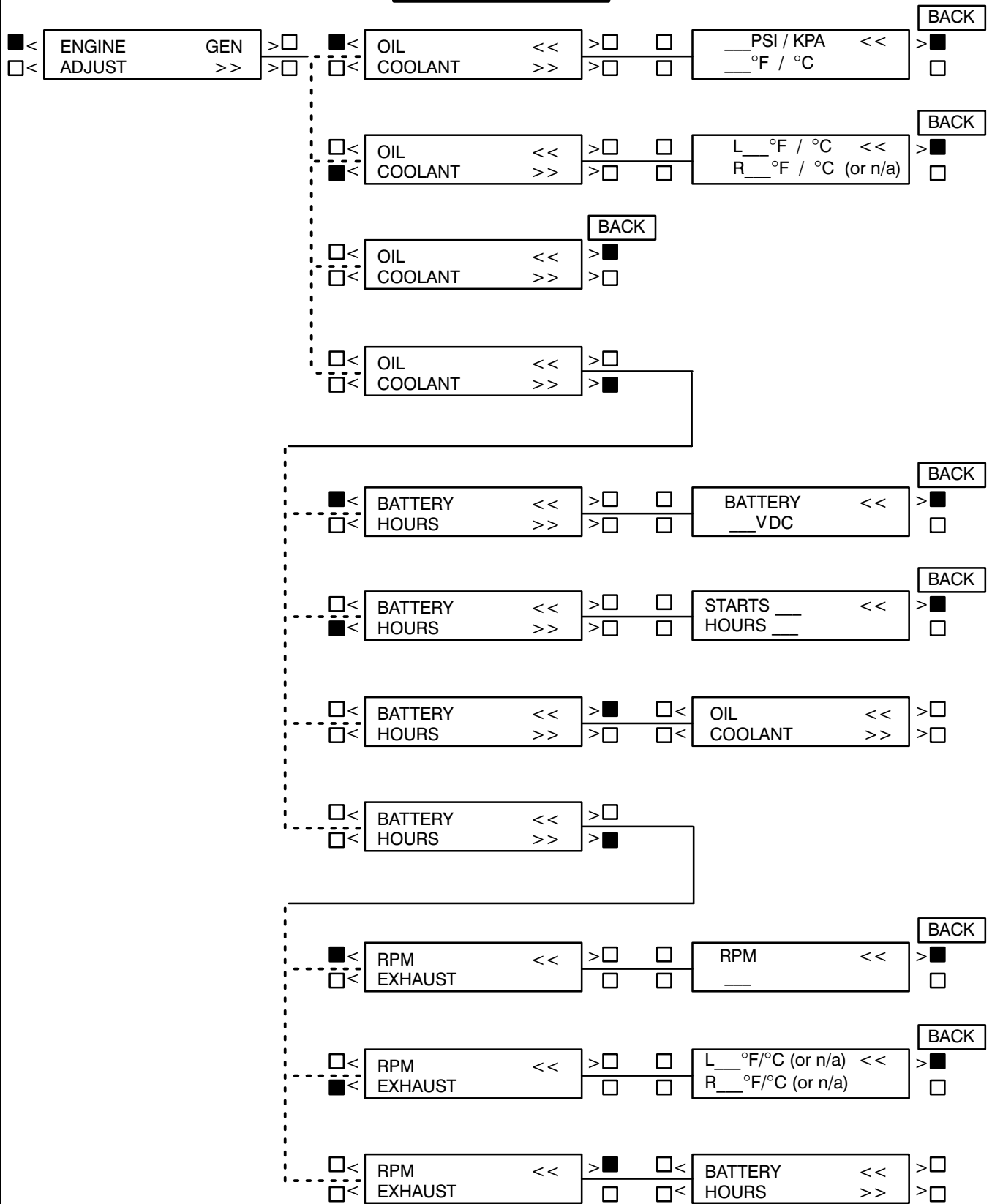
OIL/COOLANT submenu: This is the first submenu. Select OIL for a display of oil pressure and oil temperature. Select COOLANT for a display of coolant temperature. When oil or coolant parameters are displayed, pressing the button next to the “<<” will return the display (“BACK”) to the OIL/COOLANT submenu.

To check oil pressure or coolant temperature during a warning, access the oil pressure or coolant temperature menu prior to clearing the fault.

BATTERY/HOURS submenu: From the OIL/COOLANT submenu, press the button next to the “>>” in the display to move to the BATTERY/HOURS submenu. Select BATTERY for a display of battery voltage. Select HOURS for a display of the number of starts and the running hours. When battery or hours parameters are displayed, pressing the button next to the “<<” will return the display (“BACK”) to the BATTERY/HOURS submenu.

RPM/EXHAUST submenu: From the BATTERY/HOURS submenu, press the button next to the “>>” in the display to move to the RPM/EXHAUST submenu. Select RPM for a display of engine RPM. Select EXHAUST for a display of the (optional) exhaust temperature. When RPM or exhaust parameters are displayed, pressing the button next to the “<<” will return the display (“BACK”) to the RPM/EXHAUST submenu.

ENGINE MENU



- - - Indicates "OR" Condition

GEN MENU

The facing page shows a block representation of the GEN menu. If you press the button next to the word "GEN" in the display, the first GEN submenu will appear.

As shown in the diagram, the GEN menu has three submenus. Within these submenus, bold boxes indicate the possible selections made in the "Initial Start Setup" submenus (e.g., DELTA or WYE) and how the submenus will vary dependent on these selections.

VOLTS/AMPS submenu: This is the first submenu. Select VOLTS for a display of a line-line or line-neutral selection. Select line-line or line-neutral for the desired voltage display. Select AMPS for a display of L1, L2, and L3 current in amps. When voltage or current parameters are displayed, pressing the button next to the "<<" will return the display ("BACK") to the L-L/L-N submenu.

GEN MENU

< ENGINE GEN >
 < ADJUST >> >

< VOLTS << >
 < AMPS >> >

WYE

< L-L << > L12 L23 L31 << >
 < L-N >> > _ _ _ << >

BACK

< L-L << > L1N L2N L3N << >
 < L-N >> > _ _ _ << >

BACK

< L-L << >
 < L-N >> >

BACK

DELTA

L12 L23 L31 << >
 _ _ _ << >

BACK

1 PHASE

L12 L01 L02 << >
 _ _ _ << >

BACK

< VOLTS << > L1 L2 L3 << >
 < AMPS >> > _ _ _ << >

BACK

1 PHASE

L1 L2 << >
 _ _ << >

BACK

< VOLTS << >
 < AMPS >> >

CONTINUED

----- Indicates "OR" Condition

GEN MENU (Cont.)

