Service Manual

Our energy working for you.™

Power Generation

Generator Set
with PowerCommand® Control 2100

DQHAA (Spec A–E)
DQHAB (Spec A–E)

English – Original Instructions 5–2011 961–0514 (Issue 5)

Table of Contents

IMPORTANT SAFETY INSTRUCTIONS

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

Before operating the generator set (genset), read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

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

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

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

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

FUEL AND FUMES ARE FLAMMABLE

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

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use 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.

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. 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.
- 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 or combustible material are not left on or near the generator set.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under or near the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator system, turbo charger system and exhaust system.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

This manual provides troubleshooting and repair information regarding the PowerCommand® 2100 Control (PCC) and generators for the generator sets (gensets) listed on the front cover. Operating and maintenance instructions for the generator set are in the applicable Operator's Manual.

Engine troubleshooting, repair and maintenance information is provided in the applicable engine service manual.

This manual does not have instructions for servicing printed circuit board assemblies. After determining that a printed circuit board assembly is faulty, replace it, do not repair it. Attempts to repair a printed circuit board can lead to costly damage to the equipment.

This manual contains basic (generic) wiring diagrams and schematics that are included to help in troubleshooting. Service personnel must use the actual wiring diagram and schematic shipped with each unit. The wiring diagrams and schematics that are maintained with the unit should be updated when modifications are made to the unit.

Read ***Safety Precautions*** and carefully observe all instructions and precautions in this manual.

SYSTEM OVERVIEW

The generator set control system consist of the PCC control and the engine control module (ECM).

The PCC is a microprocessor-based control for Cummins Power Generation generator sets. The operating software provides control of the generator set and its performance characteristics, and displays performance information on a digital display panel. It accepts menu-driven control and setup input from the push button switches on the front panel.

The PCC circuit (Base) board provides:

- Voltage regulation,
- Alternator/genset protection and diagnostics,
- Starter control

The Engine Control Module (ECM) provides:

- Fuel system/combustion control
- Engine protection and diagnostics
- Speed governing and
- Speed sensor processing

The ECM fault codes and engine status (oil pressure, coolant temperature, etc.) are displayed on the PCC digital display panel.

TEST EQUIPMENT

To perform the test procedures in this manual, the following test equipment must be available

- True RMS meter for accurate measurement of small AC and DC voltages.
- Grounding wrist strap to prevent circuit board damage due to electrostatic discharge (ESD).
- Battery hydrometer
- Jumper leads
- Tachometer or frequency meter
- Wheatstone bridge or digital ohmmeter
- Variac
- Load test panel
- Megger or insulation resistance meter
- PCC service tool kiit (harness tool and sensor tool)
- InPower™ service tool (PC based genset service tool)
- InSite™ service tool (PC based ECM service tool)

HOW TO OBTAIN SERVICE

Always give the complete Model, Specification and Serial number of the generator set as shown on the nameplate when seeking additional service information or replacement parts. The nameplate is located on the side of the generator output box.

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service. Read and follow Important Safety Instructions on pages iii and iv.***

2. Control Operation

GENERAL

The following describes the function and operation of the PowerCommand® 2100 Control (PCC). All indicators, control switches/buttons and digital display are located on the face of the control panel as illustrated in Figure 2-1.

CONTROL PANEL POWER ON/OFF MODES

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

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

Screen Saver Mode: Power to the digital display is removed after 30 minutes (generator set not running or 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 Saver mode, indicating that the operating software is active (Awake mode).

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:

- O/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, the Sleep mode is disabled. When disabled, the operating software will always remain active (Awake mode). (If the network feature is installed, the sleep mode is not available and should not be enabled. If enabled, will cause an error condition.)

