



# Operator Manual

Our energy working for you.™



## Generator Set with PowerCommand® 2100

DFAB (Spec A-N)

DFAC (Spec A-N)



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**California**

**Proposition 65 Warning**

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

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# IMPORTANT SAFETY INSTRUCTIONS

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**SAVE THESE INSTRUCTIONS** – This manual contains important instructions that should be followed during installation and maintenance of the generator 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 zinc coated or copper fuel lines with diesel fuel.
- 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.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

## 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.

## **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.

## **MEDIUM VOLTAGE GENERATOR SETS**

### **(601V to 15kV)**

- 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.

## **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.
- 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

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## GENERAL

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 1-763-528-7229.

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.**





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## 2. Specifications

MODEL	DFAB, DFAC
<b>Engine</b> Cummins Diesel Series	LTA10
<b>Generator (Standby Rating)</b>	See Genset Nameplate for rating information.
<b>Electrical System</b> Starting Voltage Battery Group Number CCA (minimum) Cold Soak @ 0°F (-18° C)	24 Volts DC Two, 12 Volt 8D 1400
<b>Cooling System</b> Capacity with Standard Radiator	13 Gal (49 L)
<b>Lubricating System</b> Oil Capacity with Filters Oil Type*	9.5 Gal (36 L)
* Refer to Cummins engine <i>Operation and Maintenance Manual</i> for lubricating oil recommendations/specifications.	

### FUEL CONSUMPTION (STANDBY/FULL LOAD/60HZ)

MODEL	DFAB	DFAC
US gph (L/hr)	15.6 (59)	16.8 (64)

OIL PRESSURE WARNING AND SHUTDOWN LIMITS	
<b>Normal Oil Pressure</b>	<b>30-50 psi (207-345 kPa)</b>
Warning Limit	25 psi (172 kPa)
Shutdown Limit	20 psi (138 kPa)
<b>Idle Oil Pressure</b>	<b>15 psi (104 kPa)</b>
Warning Limit	12 psi (83 kPa)
Shutdown Limit	8 psi (55 kPa)



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# 3. Operation

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## GENERAL

The following describes the function and operation of the PowerCommand® Control 2100 (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 8* 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 engine coolant level. Refer to “Cooling Systems” in the Maintenance section of this manual for proper procedure.

## Fuel

Make sure the fuel tanks have sufficient fuel and that fuel system is primed. Check to make sure there are no leaks and that all fittings are tight.

## Ventilation

Make sure the generator set cooling inlet/outlet and exhaust ventilation openings are clear (not blocked) and operational.

## 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.***

## CONTROL PANEL POWER ON/OFF MODES

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

**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.

**Screen Savor Mode:** Power to the digital display is removed after 30 minutes (generator set not running). The 30 minute timer resets and begins after each control panel action (any button or switch selection) or signal received by the operating software. All LEDs on the control panel operate normally during Screen Savor mode, indicating that the operating software is active (Awake model).

When a "Warning" signal is sensed by the PCC (for example, low coolant temp), the control displays the warning message.

**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 Fault Acknowledge or Panel Lamp button or move 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.

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



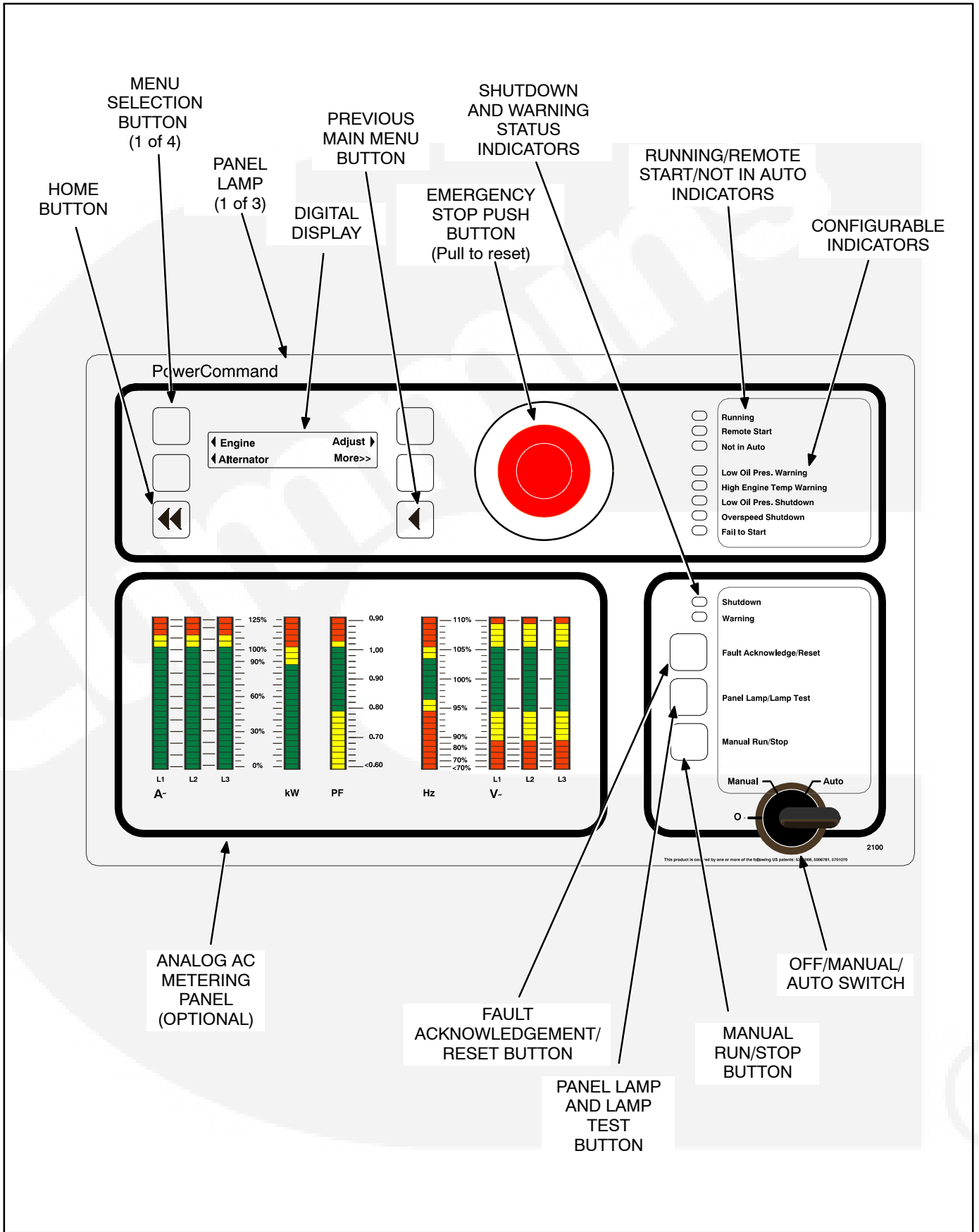


FIGURE 3-1. FRONT PANEL (PCC 2100)

## FRONT PANEL

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

**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.

**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. A green triangle (◀ or ▶), arrow (↑, ↓, ← or →), >> or plus/minus sign (+ or -) in the digital adjacent to the button is shown when the button can be used (button is “active”). Refer to Menu Display And Buttons later in this section.

**Home Button:** Press this button (◀◀) to view the Home MENU. Refer to the menu trees later in this section.

**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 section.

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

**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.

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

**Running Indicator:** This green lamp is lit whenever the generator (local or remote) is running.

**Remote Start Indicator:** This green lamp is lit whenever the control is receiving a remote start signal.

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

**Analog AC Metering Panel (Optional):** This panel simultaneously displays (in percent of genset rated output):

- 3-phase line-to-line AC current (A-) Kilowatts (kW)
- Generator output frequency in hertz (Hz)
- 3-phase line-to-line AC volts (V-)
- Power Factor (PF) (shown in 0.2 increments)

**Shutdown Status Indicator:** This red lamp is lit whenever the control detects a shutdown condition. The generator set cannot be started when this lamp is on. After the condition is corrected, shutdown indicators can be reset by turning the O/Manual/Auto switch to the O position and pressing the Fault Acknowledge/Reset button.

**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 the Fault Acknowledge/Reset button (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.

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

**Fault Acknowledge/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.

**Panel Lamp and Lamp 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.

**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.

**O/Manual/Auto:** The manual position enables the use of the Manual Run/Stop button.

The Auto position enables start/stop control of the engine from a remote location (it disables the use of the Manual Run/Stop button).

The O (Off) position prevents the starting of the set (local or remote). If the switch is set to O during set operation, the engine will immediately shut down (cool-down timers are bypassed). This hot shutdown should be avoided, if possible, to help prolong the life of the engine.

## 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.**

**Low Oil Pressure Warning Indicator:** This yellow lamp indicates the oil pressure is lower than the normal range of operation.

**High Engine Temperature Warning Indicator:** This yellow lamp indicates the engine temperature is higher than the normal range of operation.

**Low Oil Pressure Shutdown Indicator:** This red lamp indicates the engine has shut down because of low oil pressure.

**Overspeed Shutdown Indicator:** This red lamp indicates the engine has shut down because of excessive speed.

**Fail to Start Indicator:** This red lamp indicates the engine failed to start.



## STARTING

The following headings cover the systems used to start the generator set. Figures 3-2, 3-3 and 3-4 provide a flow chart for all start/run/stop sequences.

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.

**With the optional Power Transfer Control (PTC) module installed, the function and sequence of operation of the Start command can differ and is noted as “PTC” in the following paragraphs. Refer to the Power Transfer Menu in this section, which describes the operation of the PTC feature.**

### Starting at 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.

**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 (Figure 3-11) to enable/disable the idle feature.**

If the engine does not start, the starter will disengage after a specific 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.

### Starting from a Remote Location (PTC or 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).

**PTC - If a switch is connected to the remote starter input of the control and the PTC module is installed, this switch will function as a Test switch. The PTC Test sequence is shown in Figure 3-4.**

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 as shown in Figure 3-3).

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.**

### Cold Starting with Loads

In accordance with NFPA 110, Cummins Power Generation recommends installing diesel 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. Although most generator sets will start in temperatures down to -25°F (-32°C) when equipped with 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 40°F (4°C).

The **Engine Cold Code (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.

## STOPPING

### Emergency Stop

The emergency stop button is located near the center of the upper part of the control panel (Figure 3-1). 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.**

### Stopping at Control Panel (Manual Mode)

If the set was started at the set 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 (Figure 3-2).

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

**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.

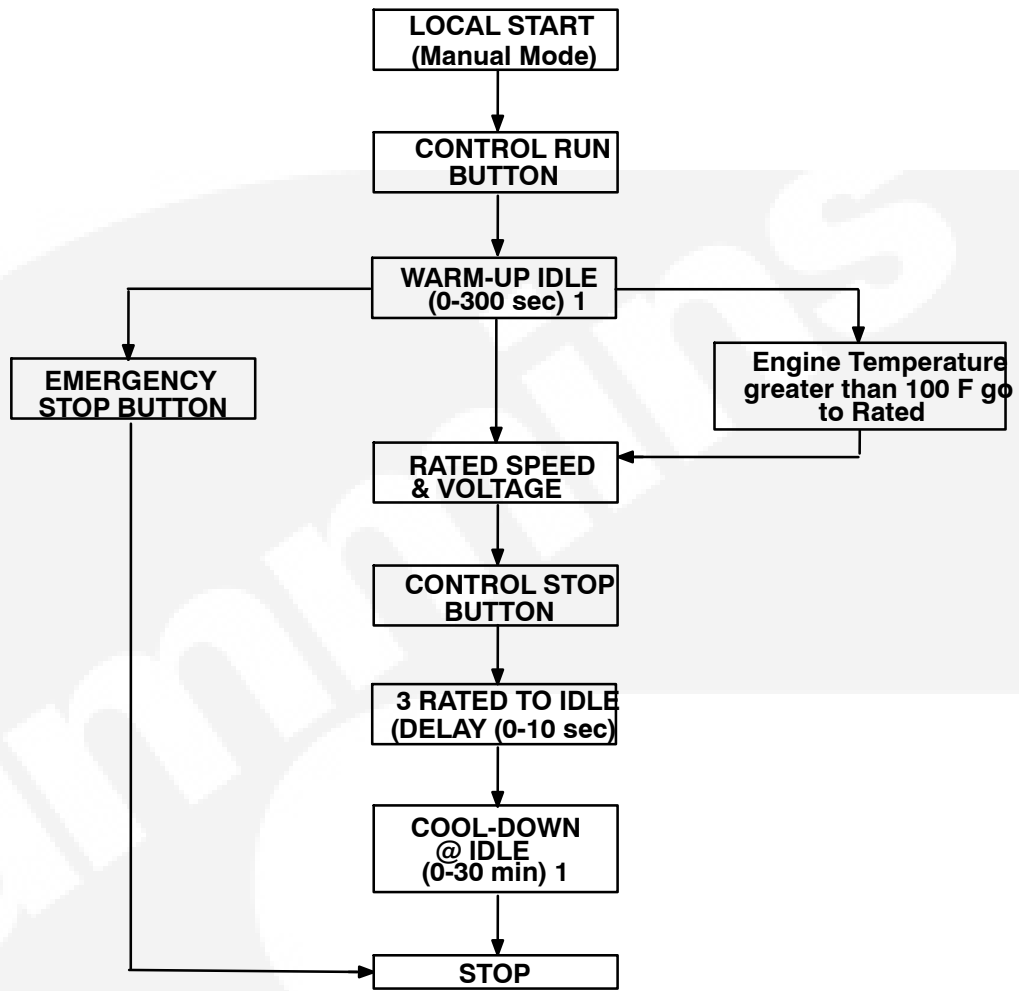
### Stopping from Remote Location (PTC or Remote Stop Signal) (Auto Mode)