POWER / KW HOURS submenu: From the VOLTS/AMPS submenu, press the button next to the ">>" in the display to move to the POWER/KW HOURS submenu. Select POWER for a display of power output in kilowatts and a power factor value. Select KW HOURS for a display of kilowatt hours. When power or kW hours parameters are displayed, pressing the button next to the "<<" will return the display ("BACK") to the POWER/KW HOURS submenu.

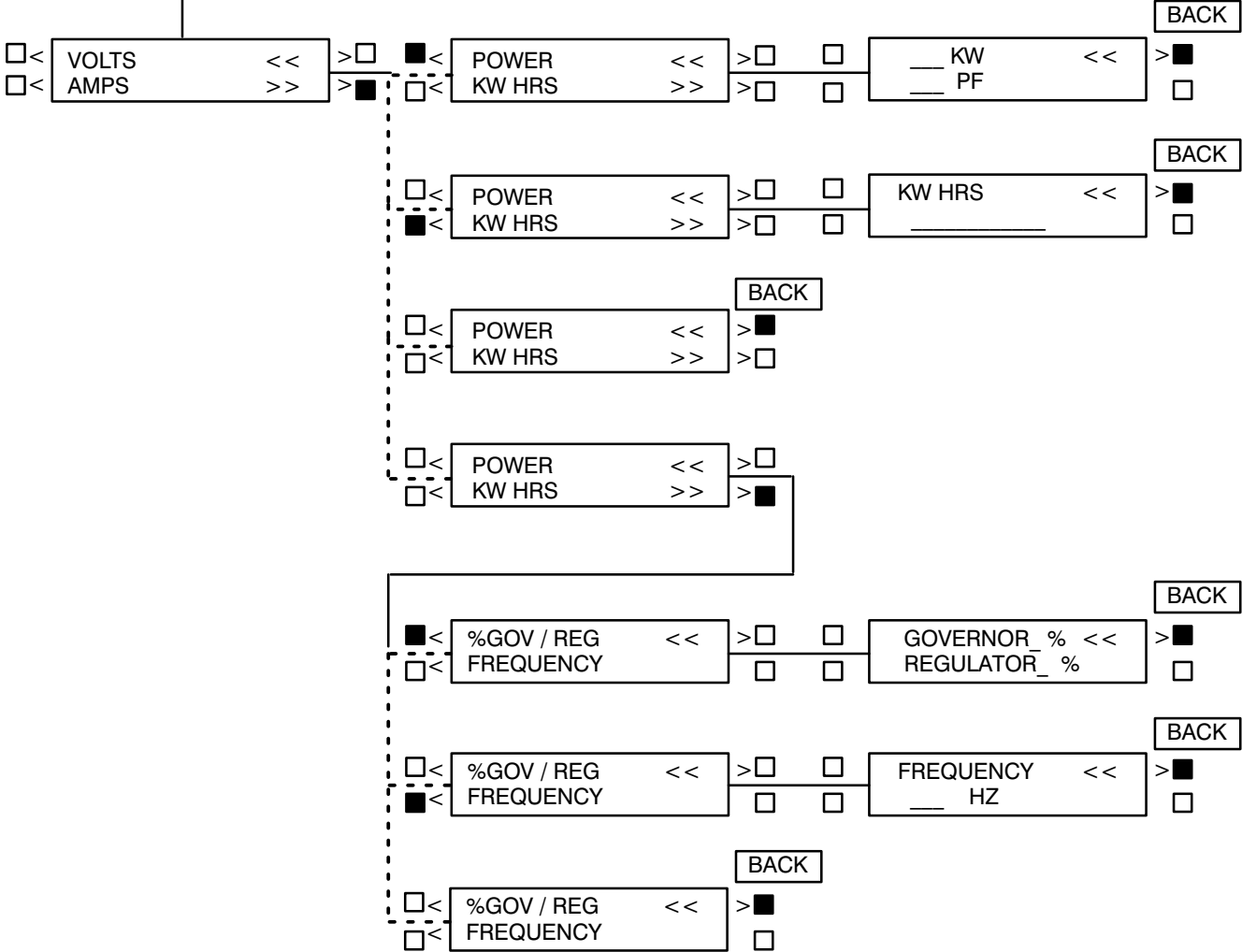
The PF reading will contain an asterisk if the power factor is leading (for example, *.3PF).

N/A is displayed in the PF field when the generator set is not running.

%GOV/REG/FREQUENCY submenu: From the POWER/KW HOURS submenu, press the button next to the ">>" in the display to move to the %GOV/REG/FREQUENCY submenu. Select %GOV/REG for a display of voltage regulator and governor duty cycle (drive) levels in percentage of maximum. Select FREQUENCY for a display of the generator output frequency. When voltage regulator and governor or frequency parameters are displayed, pressing the button next to the "<<" will return the display ("BACK") to the %GOV/REG/FREQUENCY submenu.

GEN MENU (Cont.)

CONTINUED



----- Indicates "OR" Condition

ADJUST MENU

The facing page shows a block representation of the ADJUST menu. If you press the button next to the word "ADJUST" in the display, the VOLTAGE ADJUST submenu will appear.

As shown in the diagram, the ADJUST menu has five submenus, including a save/exit procedure.

Voltage and frequency can be adjusted only when the generator set is running under normal operating parameters (not in idle mode). For example, if voltage adjustment is selected when the set is in Idle mode or not running, the digital display will be:

“↑	VOLTAGE ”
“↓	N/A >>”

VOLTAGE submenu: This is the first submenu. Use the buttons next to the “↑” and “↓” symbols to adjust output voltage $\pm 5\%$.

FREQUENCY submenu: From the VOLTAGE submenu, press the button next to the “>>” in the display to move to the FREQUENCY submenu. Use the buttons next to the “↑” and “↓” symbols to adjust output frequency $\pm 5\%$.

START DELAY submenu: This delay applies only to remote starting in the Auto mode. From the FREQUENCY submenu, press the button next to the “>>” in the display to move to the START DELAY submenu. Use the buttons next to the “↑” and “↓” symbols to set the start delay. The start delay adjustment range is 0 to 300 seconds.

STOP DELAY submenu: This delay applies only to remote stopping in the Auto mode. From the START DELAY submenu, press the button next to the “>>” in the display to move to the STOP DELAY submenu. Use the buttons next to the “↑” and “↓” symbols to set the stop delay. The stop delay adjustment range is 0 to 600 seconds.