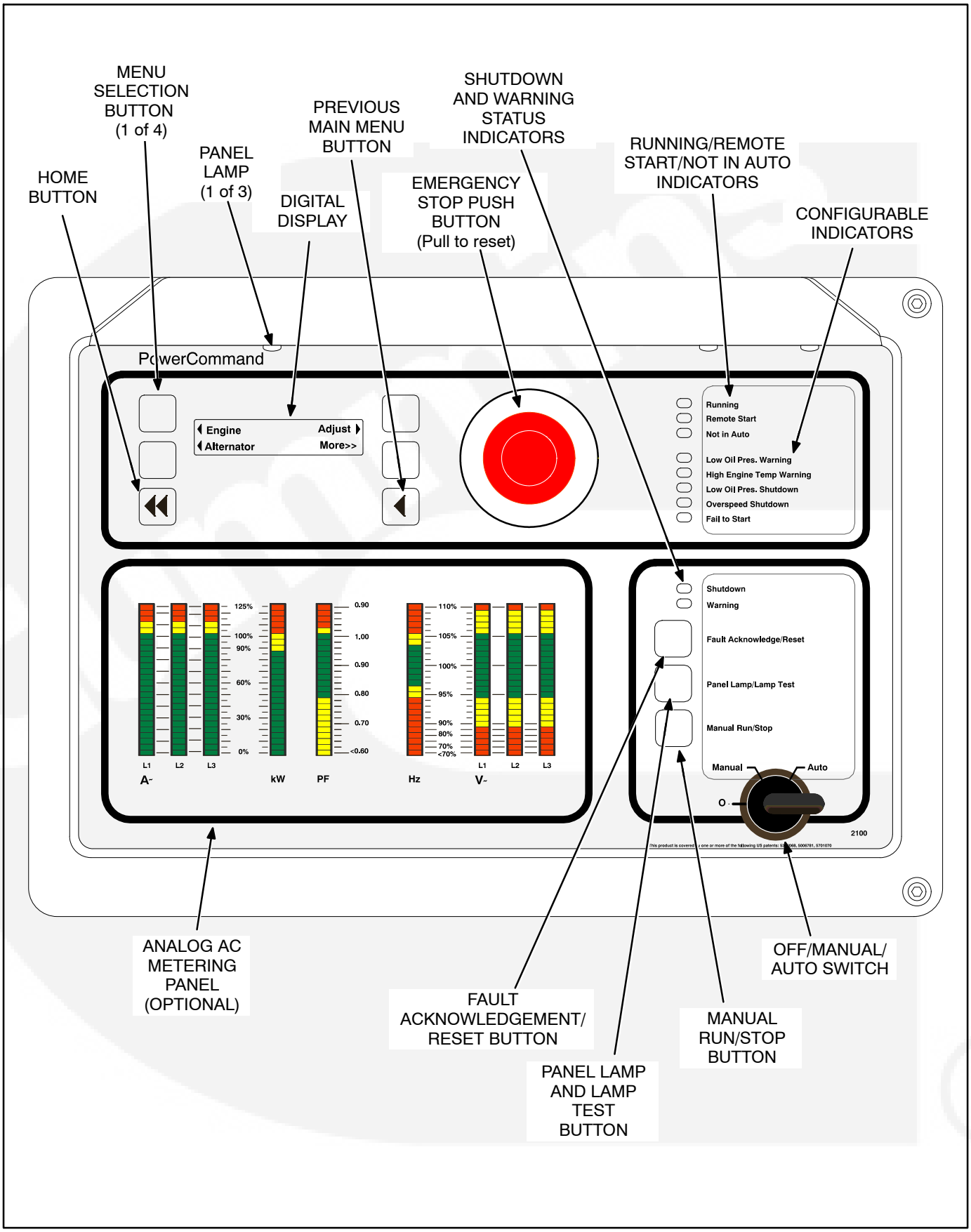

FIGURE 2-1. FRONT PANEL

FRONT PANEL

Figure 2-1 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 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. A green triangle (◀ or ▶), arrow (↑, ↓, ←, or →), >>, or plus/minus sign (+ or –) in the digital display adjacent to the button is shown when the button can be used (button is "active"). 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 genset 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. Return O/Manual/Auto switch to desired position.

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

Running Indicator: This green lamp is lit whenever the generator set 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~) (L1, L2 and L3); Single phase line-to-line (L1 and L2)
- Kilowatts (kW)
- Generator output frequency in hertz (Hz)
- 3-phase line-to-line AC volts (V~) (L1, L2 and L3); Single phase line-to-neutral (L1)
- 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, the warning indicators can be reset by pressing the Fault Acknowledge/Reset button. (The majority of faults can be reset without stopping generator set.) In Auto mode, the warning indicators can also be reset by cycling the remote reset input after the condition is corrected.

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

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 a iwarning 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. (Test can be enabled during genset operation.)

Manual Run/Stop Button: This button starts and stops the genset 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 Switch: 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 generator set (local or remote). If the switch is set to O during generator set operation, the engine will immediately shut down (cool-down timers are bypassed). If possible, hot shutdown under load should be avoided to help prolong the life of the generator set.

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.

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.

MENU DISPLAY AND BUTTONS

Figure 2-2 shows the digital display and the menu selection buttons.