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 (Figure 3-3). (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 in this section 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.**





**NOTES:**

1. Warm-up/cool down idle adjusted time-out with InPower
2. Timer expires
3. Beginning Version 2.303

**FIGURE 3-2. STARTING AT THE CONTROL PANEL (MANUAL MODE)**

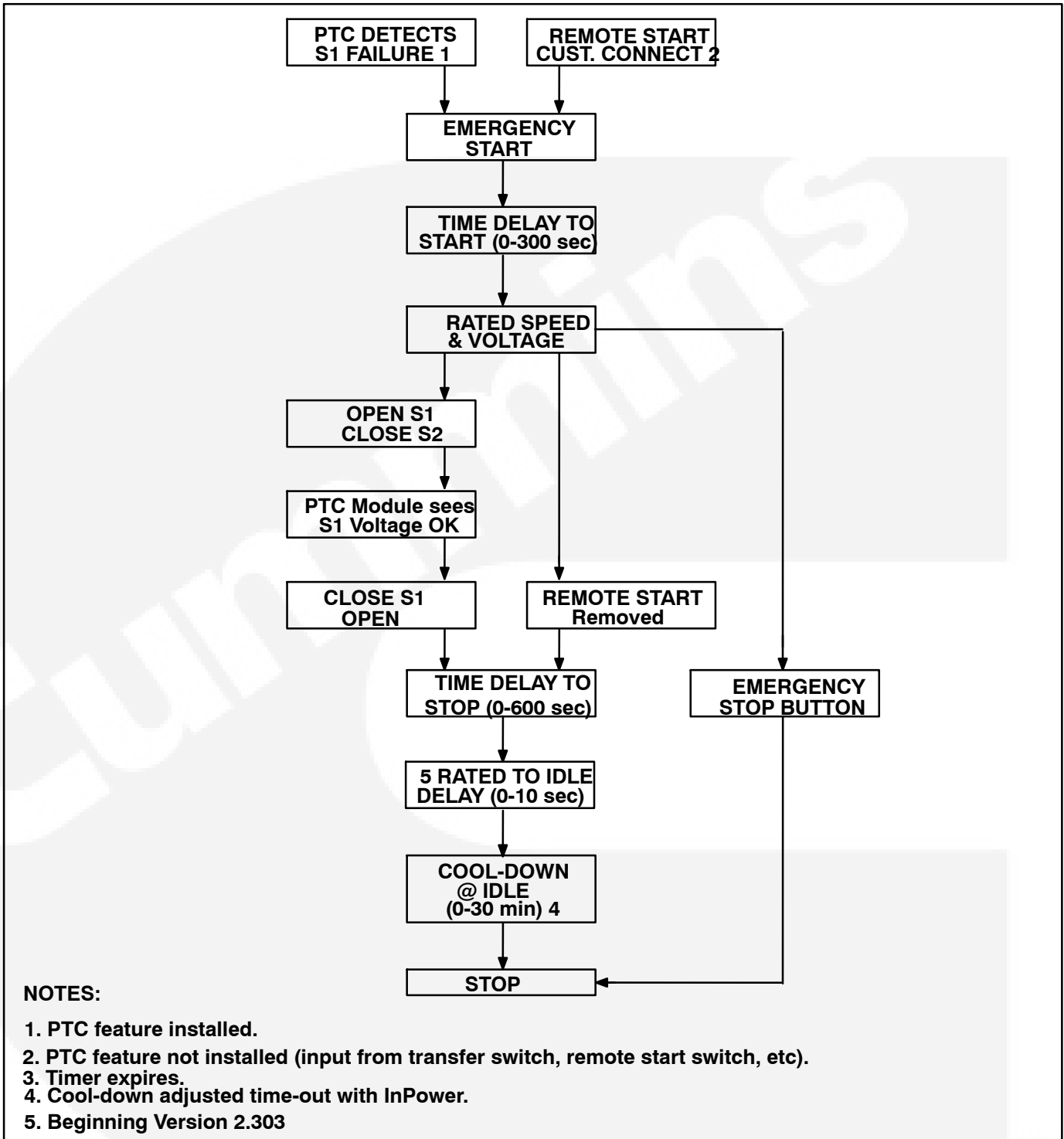
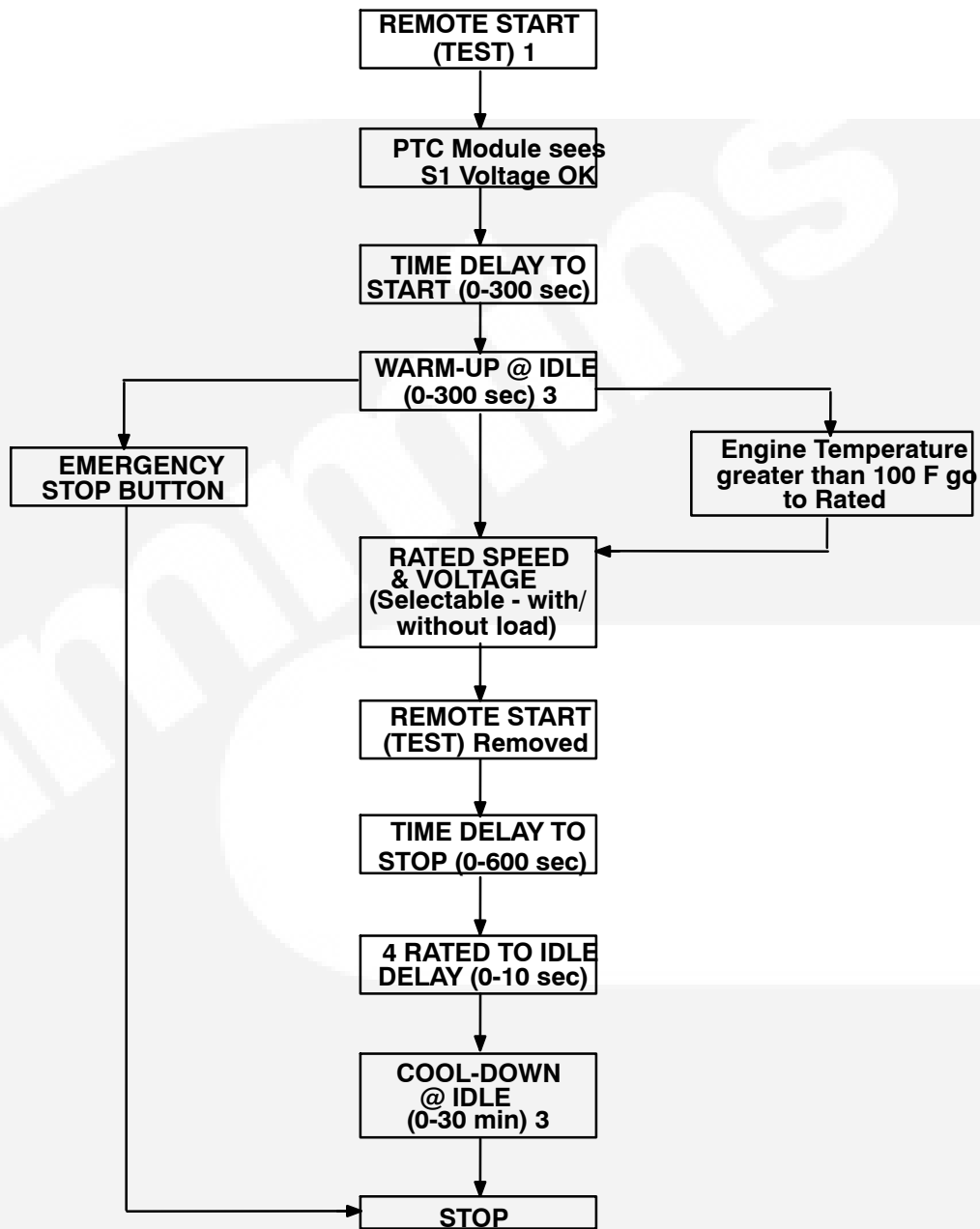


FIGURE 3-3. STARTING WITH CONTROL IN AUTO MODE (PTC OR REMOTE START SIGNAL)



**NOTES:**

1. Remote (exercise) start sequence with PTC feature installed.
2. Timer expires.
3. Warm-up/cool down idle adjust time-out with InPower
4. Beginning Version 2.303

**FIGURE 3-4. PTC FEATURE REMOTE START TEST/EXERCISE SWITCH (IN AUTO MODE)**

## MENU DISPLAY AND BUTTONS

Figure 3-5 shows the digital display and the menu selection buttons.

**Digital Display:** This two-line, 20-character per line digital display is used to view the menus of the menu-driven operating system. Refer to the menu trees later in this section. The display is also used to show fault messages.

**Display Menu Selection Buttons:** 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. The display symbol indicates the function of the button.

In the digital display for main menus (Figure 3-6), the ◀ and ▶ symbols indicate that pressing the adjacent button causes the operating program to go to the selected submenu (e.g., Engine Menu in Figure 3-9).

In the digital display the More>> symbol indicates that pressing the adjacent button causes the operating program to go to the next main menu, as shown in Figure 3-6.

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 ↑ symbol 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 but-

ton 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 increase 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.**

**Home Button:** Pressing this button causes the operating system to show Main Menu 1 (Figure 3-6) in the digital display.

**Previous Main Menu Button:** Press this button causes the operating system to show the previous Main Menu in the digital display. All main menus include both types of green triangles. (◀ and ▶).