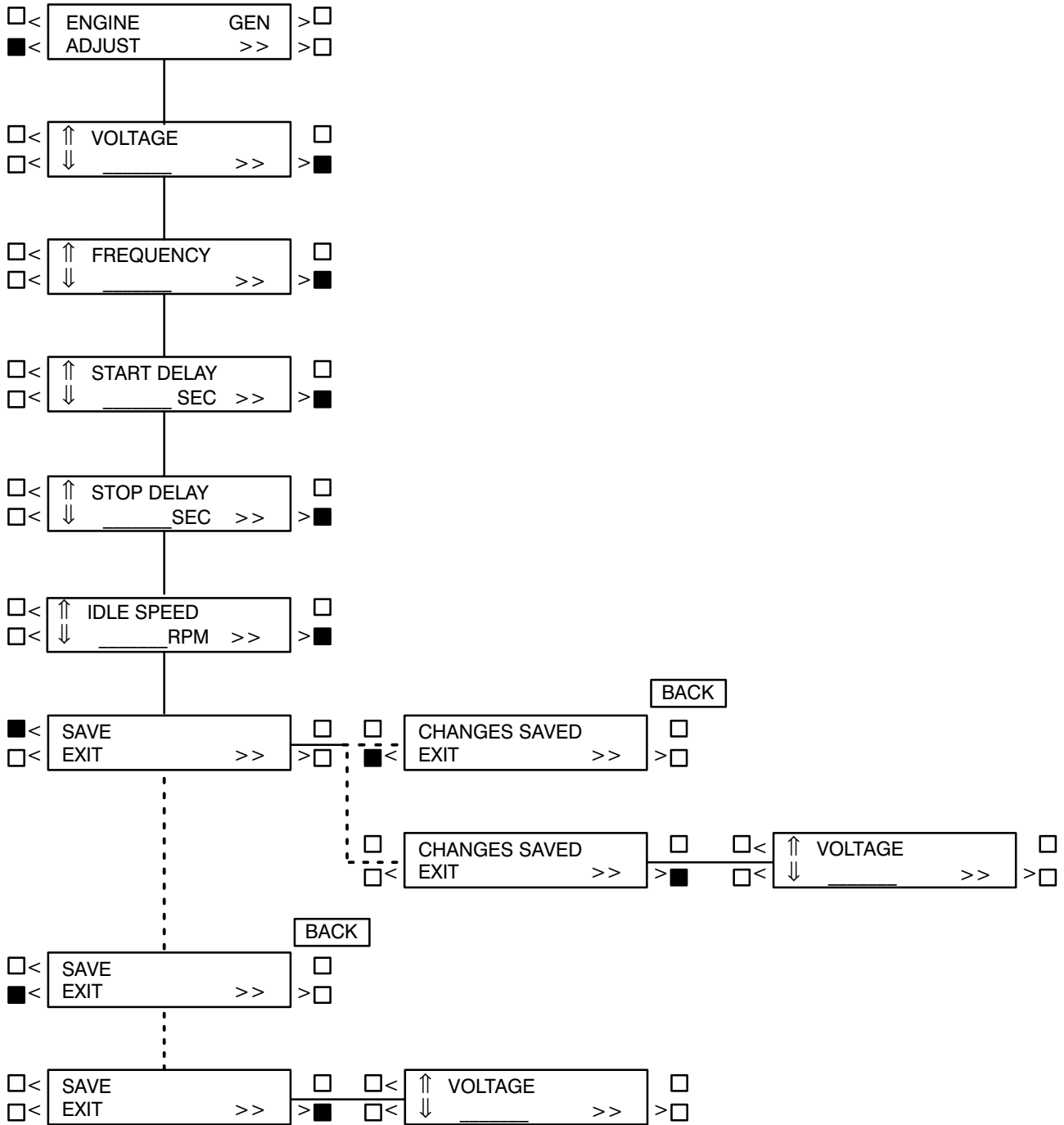
IDLE SPEED submenu: From the STOP DELAY submenu, press the button next to the “>>” in the display to move to the IDLE SPEED submenu. Use the buttons next to the “↑” and “↓” symbols to set the idle speed. The idle speed adjustment range is 800 RPM ± 100 RPM. (Default value is 800 RPM.)

The idle speed can be adjusted only when the generator set is running in the idle mode. When not in idle mode, N/A is displayed in RPM field.

SAVE/EXIT submenu: From the STOP DELAY submenu, press the button next to the “>>” in the display to move to the SAVE/EXIT submenu. Select SAVE to save your changes. At the CHANGES SAVED submenu, select EXIT to return to the main menu.

If you select SAVE, the adjustments will be retained after shutdown, and will be in effect when the set is restarted. If you select EXIT without saving first, the adjustments will remain in effect until the generator set is shut down, but will be reset (and will not be in effect) when the set is restarted.

ADJUST MENU



- - - - Indicates "OR" Condition

VERSION MENU

The facing page shows a block representation of the VERSION submenus. If you press the button next to the ">>" in the Main menu display, the VERSION/SETUP/CAL menu will appear.

VERSION submenu: If you select VERSION, the display will show the generator set model number, frequency, and kW rating, and the date and version of the operating software.

To display the generator set configuration options, press the button next to the ">>" in the submenu that displays the model number, frequency, etc.. This menu provides the following information:

- Generator set voltage
- WYE or DELTA and Full or Standard
- Standby or Prime
- 1 or 3 phase

To modify any of these entries, you must return to the "Initial Start Setup" submenus described in the *Service* manual.