Digital Display: The two-line, 20 characters 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 button is active when a symbol adjacent to the button is displayed. The displayed symbol indicates the function of the button.

- In the digital display for main menus (Figure 2-3), 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 2-5).
- 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 2-3.
- In the digital display, the ↓ or ↑ symbols indicate that pressing the adjacent button causes the operating program to go to the next or previous submenu, as shown in the menu diagrams. Only the ↓ symbol is displayed in the first submenu. Only the ↑ is displayed in the last submenu. Both symbols are displayed in the rest of the submenus.
- In the digital display, the plus or minus symbols (+ or –) indicate that pressing the adjacent button can be used to change a parameter or value shown on the display.

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

  When changing values, pressing the button adjacent to the + symbol 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 2-3) in the digital display.

Previous Main Menu Button: Pressing 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 ▶).

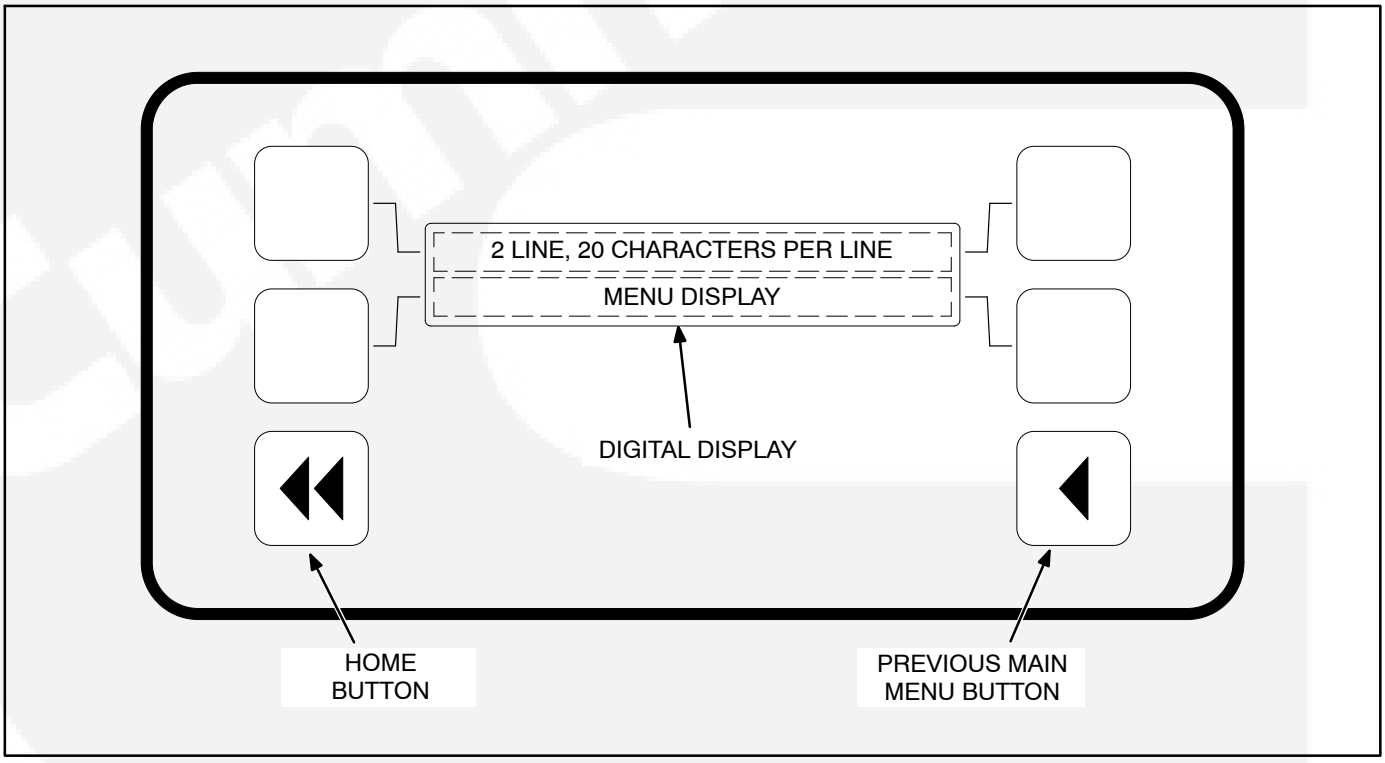

FIGURE 2-2. DIGITAL DISPLAY AND MENU SELECTION BUTTONS

MAIN MENUS

Figure 2-3 shows the three major main menus available to the user. Figure 2-3 also includes references to pages in this section where you can find additional information on submenus. When viewing a submenu, you can press the previous main menu button at any time to view its main menu.