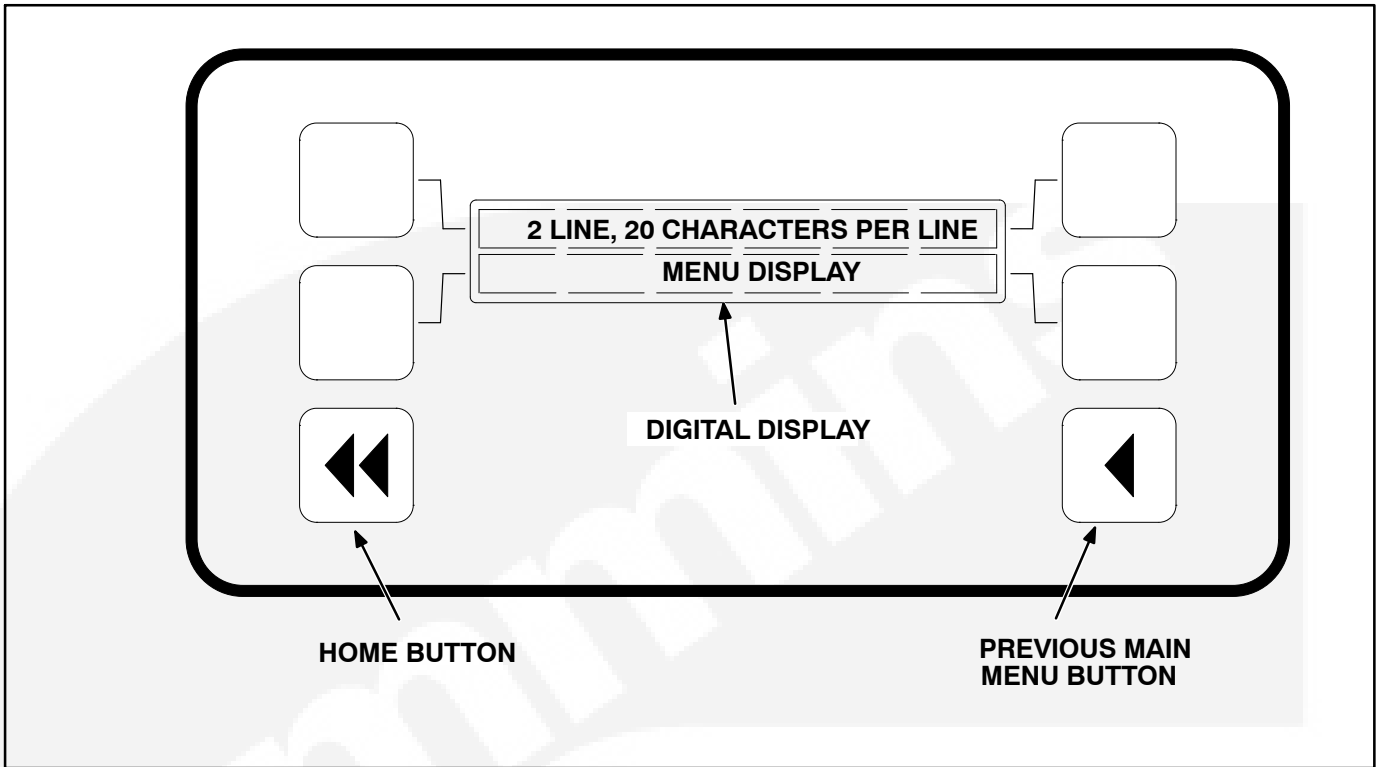


FIGURE 3-5. DIGITAL DISPLAY AND MENU SELECTION BUTTONS



## 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.

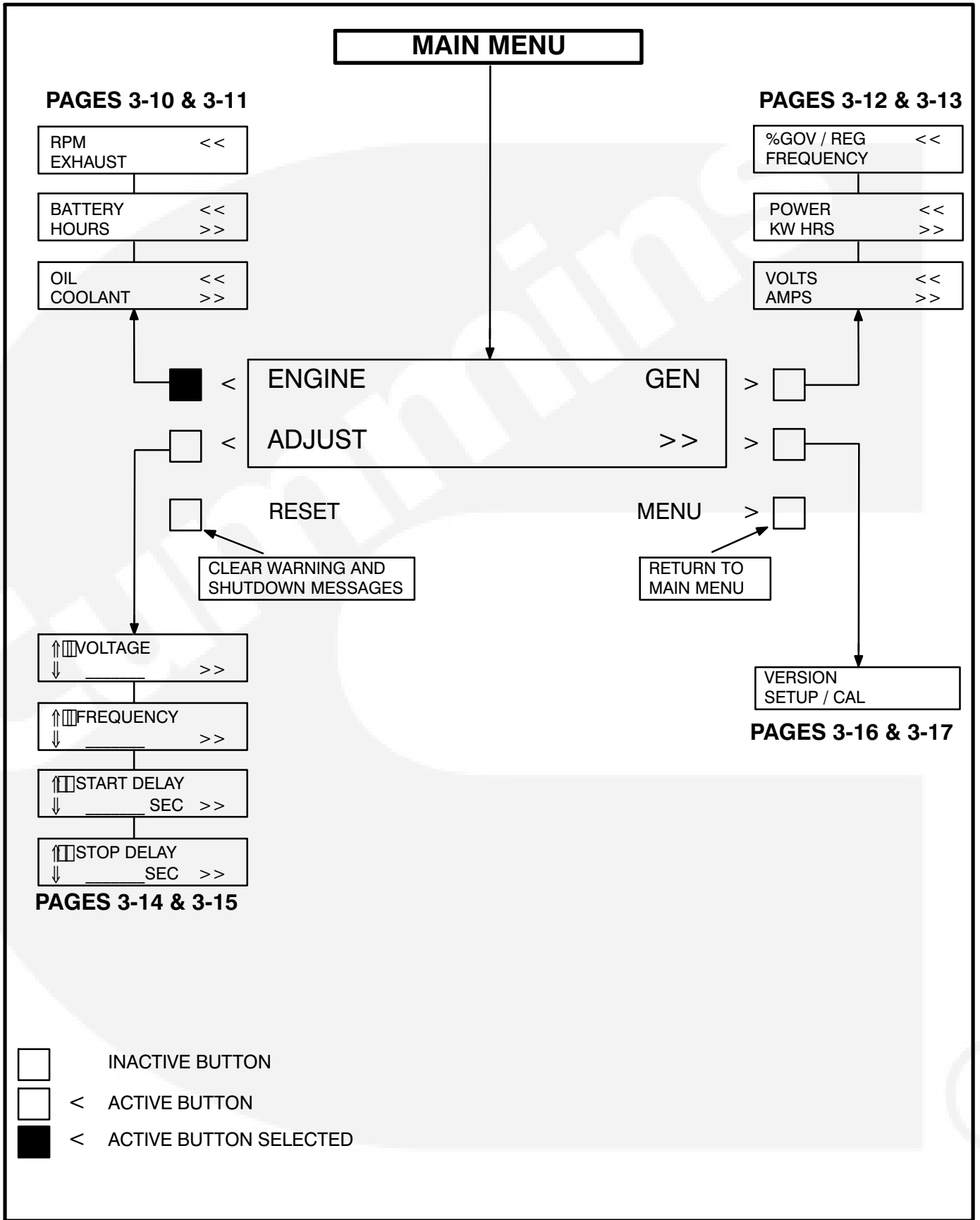
To display generator parameters, such as volts, amps, power (kW), and frequency, press the button

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 3-15.

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 3-17.







## 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.

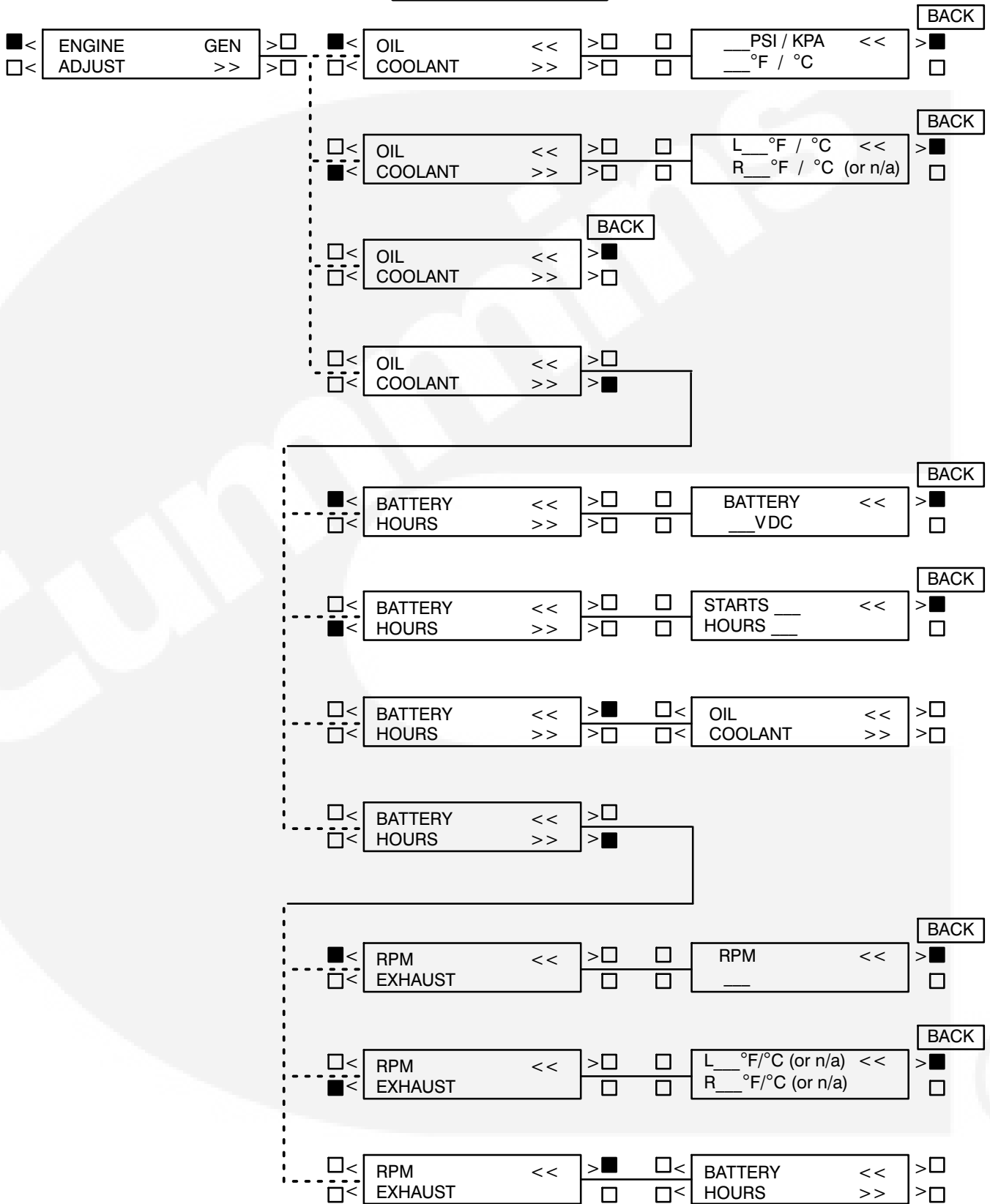
**OIL/COOLANT submenu:** This is the first submenu. Select OIL for a display of oil pressure and oil temperature. Select COOLANT for a display of coolant temperature. When oil or coolant parameters are displayed, pressing the button next to the “<<” will return the display (“BACK”) to the OIL/COOLANT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

**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.

**If DELTA is selected in the Initial Start Setup submenu, when selecting VOLTS, the "line-line" or "line-neutral" submenus will not be displayed, only the L12, L23, L31 submenu will be displayed.**

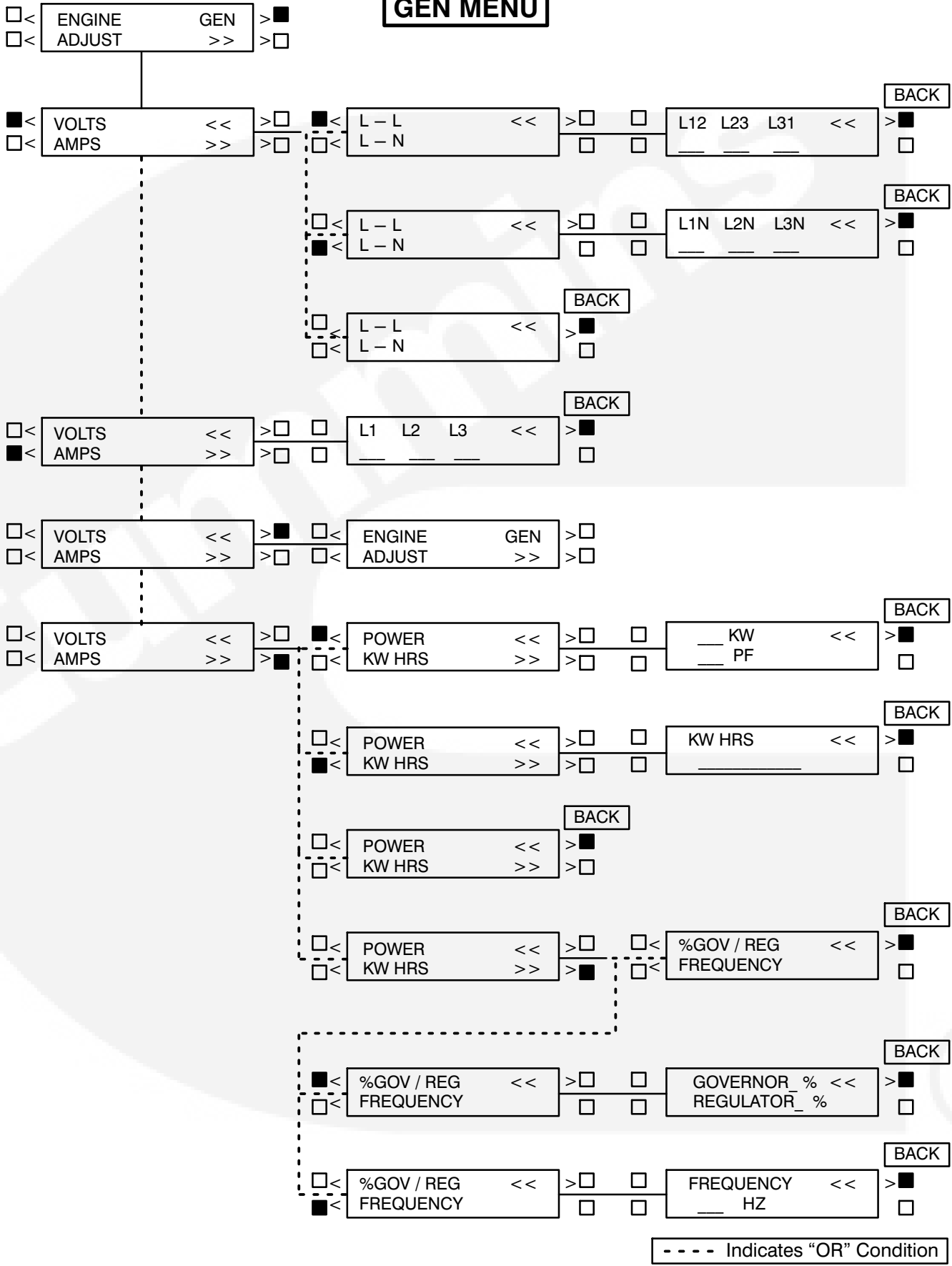
**POWER/KW HOURS submenu:** From the VOLTS/AMPS submenu, press the button next to the ">>" in the display to move to the POWER/KW HOURS submenu. Select POWER for a display of power output in kilowatts and a power factor value. Select KW HOURS for a display of kilowatt hours. When power or kW hours parameters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