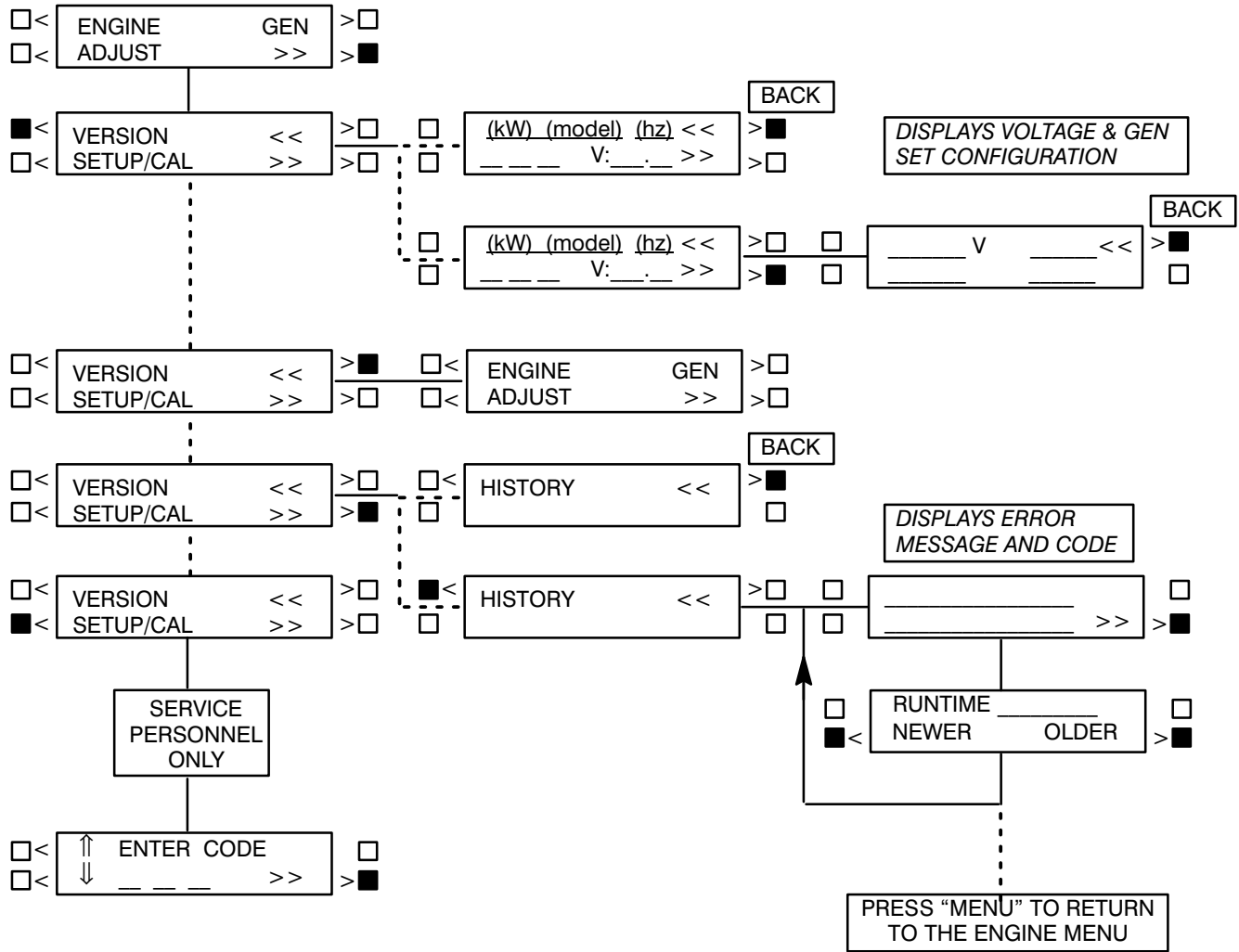
HISTORY: From the VERSION menu, press the button next to the ">>" in the display to move to the HISTORY submenu. Press the button next to "HISTORY" to display the last (latest) recorded error message.

The software will record (save) up to 20 error messages. The last error detected will always be displayed first. As each new error is detected, the oldest error recorded after 20 will be deleted.

To view the generator set runtime at which the error occurred and to scroll through the remaining recorded errors, press the button next to the ">>" in the error message menu to display the RUNTIME, NEWER/OLDER menu.

The buttons next to NEWER and OLDER are used to scroll up and down through the error messages. For example, pressing OLDER will display the next oldest recorded error message.

VERSION MENU



---- Indicates "OR" Condition

THIS PAGE LEFT INTENTIONALLY BLANK

4. Troubleshooting

The PowerCommand® 3100 Control (PCC) continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the PCC will light a yellow Warning lamp or a red Shutdown lamp and display a message on the digital display panel.

In the event of a shutdown fault (red Shutdown lamp), the PCC will stop the engine and close a set of contacts that can be wired to trip a circuit breaker. If the generator set is stopped for this reason, the operator can restart the set after making adjustments or corrections. This section lists the warning and shutdown messages (Table 4-1), and suggests troubleshooting procedures (Table 4-2).

Table 4-3 lists the PCC oil pressure warning and shutdown limits.

SAFETY CONSIDERATIONS

⚠ WARNING *Contacting high voltage components can cause electrocution, resulting in severe personal injury or death. Keep the output box covers in place during troubleshooting.*

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

⚠ CAUTION *Before disconnecting battery cable(s), press the 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.*

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

1. Move the Run/Off/Auto switch on the control panel to the OFF position.
2. Press the Emergency Stop button and wait at least 30 seconds before completing Step 3.
3. Turn off or remove AC power from the battery charger.
4. Remove the negative (–) battery cable from the generator set starting battery.

When a fault condition occurs during operation, follow the procedures listed below to locate and correct the problem. For any symptom not listed, contact an authorized service center for assistance.

STATUS INDICATORS

Non-Automatic Status Indicator: This red lamp flashes continuously when the Run/Off/Auto switch is not in the Auto position.

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 Reset switch. (It is **not** necessary to stop the generator set.) In auto mode, warning indicators can also be reset by cycling the remote reset input after the condition is corrected.

Shutdown Status Indicator: This red lamp is lit whenever the control detects a shutdown condition. After the condition is corrected, shutdown indicators can be reset by turning the Run/Off/Auto switch to the Off position, and pressing the Reset switch. In auto mode, shutdown faults can be reset by removing the remote start input and then cycling the remote reset input.

Emergency Stop shutdown status (Code 102) can be reset only at the PCC front panel.

Digital Display: This two-line, 16-character per line alphanumeric display is used in the menu-driven

operating system and to show shutdown and warning messages. Refer to Tables 4-1 and 4-2.

RESETTING THE CONTROL

Press the momentary **Reset Switch** to reset warning and shutdown messages after the condition has been corrected. To reset a shutdown message with the Reset switch, the Run/Off/Auto switch must be in the Off Position. **(The control cannot go into standby [sleep] mode until all faults have been reset.)**

In Auto mode, warning indicators can also be reset by cycling the remote reset input after the condition is corrected. Shutdown faults can be reset by removing the remote start input and then cycling the remote reset input.

Line Circuit Breaker (Optional)

The optional line circuit breaker mounts on the generator output box. If the load exceeds the generator 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.