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

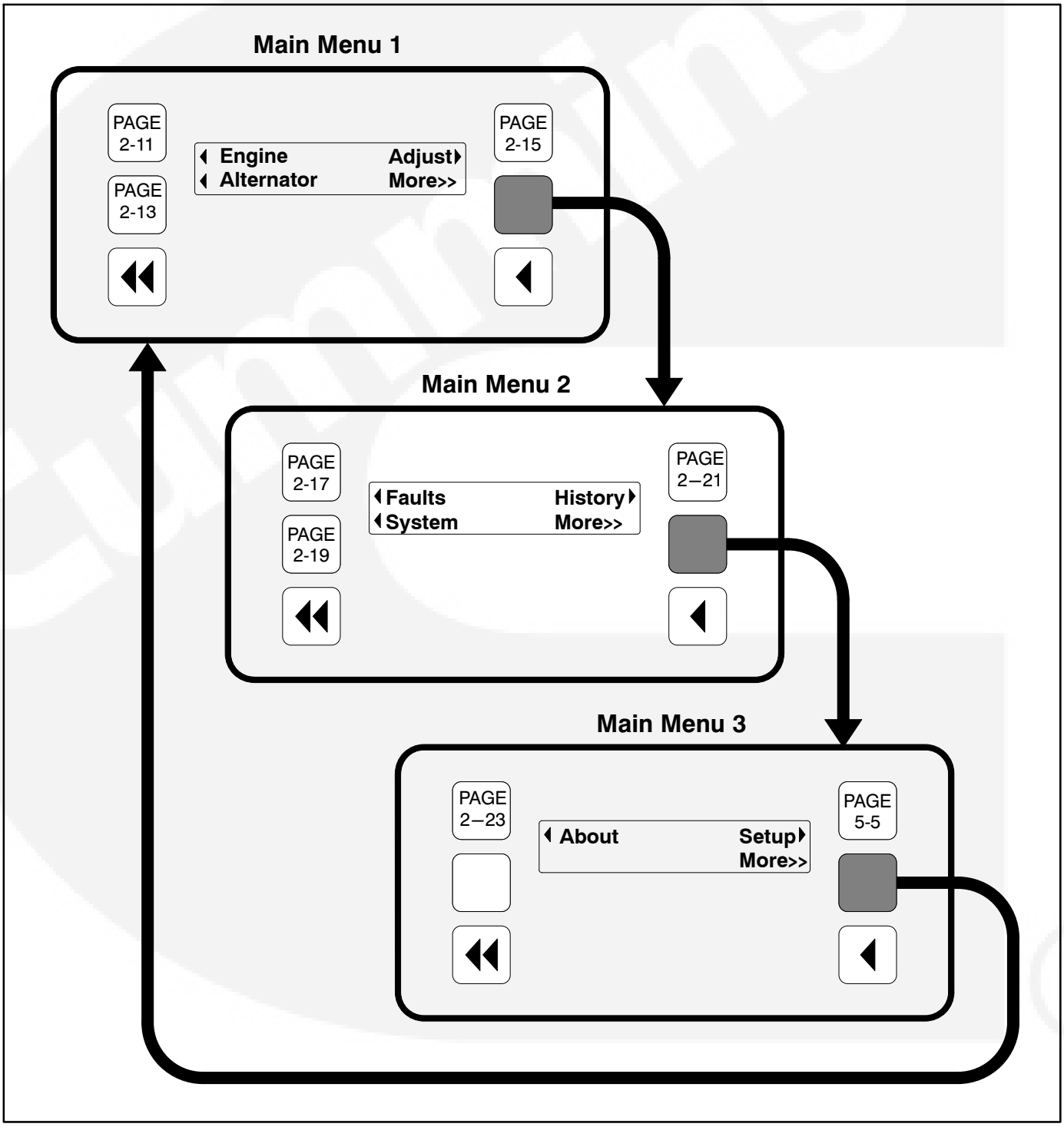

FIGURE 2-3. MAIN MENUS

CONTROLLER CONFIGURATION MENU

Figure 2-4 shows a block representation of the Controller Configuration menus. These menus are used to change the default language, temperature units, and pressure units to be displayed in menus.