**Beginning Version 1.06, 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



## 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.

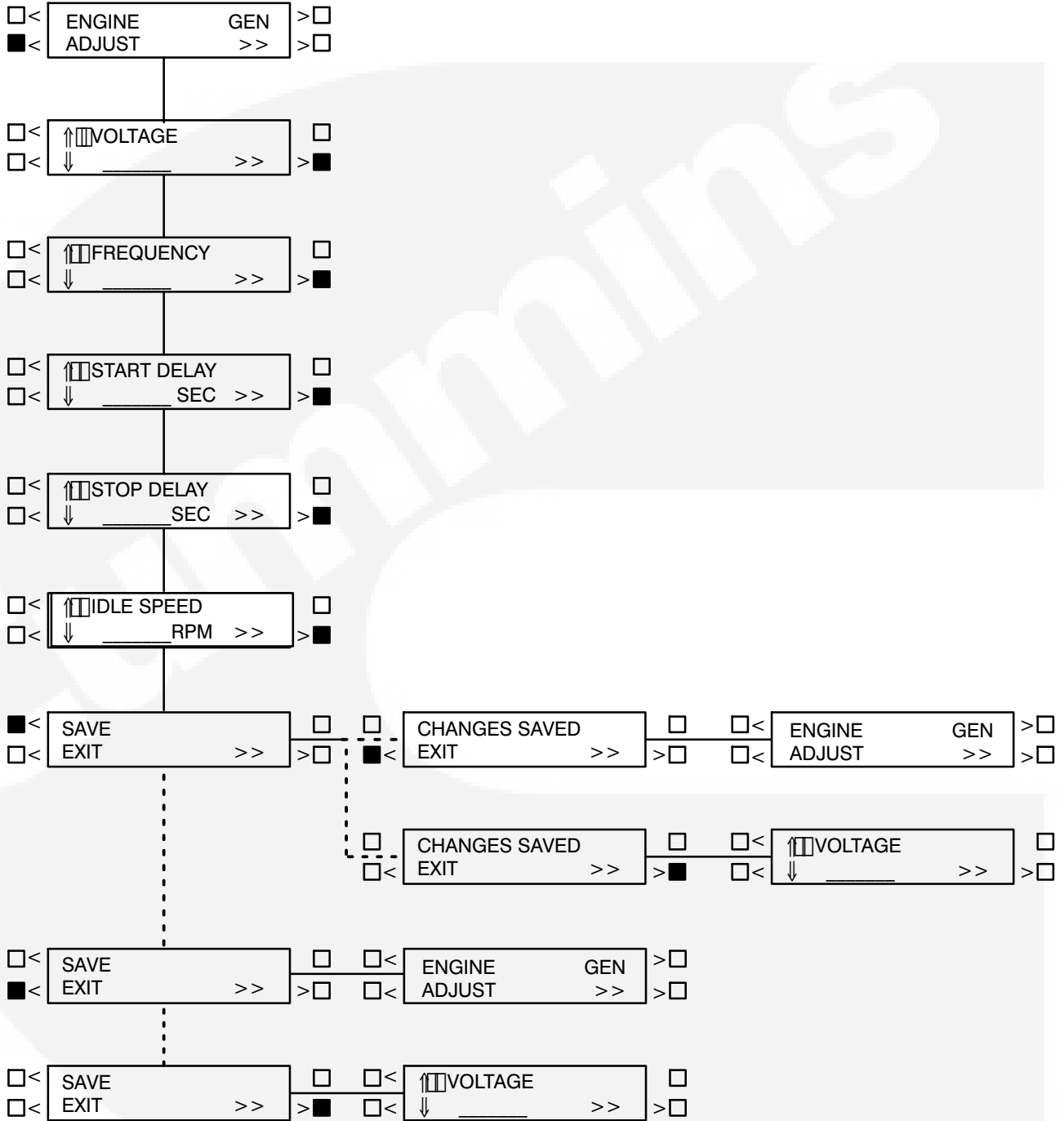
**IDLE SPEED submenu:** From the STOP DELAY submenu, press the button next to the “>>” in the display to move to the IDLE SPEED submenu. Use the buttons next to the “↑” and “↓” symbols to set the idle speed. The idle speed adjustment range is 800 RPM  $\pm 100$  RPM. (Default value is 800 RPM.)

**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 genset is shut down, but will be reset (and will not be in effect) when the set is restarted.**

# ADJUST



- - - 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 and etc. This menu provides the following information:

- Generator set voltage
- WYE or DELTA
- Standby or Prime
- Parallel or Single

**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.

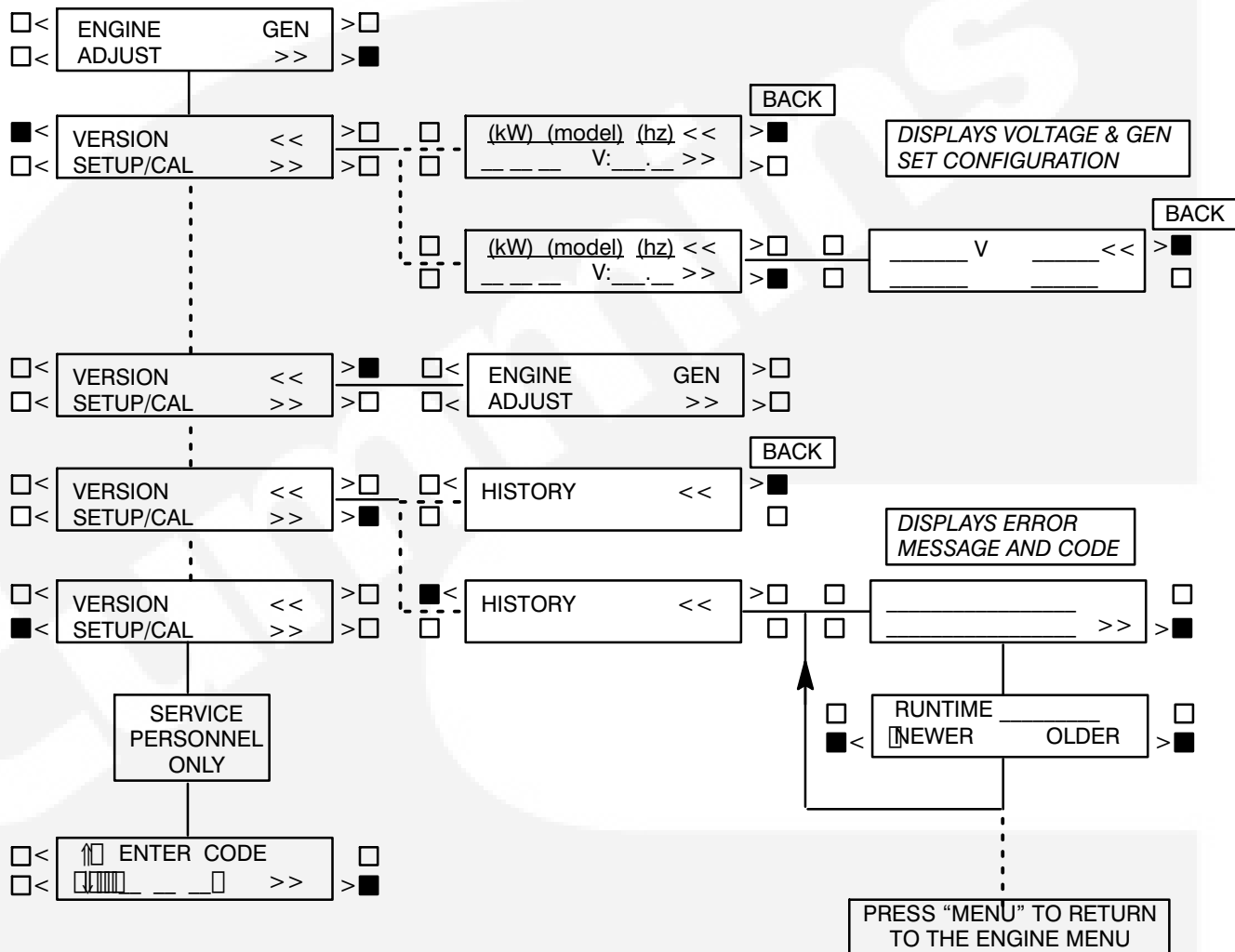
The software will record (save) up to 20 error messages. The last error detected will always be displayed first. As each new error is detected, the oldest error recorded after 20 will be deleted.

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



# 4. Troubleshooting

---

The PowerCommand® Control 2100 (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).

*Specifications* section 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.

**⚠️ 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. Turn off or remove AC power from the battery charger.
3. 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.

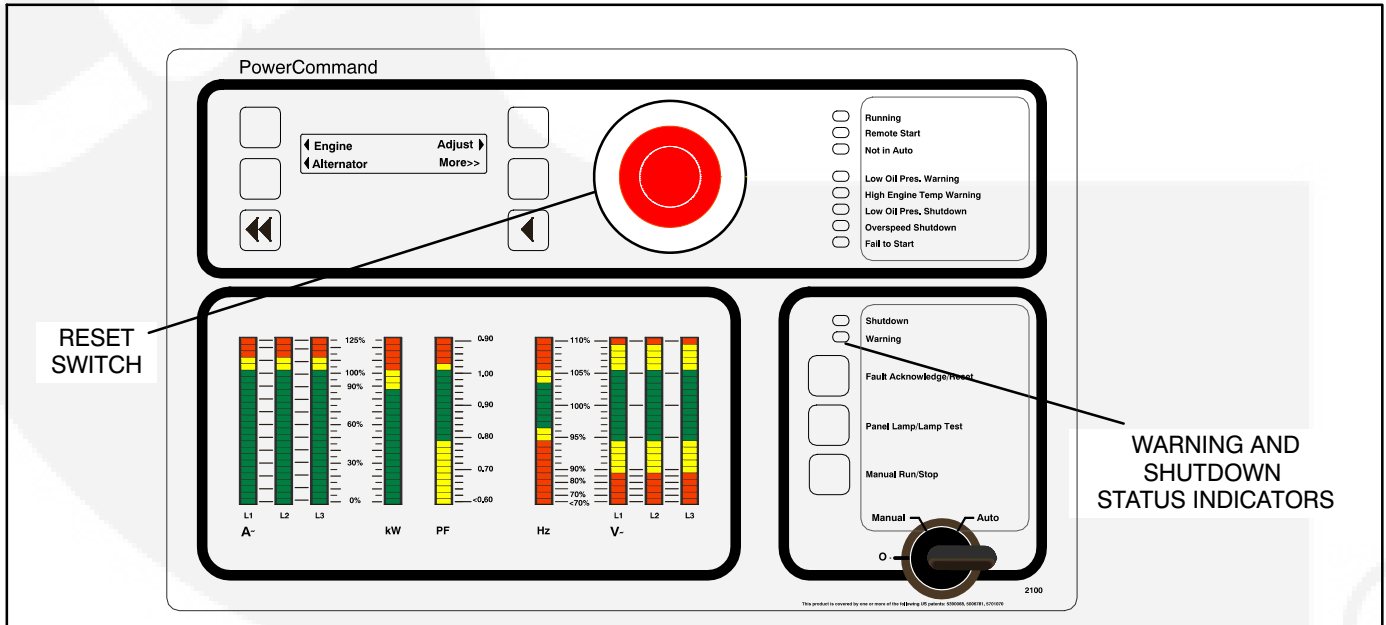


FIGURE 4-1. CONTROL PANEL (PCC 2100)

**TABLE 4-1. WARNING AND SHUTDOWN CODES**

<b>CODE</b>	<b>MESSAGE</b>	<b>STATUS LED</b>	<b>PAGE</b>
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	4-6
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	4-7
241	LOW FUEL	Warning	4-7
250	EEPROM ERROR	Shutdown	4-7
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><b>⚠ WARNING</b> <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>	
<b>SYMPTOM</b>	<b>CORRECTIVE ACTION</b>
Control does not power up when the Run/Off/Auto switch is set to Run or the Self Test switch is pressed.	<p>There is no DC power to the control.</p> <ol style="list-style-type: none"> <li>Check for battery disconnected, discharged, or improperly connected.</li> <li>Fuse F1 (20A/32V, Type 3AG) may be open. Replace with the same type. (Fuse is mounted near engine starter/solenoid, see Figure 4-2).</li> </ol> <p>Contact an authorized service center.</p>
<b>Warning, Shutdown, and Non-Automatic</b> lamps are not lit. Digital display shows main menu or selected menu.	Indicates all engine systems are normal. No corrective action required.
<b>Non-Automatic</b> 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.
<p>MESSAGE:  <b>IDLE MODE</b>  <b>101 – WARNING</b></p> <p>Engine continues to operate at reduced RPM.</p>	<p>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.</p> <p>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.</p>
<p><b>Shutdown</b> lamp lights.</p> <p>MESSAGE:  <b>EMERGENCY STOP</b>  <b>102 – SHUTDOWN</b></p> <p>Engine shuts down and will not crank.</p>	<p>Indicates local or remote Emergency Stop.</p> <p>To reset the local Emergency Stop button :</p> <ul style="list-style-type: none"> <li>Pull the button out or turn the switch clockwise (button with arrow) and allow it to pop out.</li> <li>Move the Run/Off/Auto switch to Off.</li> <li>Press the Reset switch.</li> <li>Select Run or Auto, as required.</li> </ul>
<p><b>Warning</b> lamp lights.</p> <p>MESSAGE:  <b>LOW OIL PRESSURE</b>  <b>200 – WARNING</b></p>	<p>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, <b>201 Low Oil Pressure</b> procedure. If engine can be stopped, follow <b>201</b> procedure.</p> <p><b>To check oil pressure, access Oil Pressure menu prior to clearing the fault.</b></p>

**TABLE 4-2. TROUBLESHOOTING (CONT.)**

<p><b>⚠ WARNING</b> 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>	
SYMPTOM	CORRECTIVE ACTION
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>LOW OIL PRESSURE 201 – SHUTDOWN</b></p>	<p>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 <i>Specifications</i>. Contact an authorized service center.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>OIL PRES SENDER 204 – WARNING</b></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><b>Warning</b> lamp lights. MESSAGE: <b>LOW COOLANT TEMP 210 – WARNING</b></p> <p>Set is in standby mode but is not operating. Warning occurs when engine coolant temperature is 70° F (21° C) or lower. <b>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.</b></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"> <li>Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required.</li> <li>Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required.</li> <li>Contact an authorized service center if none of the above.</li> </ol>
<p><b>Warning</b> lamp lights. MESSAGE: <b>HIGH COOLANT TEMP 211 – WARNING</b></p>	<p>Indicates engine has begun to overheat and coolant temperature has risen to an unacceptable level: <b>(215° F – standby / 207° F – primary).</b> If generator is powering non-critical and critical loads and cannot be shut down, use the following:</p> <ol style="list-style-type: none"> <li>Reduce load if possible by turning off non-critical loads.</li> <li>Check air inlets and outlets and remove any obstructions to airflow. If engine can be stopped, follow the next procedure.</li> </ol> <p><b>To check coolant temperature, access Coolant Temp menu prior to clearing the fault.</b></p>