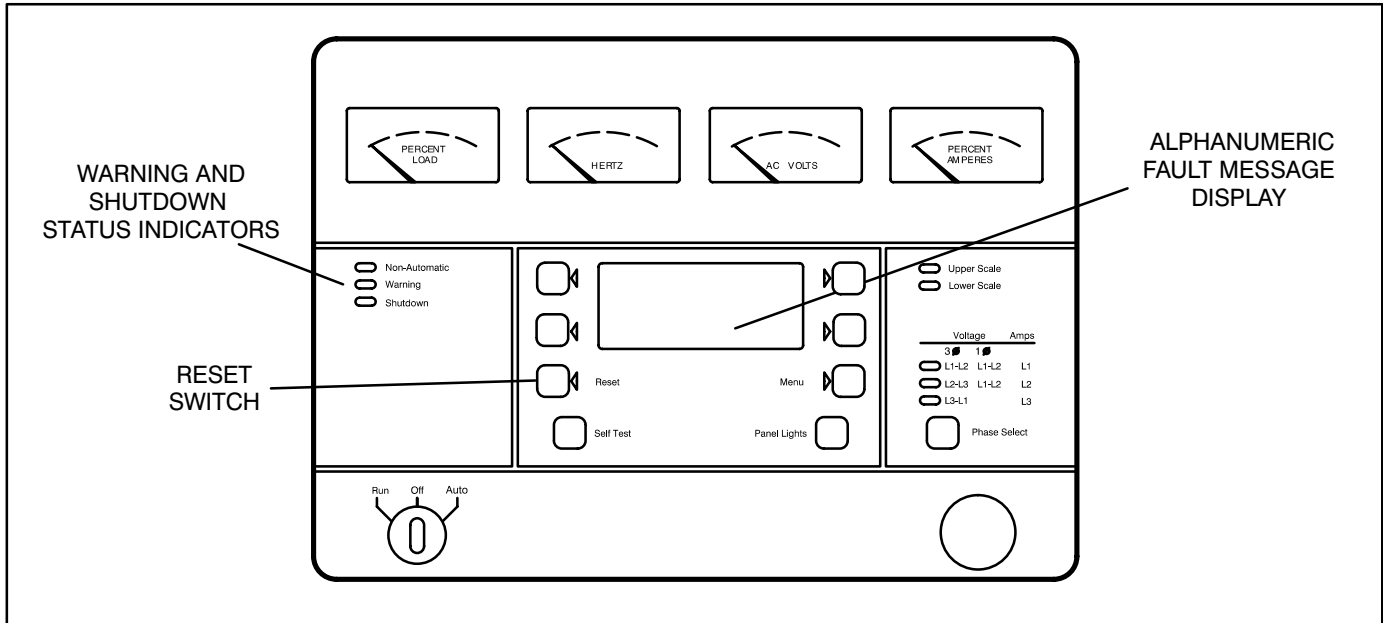


FIGURE 4-1. CONTROL PANEL (PCC 3100)

TABLE 4-1. WARNING AND SHUTDOWN CODES

CODE	MESSAGE	STATUS LED	PAGE
101	IDLE MODE	none	4-4
102	EMERGENCY STOP	Shutdown	4-4
200	LOW OIL PRESSURE	Warning	4-4
201	LOW OIL PRESSURE	Shutdown	4-4
204	OIL PRES SENDER	Warning	4-5
210	LOW COOLANT TEMP	Warning	4-5
211	HIGH COOLANT TEMP	Warning	4-5
212	HIGH COOLANT TEMP	Shutdown	4-5
213	COOLANT SENDER	Warning	4-6
214	LOW COOLANT LVL	Warning	4-6
215	LOW COOLANT LVL	Shutdown	4-6
220	MAG PICKUP	Shutdown	4-6
221	FAIL TO CRANK	Shutdown	4-6
222	OVERCRANK	Shutdown	4-7
223	OVERSPEED	Shutdown	4-7
230	LOW DC VOLTAGE	Warning	4-7
231	HIGH DC VOLTAGE	Warning	4-7
232	WEAK BATTERY	Warning	4-7
240	LOW FUEL – DAY	Warning	4-8
241	LOW FUEL	Warning	4-8
250	EEPROM ERROR	Shutdown	4-8
251	EEPROM ERROR	Warning	4-8
252	EEPROM ERROR	Warning	4-8
260	CUSTOMER FAULT 1*	Warning/Shutdown	4-8
261	GROUND FAULT*	Warning/Shutdown	4-8
262	RUPTURE BASIN*	Warning/Shutdown	4-8
263	HIGH GEN TEMP*	Warning/Shutdown	4-8
301	HIGH AC VOLTAGE	Shutdown	4-9
303	LOW AC VOLTAGE	Shutdown	4-9
313	UNDER FREQUENCY	Shutdown	4-9
320	OVERCURRENT	Warning	4-9
321	OVERCURRENT	Shutdown	4-9
322	SHORT CIRCUIT	Shutdown	4-10
330	OVERLOAD	Warning	4-10
335	REVERSE POWER	Shutdown	4-10

* Default message. Editable for customer site requirements.

TABLE 4-2. TROUBLESHOOTING

<p>⚠ WARNING <i>Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</i></p>	
SYMPTOM	CORRECTIVE ACTION
Control does not power up when the Run/Off/Auto switch is set to Run or the Self Test switch is pressed.	There is no DC power to the control. Check for battery disconnected, discharged, or improperly connected. Contact an authorized service center.
Warning, Shutdown, and Non-Automatic lamps are not lit. Digital display shows main menu or selected menu.	Indicates all engine systems are normal. No corrective action require
Non-Automatic lamp flashes.	Indicates Run/Off/Auto switch is not in the Auto position. This will prevent automatic starting if an automatic transfer switch is used. Move the Run/Off/Auto switch to the Auto position for automatic operation.
MESSAGE: IDLE MODE 101 – WARNING Engine continues to operate at reduced RPM.	Indicates that the engine is operating in idle mode. When the set is operating in the RUN mode, grounding the engine idle input causes generator build-up to be inhibited and the engine to be governed at 800 RPM. When ground is removed from this input, the set returns to normal speed and voltage. When the engine idle function is enabled, the control automatically sets lower oil pressure warning and shutdown trip points to reflect the lower operating speed. When the engine idle function is removed and the set reverts to normal operating speed, the control automatically resets oil pressure warning and shutdown trip points to the normal settings.
Shutdown lamp lights. MESSAGE: EMERGENCY STOP 102 – SHUTDOWN Engine shuts down and will not crank.	Indicates local or remote Emergency Stop. To reset the local Emergency Stop button : Pull the button out or turn the switch clockwise (button with arrow). Move the Run/Off/Auto switch to Off. Press the Reset switch. Select Run or Auto, as required.
Warning lamp lights. MESSAGE: LOW OIL PRESSURE 200 – WARNING	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 then follow, 201 Low Oil Pressure procedure. If engine can be stopped, follow 201 procedure. To check oil pressure, access Oil Pressure menu prior to clearing the fault.
Shutdown lamp lights. MESSAGE: LOW OIL PRESSURE 201 – SHUTDOWN	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. Oil pressure limits are listed in Table 4-3. Contact an authorized service center.

TABLE 4-2. TROUBLESHOOTING (CONT.)