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

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

Press the buttons next to the ↓ and ↑ symbols in the digital display to navigate between the menus.

Press the button next to the ▶ symbol in the display until the + and – symbols are displayed.

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

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

Language Selected submenu: Used to select desired language (default = English).

Temperature Units submenu: Used to select Fahrenheit or Centigrade for temperature readings.

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

CONTROLLER CONFIGURATION MENU

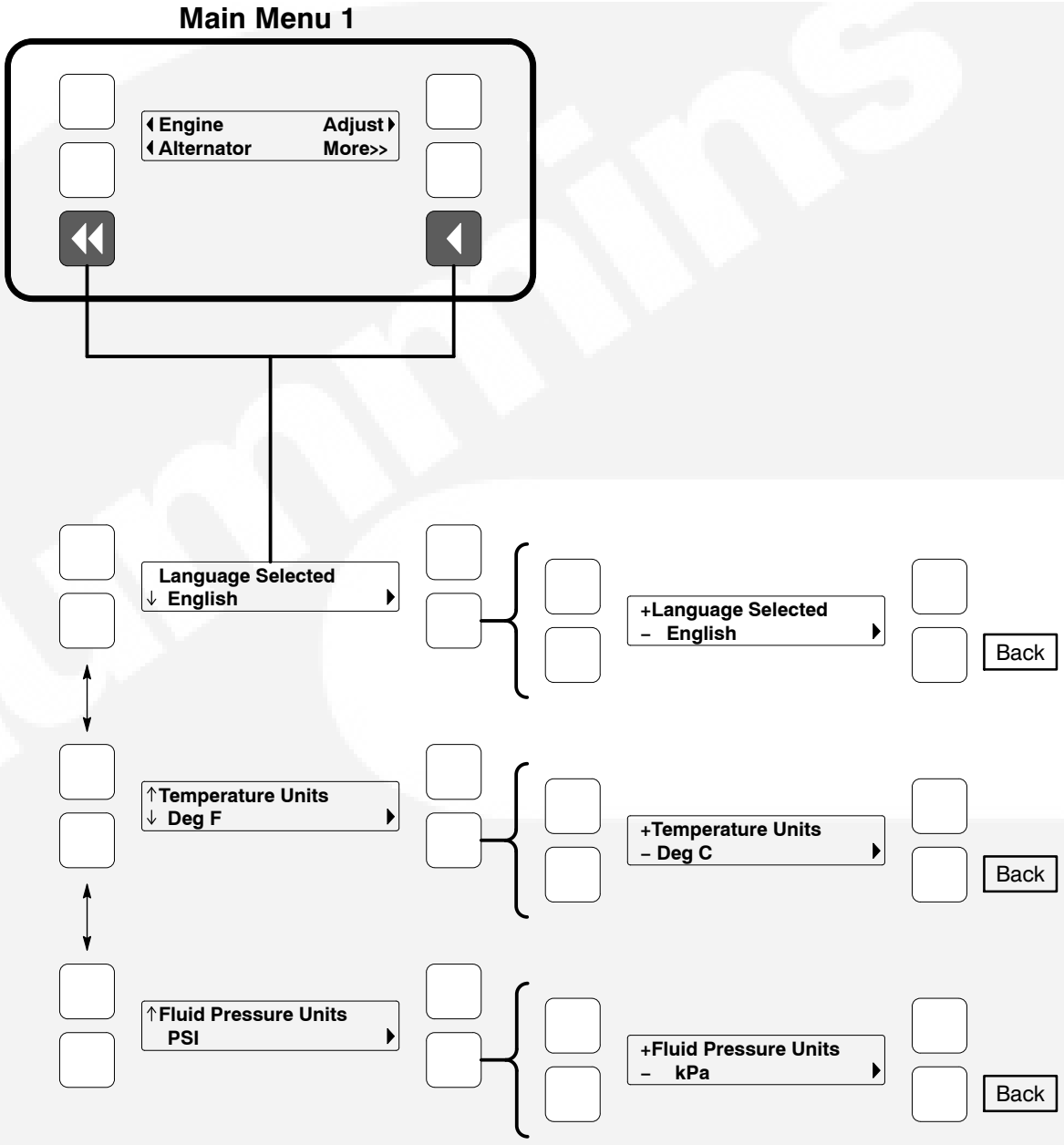

FIGURE 2-4. CONTROLLER CONFIGURATION MENU

ENGINE MENU

Figure 2-5 shows a block representation of the Engine menu. If you press the button next to the word “Engine” in the display, the first Engine submenu is displayed.