**TABLE 4-2. TROUBLESHOOTING (CONT.)**

<p><b>⚠ WARNING</b> <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><b>Shutdown</b> lamp lights. MESSAGE: <b>HIGH COOLANT TEMP</b> <b>212 – SHUTDOWN</b></p>	<p>Indicates engine has overheated (coolant temperature has risen above the shutdown trip point: <b>223° F – standby / 215° F – primary</b>) 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"> <li>a. Check coolant level and replenish if low. Look for coolant leakage and repair if necessary.</li> <li>b. Check for obstructions to cooling airflow and correct as necessary.</li> <li>c. Check fan belt and repair or tighten if necessary.</li> <li>d. Reset control and restart after locating and correcting problem. Contact an authorized service center if none of the above.</li> </ol>
<p><b>Warning</b> lamp lights. MESSAGE: <b>ENG COOLANT SENDER</b> <b>213 – WARNING</b></p>	<p>Indicates that the resistance of the coolant temperature sender is out of range. Contact an authorized service center.</p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>LOW COOLANT LVL</b> <b>214 – WARNING</b>or <b>LOW COOLANT LVL</b> <b>215 – SHUTDOWN</b></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"> <li>a. Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary.</li> <li>b. Reset control and restart after locating and correcting problem. Contact an authorized service center.</li> </ol> <p><b>LOW COOLANT LVL Shutdown will not occur if generator set is in Idle mode (low coolant warning only).</b></p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>MAG PICKUP</b> <b>220 – SHUTDOWN</b></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"> <li>a. Restart and check RPM on the digital display.</li> <li>b. Contact an authorized service center.</li> </ol>

**TABLE 4-2. TROUBLESHOOTING (CONT.)**

<p><b>⚠ WARNING</b> <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>	
<b>SYMPTOM</b>	<b>CORRECTIVE ACTION</b>
<p><b>Shutdown</b> lamp lights. Engine will not crank. MESSAGE: <b>FAIL TO CRANK</b> <b>221 – SHUTDOWN</b></p>	<p>Indicates possible fault with control or starting system. Check for the following conditions:</p> <ol style="list-style-type: none"> <li>Poor battery cable connections. Clean the battery cable terminals and tighten all connections.</li> <li>Discharged or defective battery. Recharge or replace the battery.</li> <li>Contact an authorized service center for service of starter and starting system.</li> </ol>
<p><b>Shutdown</b> lamp lights. Engine stops cranking. MESSAGE: <b>OVERCRANK</b> <b>222 – SHUTDOWN</b></p>	<p>Indicates possible fuel system problem.</p> <ol style="list-style-type: none"> <li>Check for empty fuel tank, fuel leaks, or plugged fuel lines and correct as required.</li> <li>Check for dirty fuel filter and replace if necessary.</li> <li>Check for dirty or plugged air filter and replace if necessary.</li> <li>Reset the control and restart after correcting the problem. Contact an authorized service center if none of the above.</li> </ol>
<p><b>Shutdown</b> lamp lights. Engine runs and then shuts down. MESSAGE: <b>OVERSPEED</b> <b>223 – SHUTDOWN</b></p>	<p>Indicates engine has exceeded normal operating speed. (2070 rpm @ 60 hz; 1800 rpm @ 50 hz) Contact an authorized service center.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>LOW DC VOLTAGE</b> <b>230 – WARNING</b></p>	<p>Indicates battery voltage is below 24 VDC.</p> <ol style="list-style-type: none"> <li>Discharged or defective battery. Check the battery charger fuse. Recharge or replace the battery.</li> <li>Poor battery cable connections. Clean the battery cable terminals and tighten all connections.</li> <li>Contact an authorized service center if none of the above.</li> </ol>
<p><b>Warning</b> lamp lights. MESSAGE: <b>HIGH DC VOLTAGE</b> <b>231 – WARNING</b></p>	<p>Indicates battery voltage exceeds 32 VDC. Contact an authorized service center.</p>

**TABLE 4-2. TROUBLESHOOTING (CONT.)**

<p><b>⚠ WARNING</b> <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>	
<b>SYMPTOM</b>	<b>CORRECTIVE ACTION</b>
<p><b>Warning</b> lamp lights. MESSAGE: <b>WEAK BATTERY</b> <b>232 – WARNING</b></p>	<p>Indicates battery voltage drops below 60% of nominal for two seconds, during starting. Discharged or defective battery. See Warning message <b>230, LOW DC VOLTAGE</b>.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>LOW FUEL DAY</b> <b>240 – WARNING</b></p>	<p>Indicates day tank fuel supply is running low. Check fuel supply and replenish as required.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>LOW FUEL</b> <b>241 – WARNING</b></p>	<p>Indicates fuel supply is running low. Check fuel supply and replenish as required.</p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>EEPROM ERROR</b> <b>250 – SHUTDOWN</b></p>	<p>Indicates PCC memory error. Data corruption of critical operating parameters. Contact an authorized service center.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>EEPROM ERROR</b> <b>251 – WARNING</b> or <b>252 – WARNING</b></p>	<p>Indicates PCC memory error. Data corruption of noncritical operating parameters. Contact an authorized service center.</p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>CUSTOMER FAULT 1</b> <b>260 – SHUTDOWN</b> or <b>GROUND FAULT</b> <b>261 – SHUTDOWN</b> or <b>RUPTURE BASIN</b> <b>262 – SHUTDOWN</b> or <b>HIGH GEN TEMP</b> <b>263 – SHUTDOWN</b></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. As indicated by the Shutdown lamp, a shutdown response has been preselected. Contact an authorized service center. <b>Note:</b> 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>

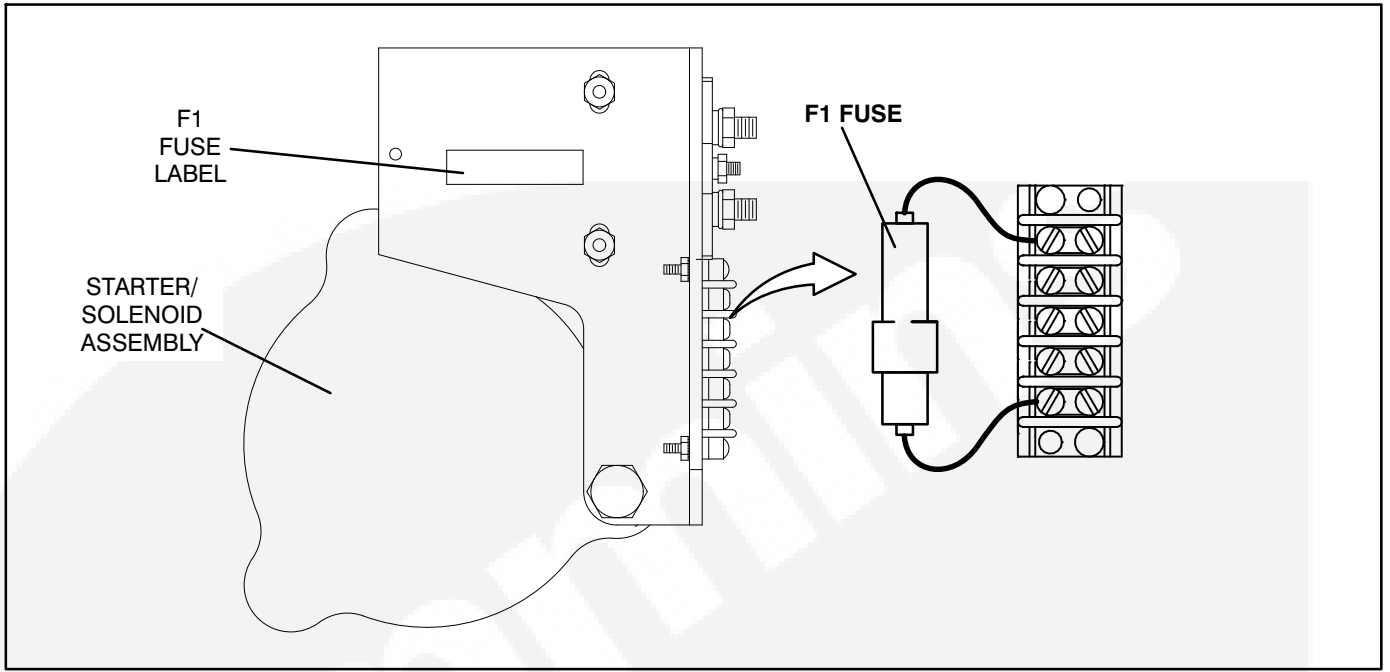


**TABLE 4-2. TROUBLESHOOTING (CONT.)**

<p><b>⚠ WARNING</b> <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>	
<b>SYMPTOM</b>	<b>CORRECTIVE ACTION</b>
<p><b>Warning</b> lamp lights. MESSAGE: <b>CUSTOMER FAULT 1</b> <b>260 – WARNING</b> or <b>GROUND FAULT</b> <b>261 – WARNING</b> or <b>RUPTURE BASIN</b> <b>262 – WARNING</b> or <b>HIGH GEN TEMP</b> <b>263 – WARNING</b></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><b>Note:</b> 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><b>Shutdown</b> lamp lights. MESSAGE: <b>HIGH AC VOLTAGE</b> <b>301 – SHUTDOWN</b></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. Contact an authorized service center.</p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>LOW AC VOLTAGE</b> <b>303 – SHUTDOWN</b></p>	<p>Indicates that one or more of the phase voltages has dropped below 85% of nominal for 10 seconds. Contact an authorized service center.</p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>UNDER FREQUENCY</b> <b>313 – SHUTDOWN</b></p>	<p>Indicates that engine speed has dropped below 90% of nominal for 10 seconds. <b>NOTE:</b> Five seconds before shutdown, a Load Dump signal is initiated. Contact an authorized service center.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>OVERCURRENT</b> <b>320 – WARNING</b></p>	<p>Indicates that generator output current has exceeded 110% of rated for 60 seconds. Contact an authorized service center.</p>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>OVERCURRENT</b> <b>321 – SHUTDOWN</b></p>	<p>Indicates that generator output current has exceeded 110% of rated, and that a PCC time/current calculation has initiated an overcurrent shutdown. Contact an authorized service center.</p>

**TABLE 4-2. TROUBLESHOOTING (CONT.)**

<p><b>⚠ WARNING</b> <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>	
<b>SYMPTOM</b>	<b>CORRECTIVE ACTION</b>
<p><b>Shutdown</b> lamp lights. MESSAGE: <b>SHORT CIRCUIT</b> <b>322 – SHUTDOWN</b></p>	<p>Indicates that generator output current has exceeded 175% of rated. Contact an authorized service center.</p>
<p><b>Warning</b> lamp lights. MESSAGE: <b>OVERLOAD</b> <b>330 – WARNING</b></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><b>Shutdown</b> lamp lights. MESSAGE: <b>REVERSE POWER</b> <b>335 – SHUTDOWN</b></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>



**FIGURE 4-2. FUSE F1 (B+) LOCATION**





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# 5. Maintenance

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## 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 weather

- 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. MAINTENANCE SCHEDULE**

MAINTENANCE ITEMS	SERVICE TIME				
	Daily or after 8 Hours	Weekly or after 50 Hours	Monthly or after 100 Hours	6 Months or after 250 Hours	Yearly or after 500 Hours
Inspect Genset	X <sup>1</sup>				
Check Coolant Heater	X				
Check Oil Level	X				
Check Coolant Level	X				
Check Fuel Level	X				
Check Charge Air Piping	X				
Check Air Cleaner (Clean if required)		X <sup>2</sup>			
Check Battery Charging System		X			
Drain Fuel Filter(s)		X <sup>4, 5</sup>			
Drain Water and Sediment from Fuel Tank		X <sup>4</sup>			
Check Anti-freeze and DCA Concentration			X <sup>5</sup>		
Check Drive Belt Tension			X <sup>3, 5</sup>		
Drain Exhaust Condensate Trap			X		
Check Starting Batteries			X		
Change Crankcase Oil and Filter				X <sup>6</sup>	
Change Coolant Filter				X <sup>5</sup>	
Clean Crankcase Breather				X <sup>5</sup>	
Change Air Cleaner Element				X <sup>2</sup>	
Check Radiator Hoses for Wear & Cracks				X	
Change Fuel Filters				X <sup>5</sup>	
Clean Cooling System					X <sup>5</sup>
Test Generator Insulation Resistance					X <sup>7</sup>
Test Rupture Basin Leak Detect Switch					X <sup>8</sup>

X<sup>1</sup> Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with set running and repair any leaks immediately.

X<sup>2</sup> Perform more often in dusty conditions.

X<sup>3</sup> Visually check belt for evidence of wear or slippage. Replace if hard or brittle.

X<sup>4</sup> Drain 1 cup or more of fuel to remove water and sediment.

X<sup>5</sup> Refer to engine operation and maintenance manual for procedure.

X<sup>6</sup> If genset is used for prime power applications, change oil and filter every 6 months or 250 hours. If used for standby applications, change oil every 12 months or 250 hours, whichever comes first.