<p>⚠ WARNING <i>Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>Warning lamp lights. MESSAGE: OIL PRES SENDER 204 – WARNING</p>	<p>Indicates that the engine oil pressure sender is not functioning correctly. Check that the engine oil pressure sender is properly connected. Contact an authorized service center.</p>
<p>Warning lamp lights. MESSAGE: LOW COOLANT TEMP 210 – WARNING</p> <p>Set is in standby mode but 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 Engine Temp may be indicated even though the coolant heaters are operating.</p>	<p>Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions:</p> <ol style="list-style-type: none"> a. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required. b. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required. c. Contact an authorized service center if none of the above.
<p>Warning lamp lights. MESSAGE: HIGH COOLANT TEMP 211 – WARNING</p>	<p>Indicates engine has begun to overheat and coolant temperature has risen to an unacceptable level: 202° F (94° C) – standby or prime.. If generator is powering non-critical and critical loads and cannot be shut down, use the following:</p> <ol style="list-style-type: none"> a. Reduce load if possible by turning off non-critical loads. b. Check air inlets and outlets and remove any obstructions to airflow. If engine can be stopped, follow the next procedure. <p>To check coolant temperature, access Coolant Temp menu prior to clearing the fault.</p>
<p>Shutdown lamp lights. MESSAGE: HIGH COOLANT TEMP 212 – SHUTDOWN</p>	<p>Indicates engine has overheated (coolant temperature has risen above the shutdown trip point: 212° F (100° C) – standby or prime or the coolant level is low. Allow engine to cool down completely before proceeding with the following checks:</p> <ol style="list-style-type: none"> a. Check coolant level and replenish if low. Look for coolant leakage and repair if necessary. b. Check for obstructions to cooling airflow and correct as necessary. c. Check fan belt and repair or tighten if necessary. d. Reset control and restart after locating and correcting problem. Contact an authorized service center if none of the above.

TABLE 4-2. TROUBLESHOOTING (CONT.)

<p>⚠ WARNING <i>Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>Warning lamp lights. MESSAGE: ENG COOLANT SENDER 213 – WARNING</p>	<p>Indicates that the resistance of the coolant temperature sender is out of range. Contact an authorized service center.</p>
<p>Shutdown or Warning lamp lights. MESSAGE: LOW COOLANT LVL 214 – WARNING or LOW COOLANT LVL 215 – SHUTDOWN</p>	<p>Indicates engine coolant level has fallen below the trip point. Allow engine to cool down completely before proceeding.</p> <ol style="list-style-type: none"> Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. Reset control and restart after locating and correcting problem. Contact an authorized service center. <p>LOW COOLANT LVL Shutdown will not occur if generator set is in Idle mode (low coolant warning only).</p>
<p>Shutdown lamp lights. MESSAGE: MAG PICKUP 220 – SHUTDOWN</p>	<p>Indicates mag pickup speed indication is not being sensed or does not match generator set output frequency.</p> <ol style="list-style-type: none"> Restart and check RPM on the digital display. Contact an authorized service center.
<p>Shutdown lamp lights. Engine will not crank. MESSAGE: FAIL TO CRANK 221 – SHUTDOWN</p>	<p>Indicates possible fault with control or starting system. Check for the following conditions:</p> <ol style="list-style-type: none"> Poor battery cable connections. Clean the battery cable terminals and tighten all connections. Discharged or defective battery. Recharge or replace the battery. Contact an authorized service center for service of starter and starting system.

TABLE 4-2. TROUBLESHOOTING (CONT.)

<p>⚠ WARNING Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</p>	
<p>SYMPTOM</p>	<p>CORRECTIVE ACTION</p>
<p>Shutdown lamp lights. Engine stops cranking. MESSAGE: OVERCRANK 222 – SHUTDOWN</p>	<p>Indicates possible fuel system/ignition problem.</p> <ol style="list-style-type: none"> a. No fuel: check for closed shutoff valve, empty propane supply tank. For natural gas fueled sets, check with the gas utility. b. Check for dirty fuel filter and replace if necessary. c. Check for dirty or plugged air filter and replace if necessary. d. Secure the spark plug leads on the spark plugs and ignition coils. e. Replace spark plugs. d. Reset the control and restart after correcting the problem. Contact an authorized service center if none of the above.
<p>Engine runs and then shuts down, Shutdown lamp lights. MESSAGE: OVERSPEED 223 – SHUTDOWN</p>	<p>Indicates engine has exceeded normal operating speed. (2070 rpm @ 60 Hz; 1800 rpm @ 50 Hz) Contact an authorized service center.</p>
<p>Warning lamp lights. MESSAGE: LOW DC VOLTAGE 230 – WARNING</p>	<p>Indicates battery voltage is below 10 VDC.</p> <ol style="list-style-type: none"> a. Discharged or defective battery. Check the battery charger fuse. Recharge or replace the battery. b. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. c. Contact an authorized service center if none of the above.
<p>Warning lamp lights. MESSAGE: HIGH DC VOLTAGE 231 – WARNING</p>	<p>Indicates battery voltage exceeds 16 VDC. Contact an authorized service center.</p>
<p>Warning lamp lights. MESSAGE: WEAK BATTERY 232 – WARNING</p>	<p>Indicates battery voltage drops below 60% of nominal for two seconds, during starting. Discharged or defective battery. See Warning message 230, LOW DC VOLTAGE.</p>

TABLE 4-2. TROUBLESHOOTING (CONT.)

<p>⚠ WARNING <i>Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>Warning lamp lights. MESSAGE: LOW FUEL DAY 240 – WARNING or LOW FUEL 241 – WARNING</p>	<p>When any one of these customer defined inputs is closed to ground, the corresponding fault message is displayed. The nature of the fault is an optional customer selection.</p>
<p>Shutdown lamp lights. MESSAGE: EEPROM ERROR 250 – SHUTDOWN</p>	<p>Indicates PCC memory error. Data corruption of critical operating parameters. Contact an authorized service center.</p>
<p>Warning lamp lights. MESSAGE: EEPROM ERROR 251 – WARNING or 252 – WARNING</p>	<p>Indicates PCC memory error. Data corruption of noncritical operating parameters. Contact an authorized service center.</p>
<p>Shutdown lamp lights. MESSAGE: CUSTOMER FAULT 1 260 – SHUTDOWN or GROUND FAULT 261 – SHUTDOWN or DAY TANK 262 – SHUTDOWN or HIGH GEN TEMP 263 – SHUTDOWN</p>	<p>When any one of these customer defined inputs is closed to ground, the corresponding fault message is displayed. The nature of the fault is an optional customer selection. These fault functions can be programmed to initiate a shutdown or a warning.</p> <p>As indicated by the Shutdown lamp, a shutdown response has been preselected.</p> <p>Contact an authorized service center.</p> <p>Note: Customer fault messages are editable. The message displayed for the code shown (260 thru 263) may have been edited and may not appear as shown in this table.</p>

TABLE 4-2. TROUBLESHOOTING (CONT.)