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

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

Coolant Temperature submenu: This submenu displays the engine coolant temperature which can be viewed in degrees Fahrenheit or Centigrade (see *Controller Configuration Menu* in this section).

Oil Pressure submenu: This submenu displays the engine oil pressure which can be viewed in PSI or kPA (see *Controller Configuration Menu* in this section).

Oil Temperature submenu (Only available on some models): This submenu displays the engine oil temperature which can be viewed in degrees Fahrenheit or Centigrade (see *Controller Configuration Menu* in this section).

Engine Speed submenu: This submenu displays the engine RPM.

Battery Voltage submenu: This submenu displays the engine battery voltage.

Governor Torque Command submenu: This submenu displays the governor torque levels in percentage of maximum value.

Fuel Rate submenu: This submenu displays the fuel rate which can be displayed in gallons per hour or liters per hour (see *Controller Configuration Menu* in this section).

Intake Manifold submenu: This submenu displays the intake manifold temperature which can be viewed in degrees Fahrenheit or Centigrade (see *Controller Configuration Menu* in this section).

Fuel Outlet Pressure submenu: This submenu displays the fuel outlet pressure which can be viewed in PSI or kPA (see *Controller Configuration Menu* in this section).

Active Time Delay submenu: This submenu displays the time delay that is currently active: warm–up, cool down, start or stop delays.