X<sup>7</sup> This procedure should be followed periodically throughout the life of the generator set, or if the generator has set idle for a period of time with no generator heaters used. Contact your authorized service center.

X<sup>8</sup> Check leak detect switch in sub-base fuel tank of optional enclosure, once a year or as required by safety code. Contact your authorized service center.

## 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 genset 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.*

### Fuel System

With the generator set operating, inspect the fuel supply lines, return lines, filters and fittings for cracks and abrasions and make sure they are not rubbing against anything that could cause breakage. If any leaks are detected, 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.*

### AC Electric System

Check the following while the genset is operating.

**Frequency/RPM (Alternator/Engine Menu):** The generator frequency should be stable and the read-

ing should be the same as the genset nameplate rating (50 or 60 Hz/1500 or 1800 RPM).

**AC Voltmeter (Alternator Menu):** At no load, the line-to-line or line-to-neutral voltage(s) should be the same as the genset nameplate rating.

**AC Ammeter (Alternator Menu):** At no load the current ratings should be zero. With a load applied, each line current should be about the same.

**Panel Lamp/Lamp Test Button:** Press and hold this button to test all front panel LEDs and meters. The meters will light one bar at a time. Make sure that all LEDs and meters are OK and then release the button.

### 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.

### 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.



## GENERATOR SET MAINTENANCE (Battery Disconnected)

**⚠ 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:

1. Move the O/Manual/Auto switch on the control panel to the O (off) position.
2. Turn off or remove AC power from the battery charger.
3. 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.

### Oil API Classification

Refer to the Cummins engine *Operation and Maintenance Manual* for lubricating oil classification.

### Oil Viscosity

Refer to the Cummins engine *Operation and Maintenance Manual* for lubricating oil recommendations/specifications.

### Engine Oil Level

Check the engine oil level during engine shutdown periods at the intervals specified in Table 5-1. The oil dipstick and oil fill are located on the side of the engine as shown in Figure 5-1. The dipstick is stamped with FULL and ADD to indicate the crankcase oil level. For accurate readings, shut off the engine and wait approximately 10 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 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 low mark or above the high mark. Overfilling can cause foaming or aeration of the oil while operation below the low mark can cause loss of oil pressure.

### Oil and Filter Change

Change the oil and filter at the intervals recommended in the Maintenance Table 5-1. The Cummins engine *Operation and Maintenance Manual* contains the procedure to drain the oil and replace the oil filter. Use oil that meets Cummins recommendations/specifications.

**⚠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.

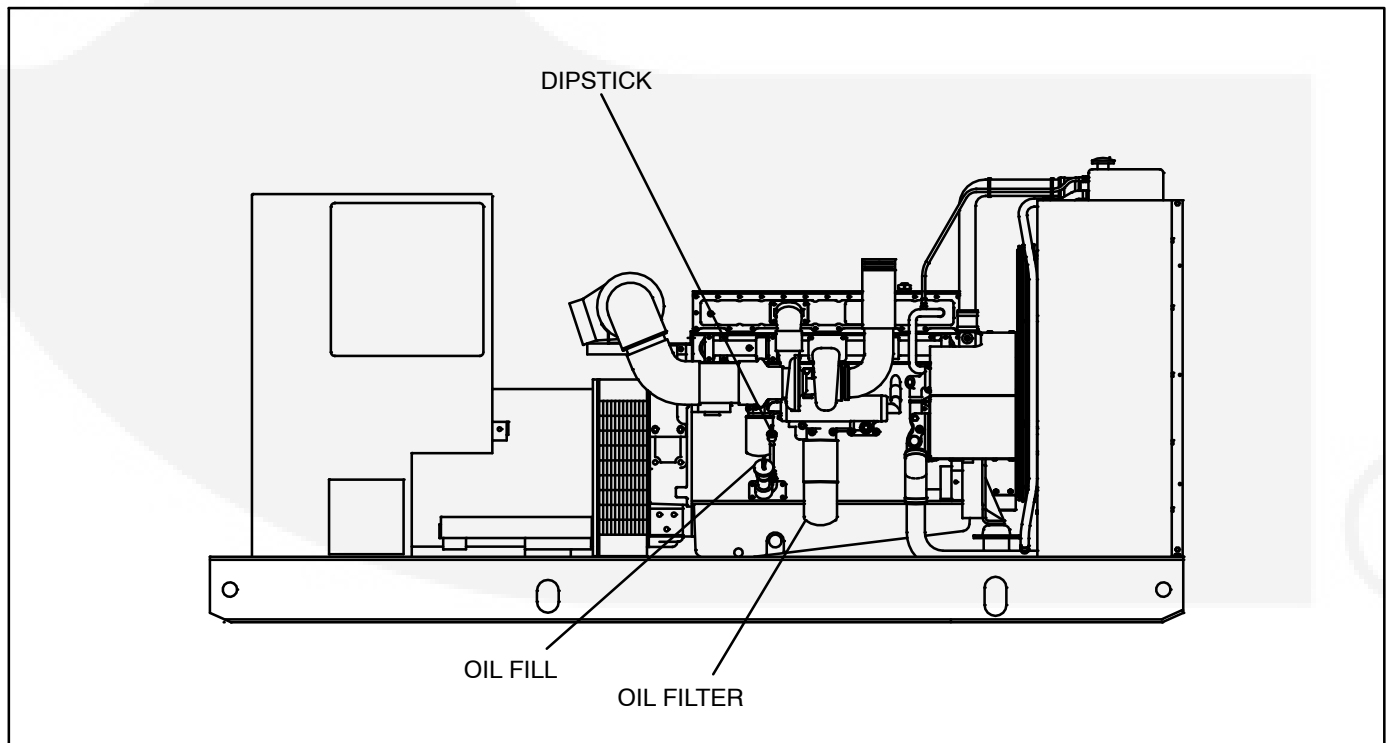


FIGURE 5-1. LUBRICATION SYSTEM

## COOLING SYSTEM

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

**CAUTION** *The optional 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** *Remove AC power to the heater before disconnecting battery cables. Heater will run continuously without DC power and can overheat and damage heater.*

**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 level during shutdown periods at the interval specified in Table 5-1. Remove the radiator cap after allowing the engine to cool and if necessary, add coolant until the level is about 3/4 inch (18 mm) below the radiator cap lower sealing surface. Use a coolant solution as recommended in the Cummins engine *Operation and Maintenance Manual*.

**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.*

### Cooling System Maintenance

Heavy duty diesel engines require a balanced coolant mixture of water, antifreeze and coolant additives.

Refer to the Cummins engine *Operation and Maintenance Manual* for all cooling system maintenance, such as, coolant requirements, filling of cooling system, coolant filter replacement and flushing and cleaning.

### 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.*

## CHARGE-AIR PIPING

Inspect the charge air piping and hoses, daily, for leaks, holes, cracks, or loose connections. Tighten the hose clamps if necessary.

Inspect the charge air cooler for dirt and debris blocking the fins. Check for cracks, holes, or other damage.

## FUEL SYSTEM

Refer to the Cummins engine *Operation and Maintenance Manual* for fuel system maintenance.

## AIR CLEANER

The engine air intake components should be checked at the interval indicated in Table 5-1. The frequency of cleaning or replacing air cleaner filter elements is primarily determined by the conditions in which the genset operates. The standard air cleaner and optional heavy duty air cleaner contain a paper cartridge filter element which can be cleaned and reused if not damaged, or discarded and replaced

### **To Service the Air Cleaner:**

1. Loosen fastener(s) and remove air cleaner housing end cap.
2. Remove the air filter element from the filter housing.
3. To clean, blow low pressure compressed air (30 psi/207 kPa) through the element from the clean side. Hold the nozzle at least 1 inch (25 mm) away to avoid damaging the element.
4. Soak the filter for at least 15 minutes in water and Donaldsons D1400 solvent to remove soot, carbon and dirt.
5. Rinse with clean water (low pressure) and allow to air dry. Do not blow dry with compressed air. Reinstall when the filter element is dry. Replace the filter after two cleanings to avoid restricting the airflow.

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

## ELECTRONIC GOVERNOR

Generator frequency is in direct ratio to engine speed. The genset uses a Cummins model EFC electronic governor which is factory adjusted. If maintenance or adjustments are required, contact your authorized service center.

## EXHAUST CONDENSATION TRAP

If exhaust system has a condensation trap installed, water must be drained to prevent it from flowing back into the engine. See Figure 5-3 for a typical trap installation.

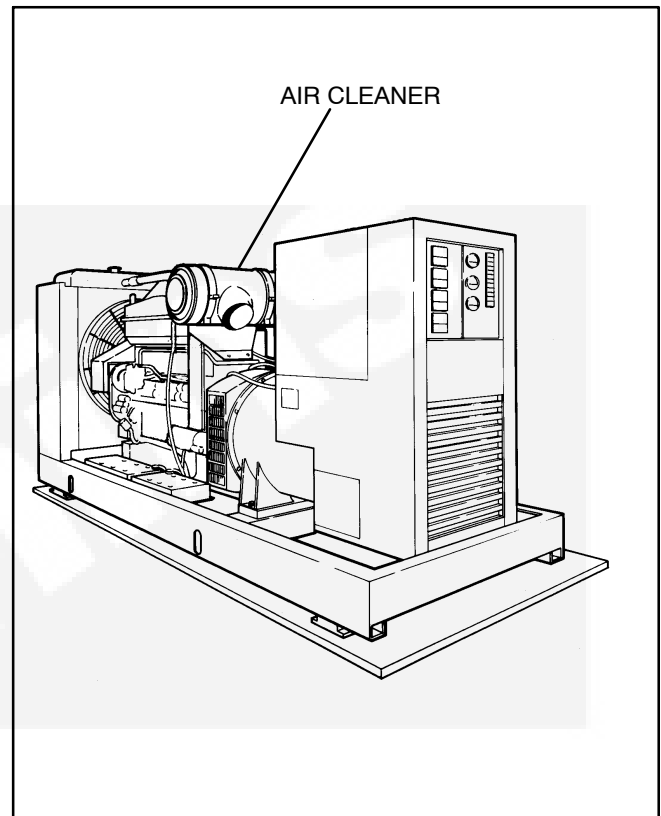


FIGURE 5-2. AIR CLEANER

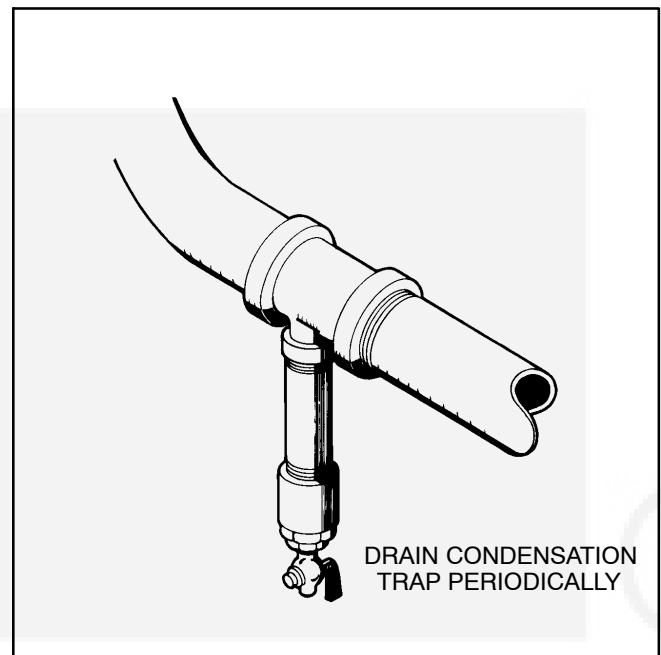


FIGURE 5-3. EXHAUST CONDENSATION TRAP

## BATTERIES

**⚠ 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.*

# 6. Operating Recommendations

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## 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.





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# 7. Optional Enclosure Features

## GENERAL

This section describes the function and operation of the optional enclosure features. Figure 7-1 shows the location of the optional features within the enclosure.

## EXTERNAL RECEPTACLE

This receptacle is located on the outside of the enclosure (Figure 7-1) and provides shore power at 20A, 120 VAC. With the AC distribution panel provided, this receptacle is GFCI protected. If power to the external receptacle is lost, reset the GFCI receptacle that is mounted to the side of the AC distribution panel (Figure 7-4).