<p>⚠ WARNING <i>Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>Warning lamp lights. MESSAGE: CUSTOMER FAULT 1 260 – WARNING or GROUND FAULT 261 – WARNING or DAY TANK 262 – WARNING or HIGH GEN TEMP 263 – WARNING</p>	<p>When any one of these customer defined inputs is closed to ground, the corresponding fault message is displayed. The nature of the fault is an optional customer selection. These fault functions can be programmed to initiate a shutdown or a warning.</p> <p>As indicated by the Warning lamp, a warning response has been pre-selected.</p> <p>Contact an authorized service center.</p> <p>Note: Customer fault messages are editable. The message displayed for the code shown (260 thru 263) may have been edited and may not appear as shown in this table.</p>
<p>Shutdown lamp lights. MESSAGE: HIGH AC VOLTAGE 301 – SHUTDOWN</p>	<p>Indicates that one or more of the phase voltages has exceeded 130% of nominal, or has exceeded 110% of nominal for 10 seconds.</p> <p>Contact an authorized service center.</p>
<p>Shutdown lamp lights. MESSAGE: LOW AC VOLTAGE 303 – SHUTDOWN</p>	<p>Indicates that one or more of the phase voltages has dropped below 85% of nominal for 10 seconds.</p> <p>Contact an authorized service center.</p>
<p>Shutdown lamp lights. MESSAGE: UNDER FREQUENCY 313 – SHUTDOWN</p>	<p>Indicates that engine speed has dropped below 90% of nominal for 10 seconds.</p> <p>NOTE: Five seconds before shutdown, a Load Dump signal is initiated.</p> <p>Contact an authorized service center.</p>
<p>Warning lamp lights. MESSAGE: OVERCURRENT 320 – WARNING</p>	<p>Indicates that generator output current has exceeded 110% of rated for 60 seconds.</p> <p>Contact an authorized service center.</p>
<p>Shutdown lamp lights. MESSAGE: OVERCURRENT 321 – SHUTDOWN</p>	<p>Indicates that generator output current has exceeded 110% of rated, and that a PCC time/current calculation has initiated an overcurrent shutdown.</p> <p>Contact an authorized service center.</p>

TABLE 4-2. TROUBLESHOOTING (CONT.)

<p>⚠ WARNING <i>Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>Shutdown lamp lights. MESSAGE: SHORT CIRCUIT 322 – SHUTDOWN</p>	<p>Indicates that generator output current has exceeded 175% of rated. Contact an authorized service center.</p>
<p>Warning lamp lights. MESSAGE: OVERLOAD 330 – WARNING</p>	<p>Indicates that three-phase power output exceeds 105% of standby (or 115% of prime) rating. After five seconds, the Load Dump output is activated. After 60 seconds, the OVERLOAD warning is activated. Contact an authorized service center.</p>
<p>Shutdown lamp lights. MESSAGE: REVERSE POWER 335 – SHUTDOWN</p>	<p>Indicates improper CT or PT phasing. (Non-parallel units only.) Contact an authorized service center.</p>
<p>Engine starts from generator control panel but will not start automatically or from a remote panel. (Note: The Run/Off/Auto switch must be in the Auto position for automatic or remote starting).</p>	<p>Check the control wiring between the remote switch and the PCC. Contact an authorized service center.</p>
<p>No AC output voltage.</p>	<p>Contact an authorized service center.</p>

TABLE 4-3. OIL PRESSURE WARNING/SHUTDOWN LIMITS

ENGINE MODEL	6C
<p>Normal Oil Pressure Warning Limit Shutdown Limit</p>	<p>40 - 70 psi (276 - 483 kPa) 20 psi (138 kPa) 15 psi (103 kPa)</p>
<p>Idle Oil Pressure Warning Limit Shutdown Limit</p>	<p>10-30 psi (69-207 kPa) 12 psi (83 kPa) 8 psi (55 kPa)</p>

5. Maintenance

GENERAL

Establish and adhere to a definite schedule for maintenance and service based on the application and severity of the environment. Table 5-1 covers the recommended service intervals for a generator set on STANDBY service. If the set will be subjected to extreme operating conditions, the service intervals should be reduced accordingly. Some of the factors that can affect the maintenance schedule are the following:

- Use for continuous duty (prime power)
- Extremes in ambient temperature
- Exposure to water
- Exposure to salt water
- Exposure to dust, sand or other airborne contaminants.

Consult with your local Cummins Power Generation 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 5-1 to determine the maintenance required and then refer to the sections that follow for the correct service procedures.

TABLE 5-1. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	SERVICE TIME			
	Daily or after 8 Hours	Monthly or after 100 Hours	6 Months or after 250 Hours	2 Years or after 6000 Hours
General genset inspection	X ^{1, 2}			
Check engine oil level	X ¹			
Check radiator coolant level	X ¹			
Check Fuel System	X ²			
Check Ignition System	X ²			
Check Exhaust System	X ²			
Check air cleaner (clean or replace as necessary)		X ³		
Check all hardware (fittings, clamps, fasteners, etc.)		X		
Check battery electrolyte level		X		
Drain exhaust condensate trap		X		
Check drive belt		X		
Change engine oil and filter			X ^{3, 5}	
Inspect or replace spark plugs			X	
Inspect coolant hoses and clamps			X ⁴	
Inspect coolant heater hoses			X ⁴	
Check coolant anti-freeze protection			X	
Check AC generator and controls			X	
Clean cooling system				X ²

X¹ - As noted or after every run.

X² - Refer to Maintenance Section in Cummins Natural Gas Engine (CNGE) Operation & Maintenance Manual

X³ - Perform more often in extremely dusty conditions.

X⁴ - Replace if hard or brittle.

X⁵ - Standby: 6 months or after 250 hours.

- Prime: 6 months or after 750 hours.

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.

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 serious personal injury or death. Be sure deadly exhaust gas is piped outside and away from windows, doors, vents or other inlets to building and not allowed to accumulate in inhabitable areas.*

Fuel System

With the generator set operating, 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.*

Ignition/Carburetion System

⚠WARNING *Incorrect adjustment of the ignition system or carburetion system can cause personal injury or equipment damage. If detonation or preignition is observed, turn off the generator set if it is safe to do so (i.e. not powering critical loads) or reduce load applied to the generator set. Contact an authorized service center to correct problem.*

Detonation and/or preignition are classifications of two forms of improper combustion of the fuel air mixture in the engine power cylinder. Both detonation and preignition can result in a hazardous operating condition and engine damage or loss of generator set power.