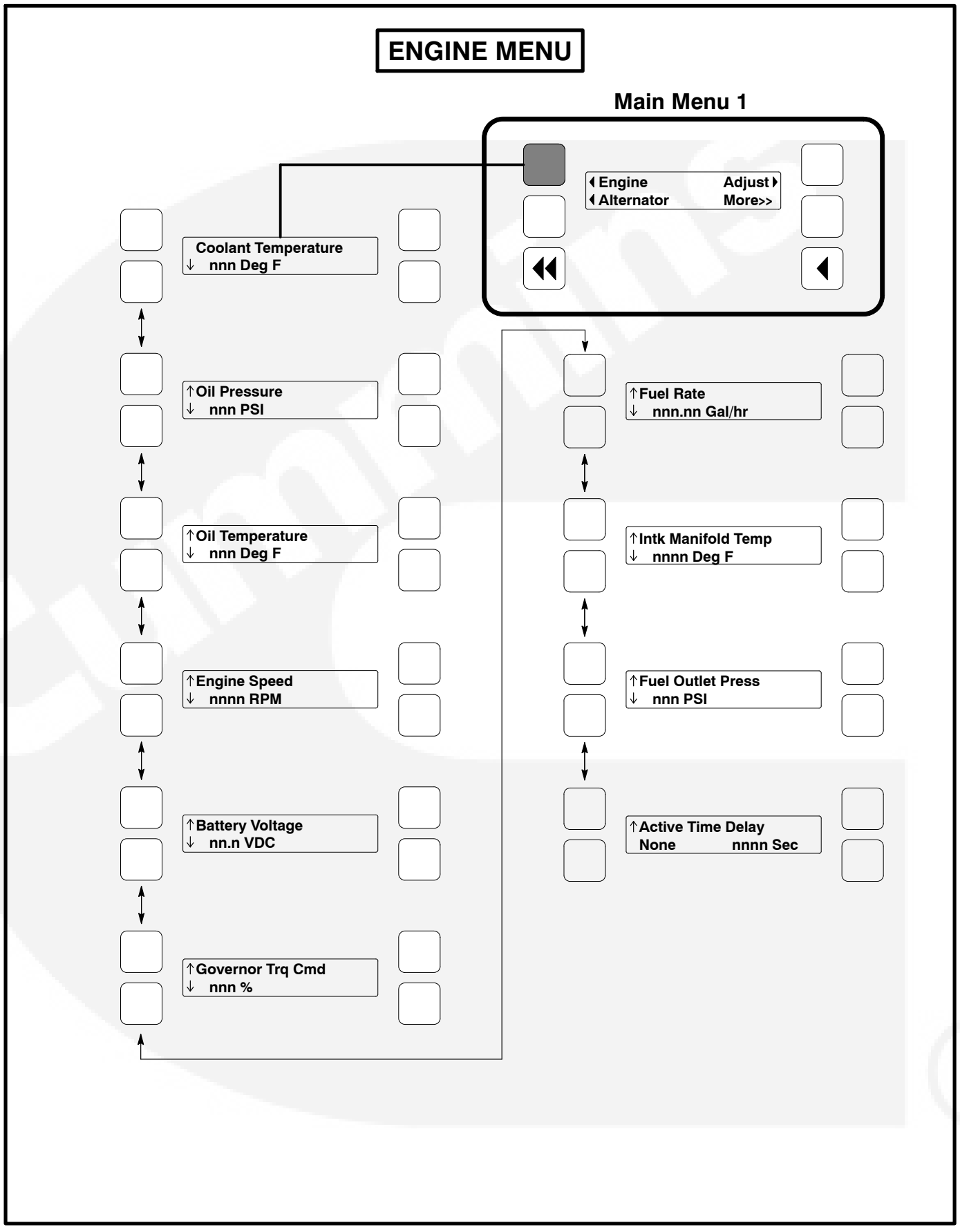

FIGURE 2-5. ENGINE MENU

ALTERNATOR MENU

Figure 2-6 shows a block representation of the Alternator menu. If you press the button next to the word “Alternator” in the display, the first Alternator submenu is displayed.

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

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

Line-to-Line Voltage submenu: The voltage Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively. (Single phase – L1 to L2 only.)

Line-to-Neutral Voltage submenu: Note that the Line-to -Neutral column will not be displayed for a 3 phase/3 wire system. Single phase – L1 to N and L2 to N.

Amps submenu: All phases. (Single phase – L1 and L2 only.)

Frequency submenu: Generator set output frequency.

Total Real Power submenu: This submenu displays the total amount of real power output, in kilowatts (kW).

Real Power submenu: This submenu displays the amount of real power output for L1, L2, and L3, in kilowatts (kW). (Single phase – L1 and L2 only.)

Total Apparent Power submenu: This submenu displays the total amount of apparent power output, in kilovolt amps (kVA).

Apparent Power submenu: This submenu displays the amount of apparent power output for L1, L2, and L3, in kilovolt amps (kVA). (Single phase – L1 and L2 only.)

Total Power Factor submenu: This submenu displays the power factor with leading/lagging indication.

The PF reading will contain an asterisk if the power factor is leading (for example, Total PF 0.9 *).

Power Factor submenu: This submenu displays a power factor value for L1, L2, and L3. (Single phase – L1 and L2 only.)

The PF reading will contain an asterisk if the power factor is leading (for example, PF L1 0.9*).

AVR Duty Cycle submenu: This submenu displays the voltage regulator (drive) level in percentage of maximum. (Where maximum is 100% Duty Cycle, software clamps Duty Cycle maximum to 60% for PMG and 90% for shunt.)