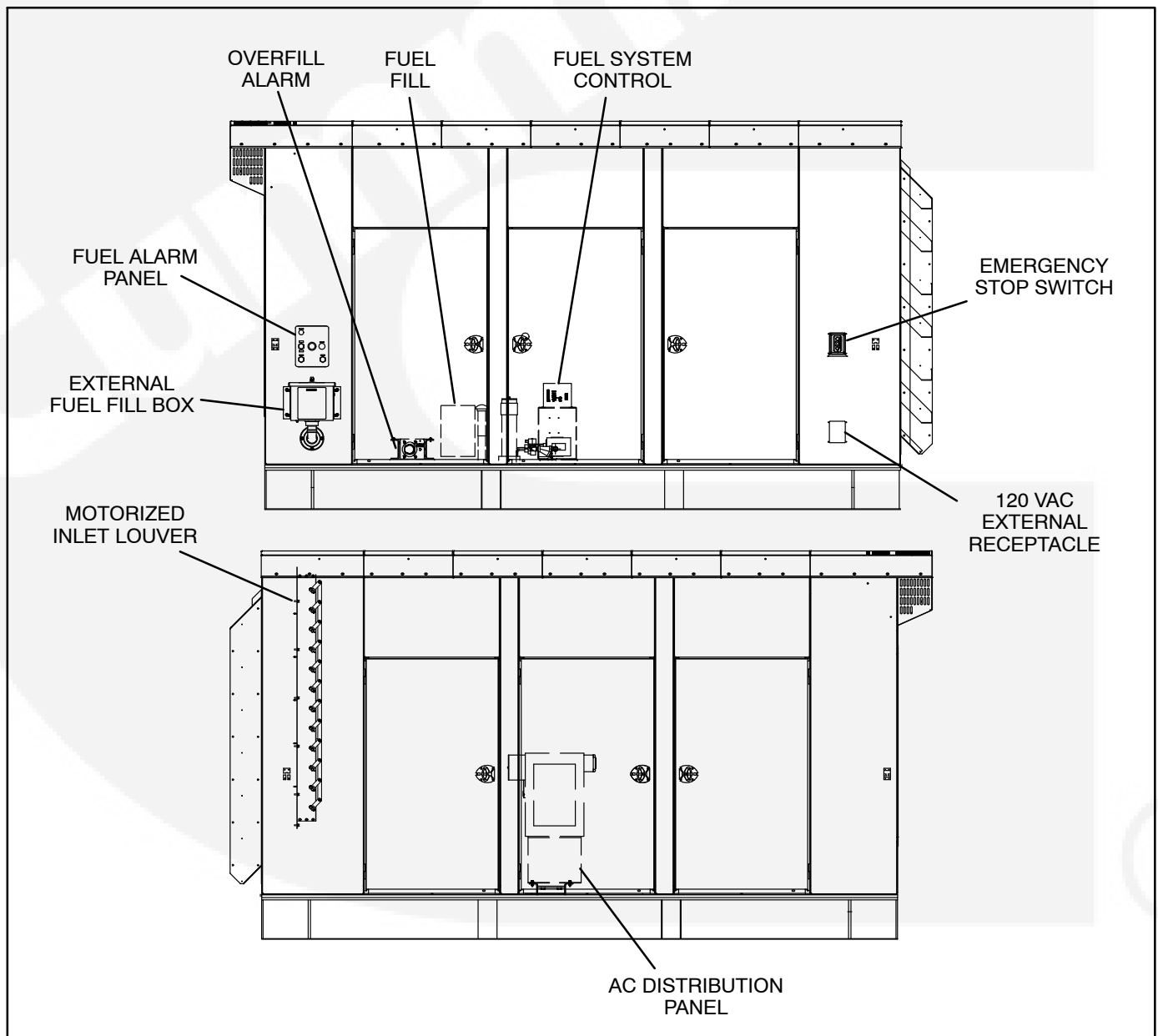


FIGURE 7-1. OPTIONAL ENCLOSURE FEATURES (WEATHER ENCLOSURE SHOWN)

## OVERFILL ALARM

The overfill alarm indicates that the fuel has reached an abnormally high level (alarm sounds at approximately 90% of fuel tank capacity). Immediately stop adding fuel. The horn can be turned off by pressing the reset button (Figure 7-2).

**Note: The automatic shutoff of a fuel truck nozzle is approximately 95% of fuel tank capacity.**

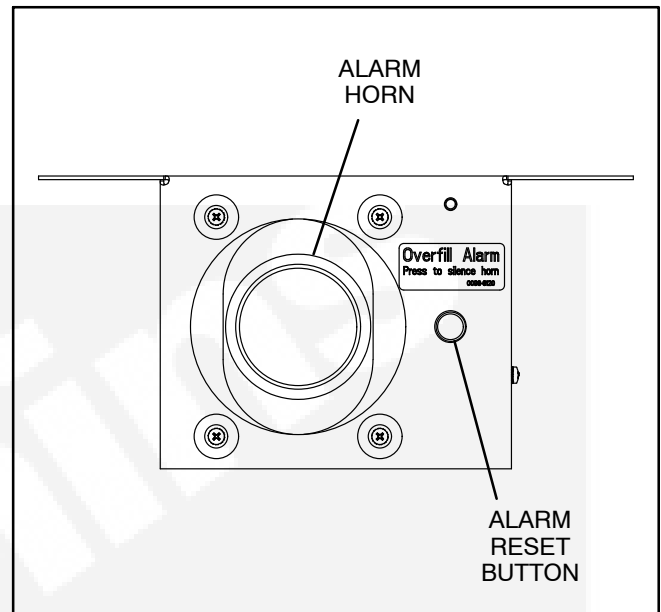


FIGURE 7-2. OVERFILL ALARM PANEL

## EXTERNAL EMERGENCY STOP SWITCH

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 or remote).

**Emergency Stop shutdown can be reset only at the generator set control panel.**

To reset:

1. Pull the button (external) 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.

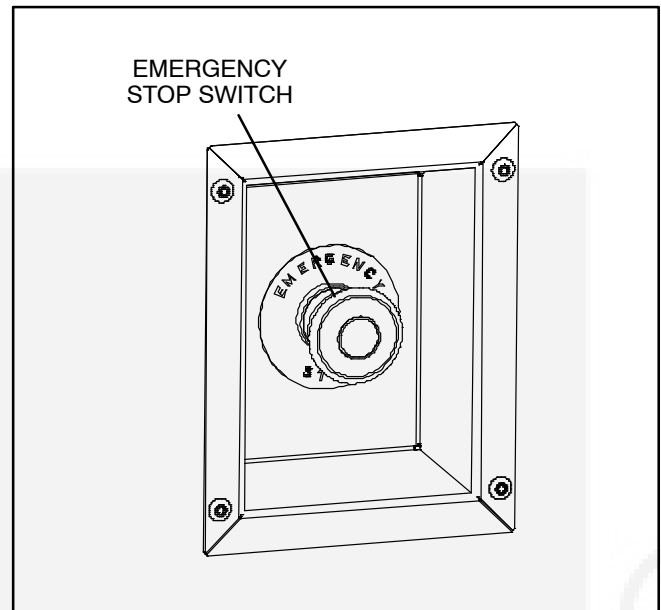


FIGURE 7-3. EXTERNAL EMERGENCY STOP SWITCH



## AC DISTRIBUTION PANEL

The AC distribution panel provides a centralized power source (120 VAC) for all optional enclosure features. Figure 7-4 shows the locations of the circuit breakers and optional feature connection points.

**GFCI RECEPTACLE:** 120VAC/20A ground fault protected outlet. For use by service personnel. (GFCI receptacle also supplies power to external receptacle.)

**RECEPTACLES (J1–J4):** For internal use only (not GFCI protected). 120VAC/20A outlets for optional enclosure features.

**⚠ WARNING** *Electrical shock can cause severe personal injury or death. Receptacles J1 through J4 are not GFCI protected and must not be used by service personnel as a power source for tools/lighting.*

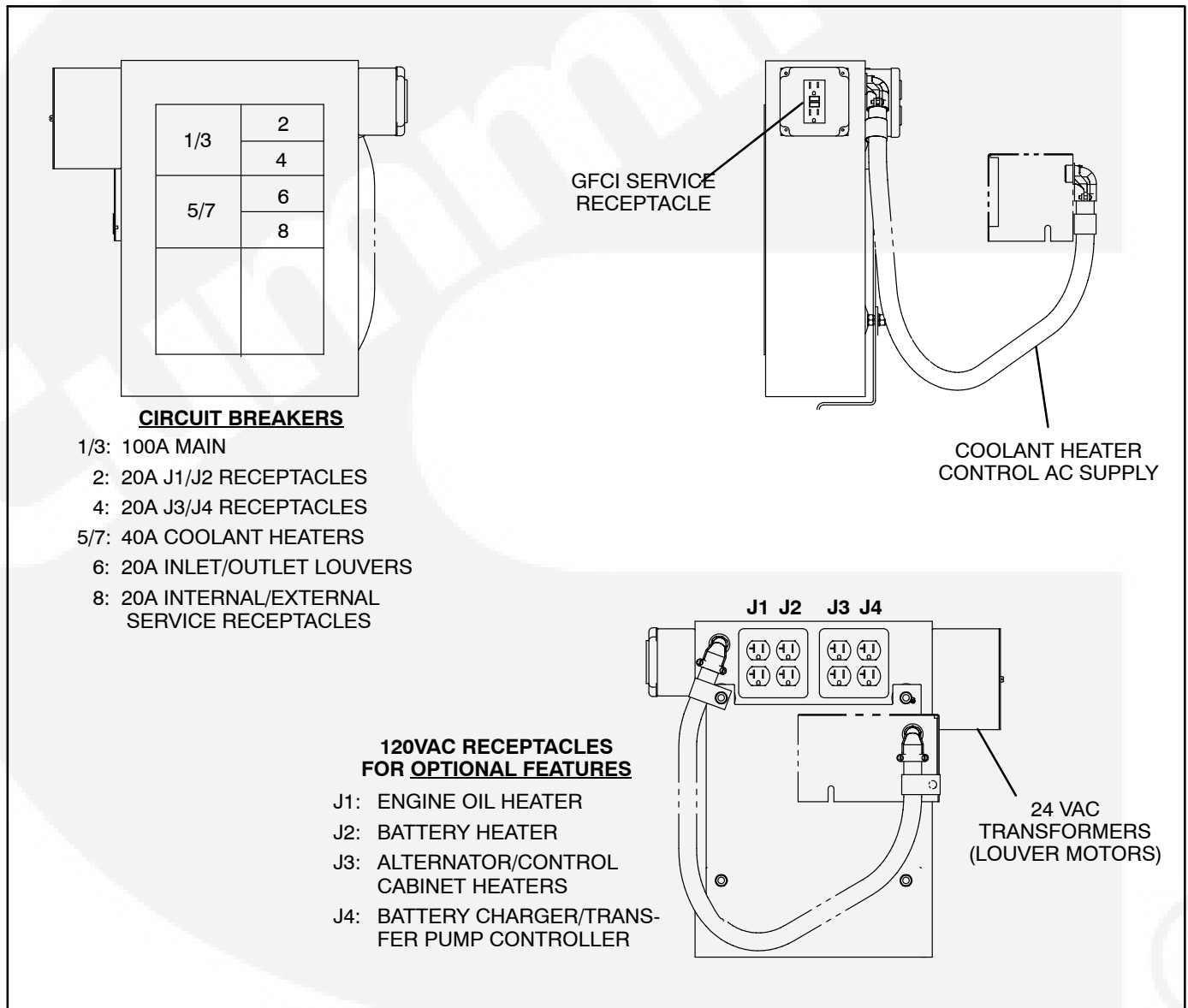


FIGURE 7-4. AC DISTRIBUTION PANEL FEATURES

## FUEL TRANSFER PUMP

The fuel transfer pump and control are available as an option when a sub-base fuel tank is provided. The automatic control operates the fuel pump to maintain a reservoir of fuel in the sub-base tank.

This section explains functions of the control panel lamps, components and operation of the day tank fuel control system. All red color lamps indicate a fault condition.

### Control Panel Switches and Indicators

The following paragraphs describe the operation of

the control switches and indicators.

### Indicators:

- **FUEL LEVEL** (green): indicates in percent the amount of fuel that is contained in the sub-base tank.
- **HIGH FUEL** (red): indicates that the fuel has reached an abnormally high level (approximately 90%). It indicates a possible failure of the "pump-off" float gauge in the sub-base tank. The lamp will turn off when the fuel level drops to normal.

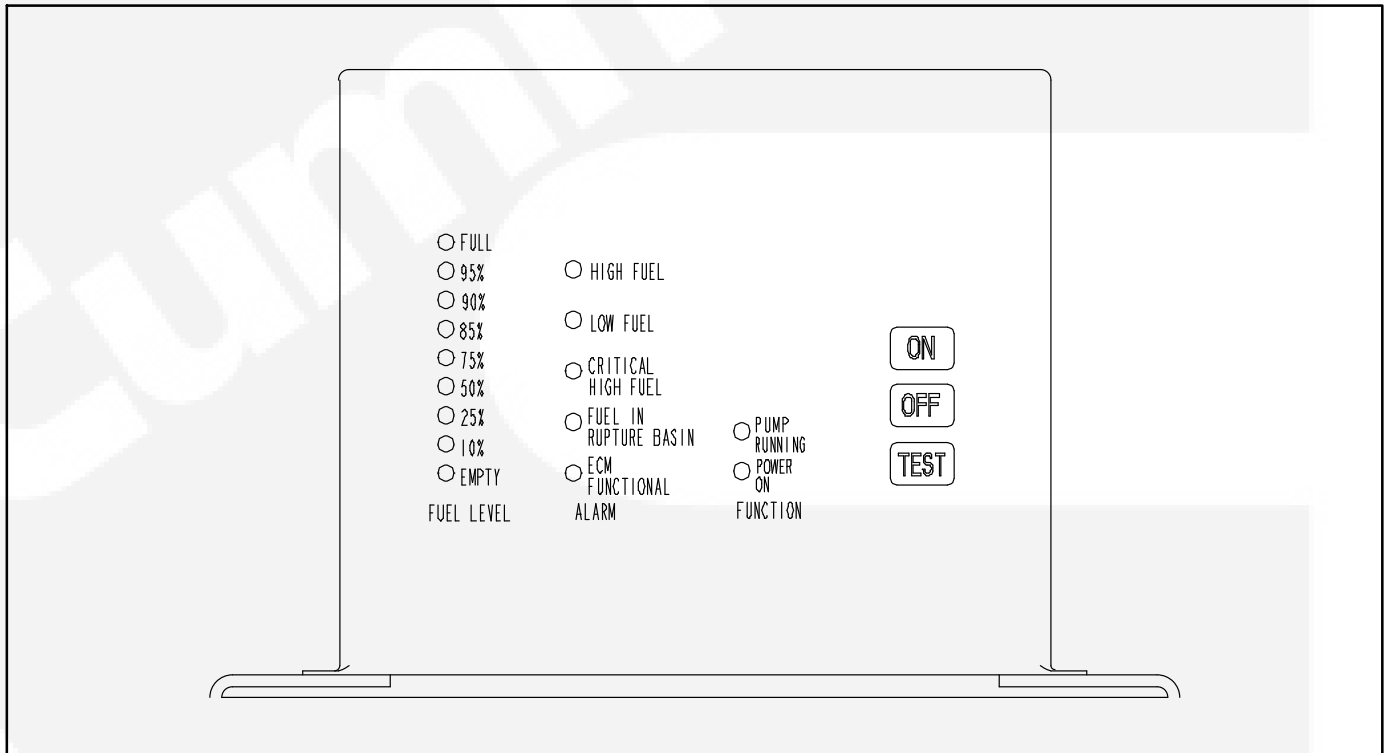


FIGURE 7-5. TRANSFER PUMP CONTROL FRONT PANEL

- **LOW FUEL** (red): indicates that the fuel level has dropped below low fuel level (approximately 62%). This warning enables the operator time to react to a potential problem before low fuel shutdown occurs. It indicates a possible empty main fuel tank, fuel line restriction, pump failure, or failure of the float gauge.
- **CRITICAL LOW FUEL** (red): indicates that the fuel level has dropped to tank bottom. This warning enables the operator time to shut down generator set before fuel runs out, preventing loss of prime or engine damage. It indicates a possible empty main fuel tank, fuel line restriction, pump failure, or failure of the float gauge.