Normally, detonation or preignition are characterized by a knock or ringing sound from the engine. The knock or ringing can at times be masked by other engine/equipment noise. Both detonation and preignition can result in damage to engine components, including but not limited to: pistons, liners, spark plugs, bearings. If the engine is operated in a preignition condition it is possible to get a backfire through the intake system. This intake system backfire can cause severe damage to parts of the intake system, including but not limited to: throttle body, intake manifold cover, charge air cooler.

AC Electric System

Check the following while the generator set is operating; otherwise measure load lines L1, L2 and L3 using the appropriate AC meter.

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

AC Voltmeter: Press the phase selector switch to select 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 genset nameplate rating.

AC Ammeter: Press the phase selector switch to select 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.

DC Electrical System

Check the terminals on the battery 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.

Mechanical

With the set running, listen for any unusual noises that may indicate mechanical problems and check the oil pressure frequently. Investigate anything that indicates possible mechanical problems.

GENERATOR SET MAINTENANCE (Battery Disconnected)

⚠ CAUTION Before disconnecting battery cable(s), press the 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.

⚠ 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 before beginning maintenance procedures.

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

5. Move the Run/Off/Auto switch on the control panel to the OFF position.
6. Press the Emergency Stop button and wait at least 30 seconds before completing Step 3.
7. Turn off or remove AC power from the battery charger.
8. Remove the negative (–) battery cable from the generator set starting battery.

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.

LUBRICATION SYSTEM

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

Engine Oil Requirements

Special oil is required for the gaseous Cummins 6C engines (8.3). Cummins recommends the use of a natural gas oil that meets the following specifications.

API	CD Quality
SAE Viscosity	15W40
Sulfated Ash	Less than .5%
Phosphorous	600/800 PPM
Zinc	650/850 PPM
Calcium	1200 PPM
TBN (ASTM D2896)	.5/5.5
TAN (ASTM D664)	.5/.7

Sulfated Ash Limit – A sulfated ash limit has been placed on lubricating oil for use in Cummins NG engines. Experience has shown that oils with a high ash content may produce deposits on valves that can progress to guttering and valve burning. **A maximum sulfated ash content of .5% is recommended.**

Cummins does not recommend the use of ashless oils for natural gas engines. When the ash content is below .15 mass percent, the ash should represent organo-metallic anti-wear additives, provided such additives do not contain barium, or magnesium.

Oil Viscosity

Refer to Table 5-2 for the recommended oil viscosity grades at various ambient temperatures.

TABLE 5-2. OIL VISCOSITY

SAE VISCOSITY GRADE	AMBIENT TEMPERATURE
10W-30	-13° F to 35° F (-25° C to 2° C)
15W-40	14° F & above (-10° C & above)
20W-40	32° F & above (0° C & above)

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 FULL and ADD to indicate the level of oil in the crankcase. For accurate readings, shut off the engine and wait approximately 10 minutes before checking the engine 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 FULL mark on the dipstick. Remove the oil fill cap and add oil of the same quality and brand when necessary.

⚠ CAUTION *Do not operate the engine with the oil level below the ADD mark or above the FULL mark. Overfilling can cause foaming or aeration of the oil. Operation below the ADD mark can cause loss of oil pressure.*

OIL AND FILTER CHANGE

Change the oil and filter at the intervals recommended in the maintenance table. Use oil that meets Cummins recommendations/specifications.

Engine Oil Change

Refer to the Cummins Natural Gas Engine (CNGE) *Operation And Maintenance Manual* for lubricating oil and filter changing procedure. Refer to *Specifications* in Section 2 of this manual for oil capacity.

⚠ 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.*

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.

⚠ 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.*

BATTERIES

⚠ CAUTION *Before disconnecting battery cable(s), press the 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.

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.

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.

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.

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.

COOLING SYSTEM

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

The cooling system capacity of a standard unit with set mounted radiator is shown in Specifications section.

⚠ 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.*

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.

Periodically check the radiator coolant level. The coolant should be up to the cap opening if the coolant recovery system is working.

Refer to the *CNGE Operation And Maintenance 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.*

Coolant Requirements

Heavy duty engines require a balanced coolant mixture of water and antifreeze. Drain and replace the mixture every two years or after 6000 hours of operation (whichever occurs first) to eliminate build-up of harmful chemicals.

Refer to the *CNGE Operation And Maintenance Manual* for coolant recommendations/specifications.

Flushing and Cleaning

The cooling system must be clean and free of rust and scale if it is to perform properly.

Refer to the *CNGE Operation And Maintenance Manual* to flush and clean the cooling system.

(Standard Radiator and Heat Exchanger Sets)

Remove the cooling system pressure cap and fill the system with water/antifreeze mixture.

Refer to the *CNGE Operation And Maintenance Manual* for coolant recommendations/specifications.

When the engine is first started (with the pressure cap removed), monitor the coolant level. As trapped air is expelled from the system, the coolant level will drop and additional coolant should be added. Replace the pressure cap when the coolant level is stable.

⚠ CAUTION *Be sure the electric solenoid valve used with city water cooled sets is open before initial starting of unit to allow coolant chambers to fill. Otherwise overheating and damage to the engine can result.*

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.

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.*

Change the air filter at the intervals recommended in the maintenance table.

Refer to the *CNGE Operation And Maintenance Manual* for air filter cleaning/changing procedure.

DRIVE BELT

The alternator, water pump and fan are driven by a single belt. The belt tension is maintained by a belt tensioner and does not require adjustment.

Inspect the belt at the recommended intervals. Replace a worn or damaged belt before belt failure occurs. A defective or broken belt will cause overheating and insufficient battery charging.

IGNITION SYSTEM

The ignition system consists of the ignition coil, high tension wires, spark plugs and electronic control module. 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.

Refer to the *CNGE Operation And Maintenance Manual* for ignition system inspection and adjustment procedures.

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 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 battery (negative [-] first) and store in a cool, dry place. Connect 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 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 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.

THIS PAGE LEFT INTENTIONALLY BLANK

6. Operating Recommendations

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.

EXERCISE PERIOD

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

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

Exercise the generator set at least once a month for a minimum of 30 minutes, under not less than 30 percent of the nameplate rating.

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 heater, be sure the cooling system is full before applying power to the heater.*

HIGH OPERATING TEMPERATURE

Refer to the genset nameplate for the maximum ambient operating temperature, if applicable.

THIS PAGE LEFT INTENTIONALLY BLANK

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-6626
763-574-5000 International Use
Fax: 763-528-7229

Cummins is a registered trademark of Cummins Inc.