The control should be wired to shut down the genset (optional) as continued operation will allow air to enter the engine injection pump necessitating bleeding to restart the engine. The control will reset after restoring the tank fuel level. This will also restore engine operation if the tank control has been connected to shut down the engine.

**⚠ CAUTION** *Continued operation with a CRITICAL LOW FUEL fault can lead to a low fuel shutdown if the fuel level float switch fails.*

- **FUEL IN RUPTURE BASIN** (red): indicates that the fuel has flooded the safety basin surrounding the fuel tank. The basin float switch turns off the fuel pump. The pump cannot function again until the basin is drained of fuel. Possible cause, leak in fuel tank.
- **PUMP** (green): indicates that the fuel pump is running. It will come on and go off as fuel is pumped to maintain the fuel tank level.
- **ECM FUNCTIONAL** (green): indicates no faults are detected within the control circuitry (including float gauge). If a fault occurs, the lamp will go out and de-energize the control relay. It is suggested that the customer wire to

the normally closed contact to provide a signal if a fault does occur.

- **POWER ON** (green): indicates that AC power is available to the control.

### Switches:

- **ON:** This pushbutton activates the control after the OFF pushbutton has been pressed.
- **OFF:** This pushbutton disables the control for routine maintenance to the tank system without disrupting the control. **NOTE: This also de-energizes the ECM FUNCTIONAL relay which will activate a customer alarm wired to this relay.**
- **TEST:** This pushbutton will test all front panel lamps for three seconds and activate pump/motor for as long as the button is pressed. All alarm relays will not activate but will maintain their original state.

### Operation

The following steps describe how to operate the day tank controller.

**NOTE: When power is applied to the control or is restored after a power interruption, the control will automatically go to the power on mode (functions the same as pressing the ON switch). The pump will start if the control detects low fuel in tank.**

1. Press the control ON switch for automatic operation. The green PUMP light will come on and the pump will fill the tank. The level of fuel in the tank will be automatically kept between a set of pump-on and pump-off float gauge.

**When filling an empty tank, the red CRITICAL LOW FUEL and LOW FUEL lights will come on when the control switch is pushed to the ON position. This is normal. The red lights will turn off as the tank is filled.**

2. The green PUMP light indicates when the pump is running. It will come on and off as fuel is pumped to maintain the proper level in the tank.



## EXTERNAL ALARM PANEL

The following paragraphs describe the operation of the external alarm panel components.

### Overfill Indicator/Horn/Mute Button

The overfill alarm indicates that the fuel has reached an abnormally high level (95%). Immediately stop adding fuel. It also indicates a possible failure of the “pump-off” float gauge for fuel systems that contain the fuel transfer pump.

The horn can be turned off by pressing the mute button. The indicator will turn off when the fuel level drops to normal.

### Fuel Gauge

Indicates the amount of fuel that is contained in the sub-base tank.

### Solenoid Override Button

The Solenoid Override Button is only provided on the Alarm Panel when the optional overflow preventive valve (Figure 5-7) is provided with the external fill box feature.

This switch is used to release the delivery hose pressure caused by the closing of the overflow preventive valve. This valve automatically closes during an overfill alarm, stopping the filling of the tank and creating pressure between the valve and the delivery hose. Before disconnecting the delivery hose, always press this button after an overfill warning to release fuel back pressure into the sub-base tank.

### Test Button

Press the TEST switch to test the indicator light and the horn. The test will remain active for as long as the button is pressed.

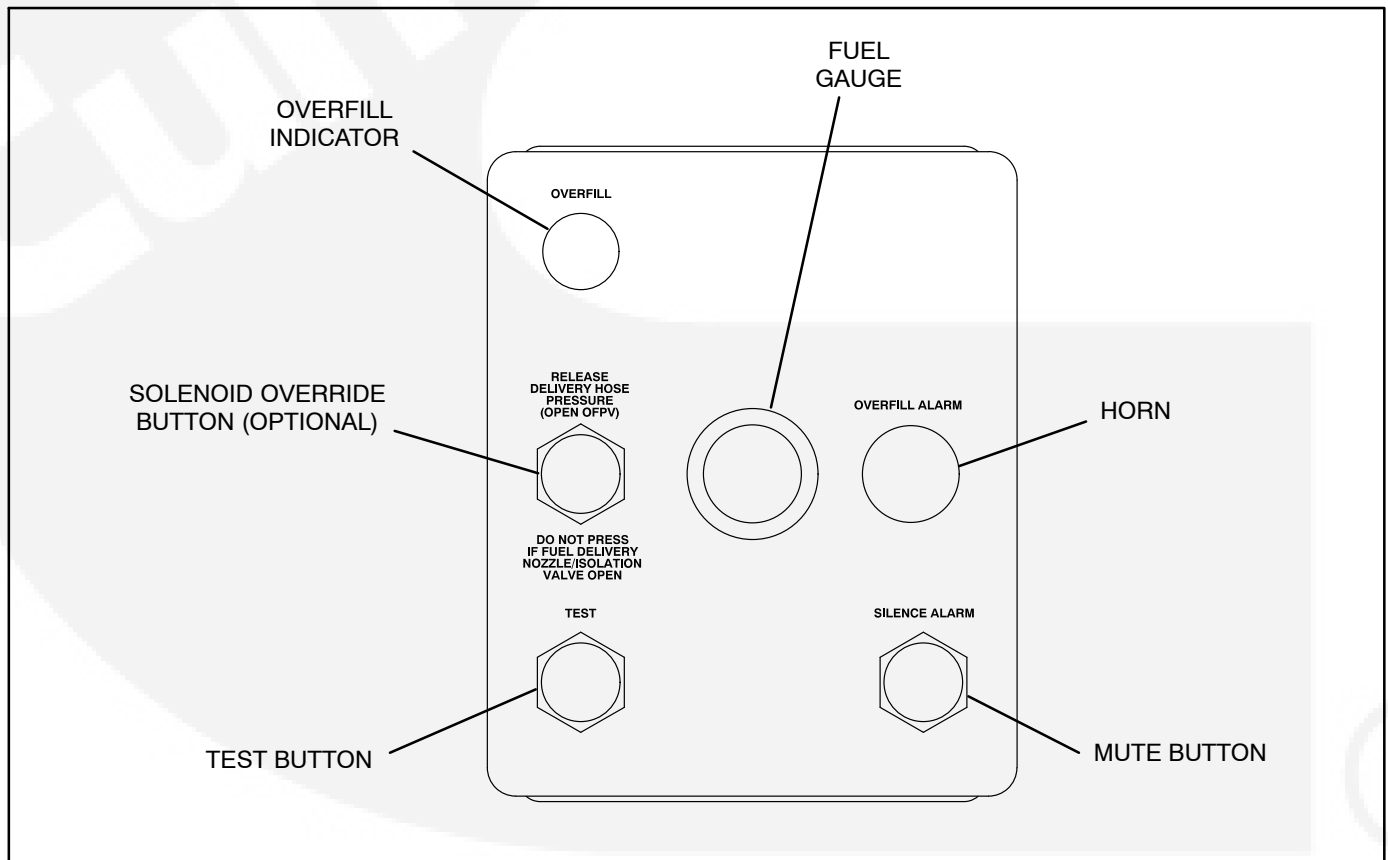


FIGURE 5-6. EXTERNAL ALARM PANEL

## EXTERNAL FUEL FILL BOX

The external fuel fill box plumbing may contain the optional overflow preventive valve (OFPV), which is used to prevent the overfilling of the fuel tank. The

valve will energize (close) when a Critical High fuel condition (95% full) is detected/displayed by the External Alarm panel (Figure 5-6). If this valve is installed, the External Alarm panel will contain the Solenoid Override button.

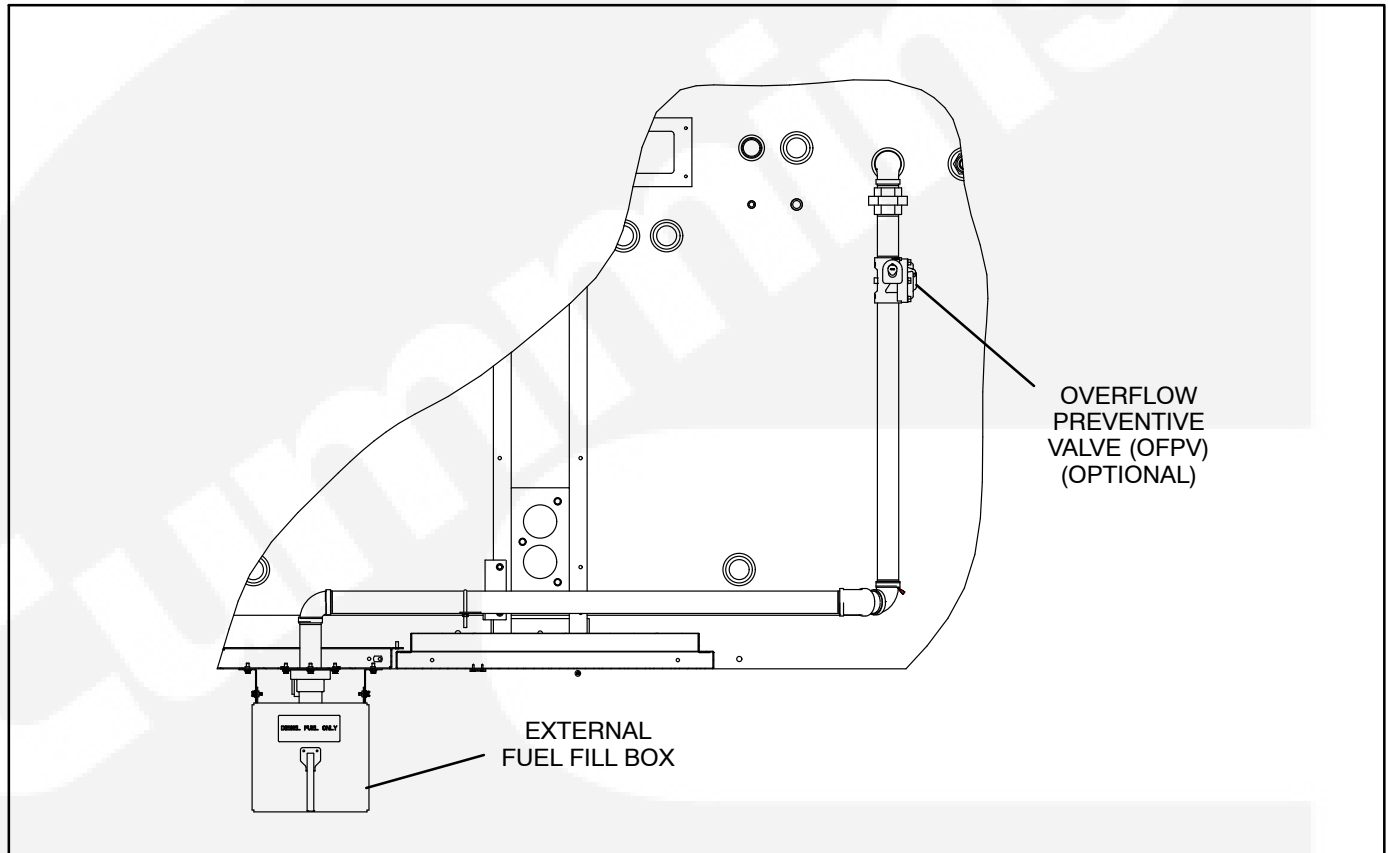


FIGURE 5-7. OPTIONAL FUEL (SPILL) FILL BOX



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