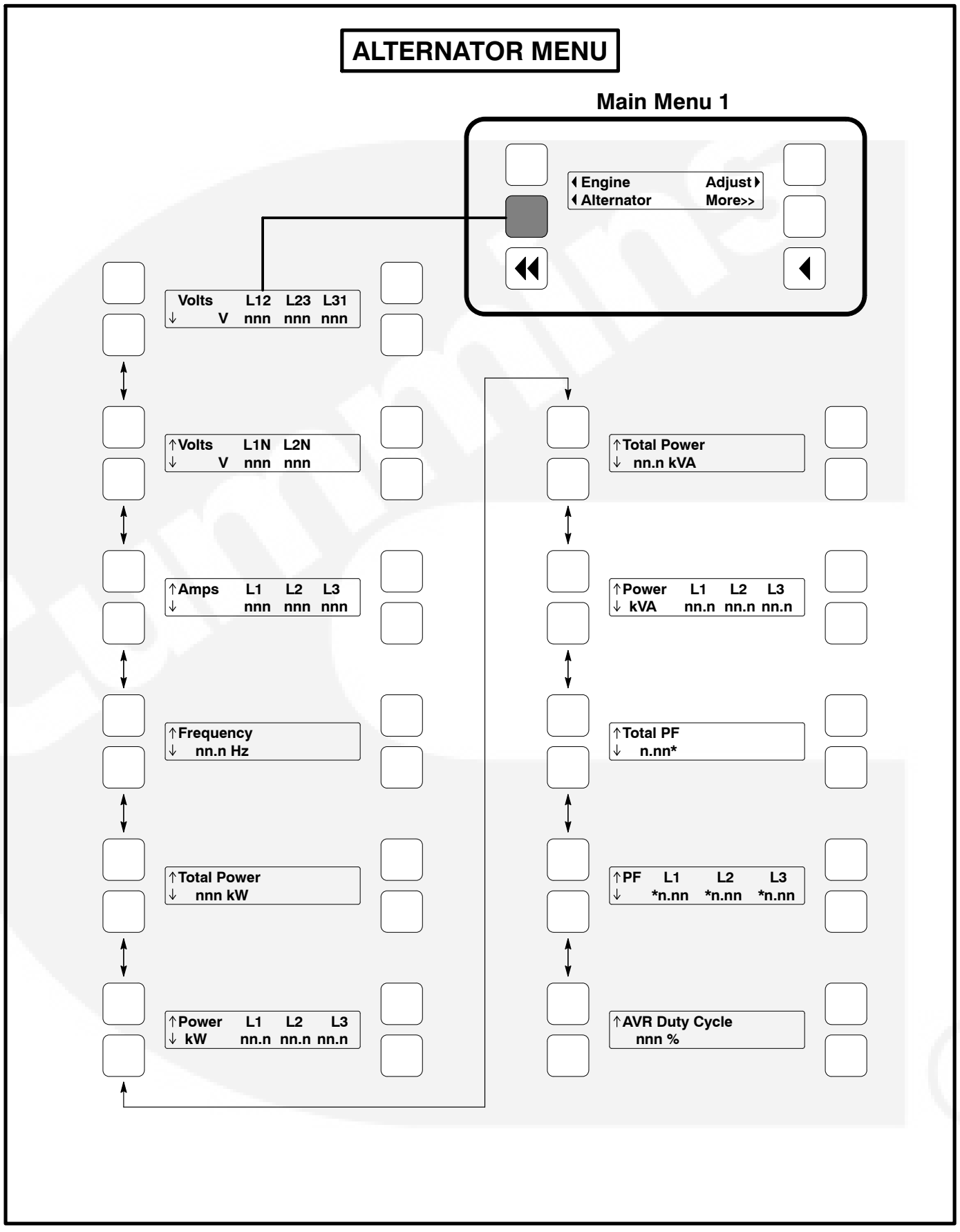

FIGURE 2-6. ALTERNATOR MENU

ADJUST MENU

Figure 2-7 shows a block representation of the Adjust menu. If you press the button next to the word “Adjust” in the display, the first Adjust submenu is displayed.

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

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

Adjusting Values/Parameters:

1.. Press the button next to the ▶ symbol in the display until the + and – symbols are displayed.

2.. If necessary, press the button next to the ← or → symbols to move to the numeric character you wish to change.

3.. Press the button next to the + symbol to increase the value or select parameter; press the button next to the – symbol to decrease the value or select parameter.

4.. After adjusting values/selecting parameters, pressing the ▶ symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ▶ symbol).

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

Voltage Adjust submenu: Voltage can be adjusted to ±5 percent of the nominal voltage. For example, if genset output voltage is 208 volts, the voltage can be adjusted from 198 to 218 volts.

If the entered value is greater or less than the allowed (5%) range, the control will not accept the entry and will return to the previous setting. Retry by entering a smaller change in one volt increments.

Frequency Adjust submenu: Frequency can be adjusted to ±5 percent of the nominal frequency. For example, if the genset frequency is 60.0 Hz, the frequency can be adjusted from 57.0 to 63.0 Hz.

Start Delay submenu: Start Delay can be set from 0 to 300 seconds (default = 0). (Enter 1 or more to enable.) This function is bypassed during a manual start/stop sequence.

Stop Delay submenu: Stop Delay can be set from 0 to 600 seconds (default = 0). (Enter 1 or more to enable.) This function is bypassed during a manual start/stop sequence and engine shutdown faults.

Rated To Idle: Rated To Idle delay can be set from 0 to 10 seconds (default = 0). (Enter 1 or more to enable.) Entering a non-zero delay will cause the genset to delay the transition to Cooldown At Idle.

Idle Start submenu (Only available on some models): Idle Start can be enabled or disabled (default = Disable). This function can only be used in manual mode and can be enabled or disabled before or during genset operation.

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

The idle speed can be adjusted from 700 to 1100 RPM (default of 800 RPM). Refer to *Crank/Idle Set-up Menu* in Section 5. A countdown timer is used to limit engine idle time. With InPower, idle time can be adjusted from 0 to 60 minutes in 1 minute increments.

Keyswitch submenu: Used to turn Keyswitch power to engine control module on/off. To select OFF, genset speed must be zero.

The keyswitch on/off control is intended to aid or be used in downloads to the engine control module, via InSite.

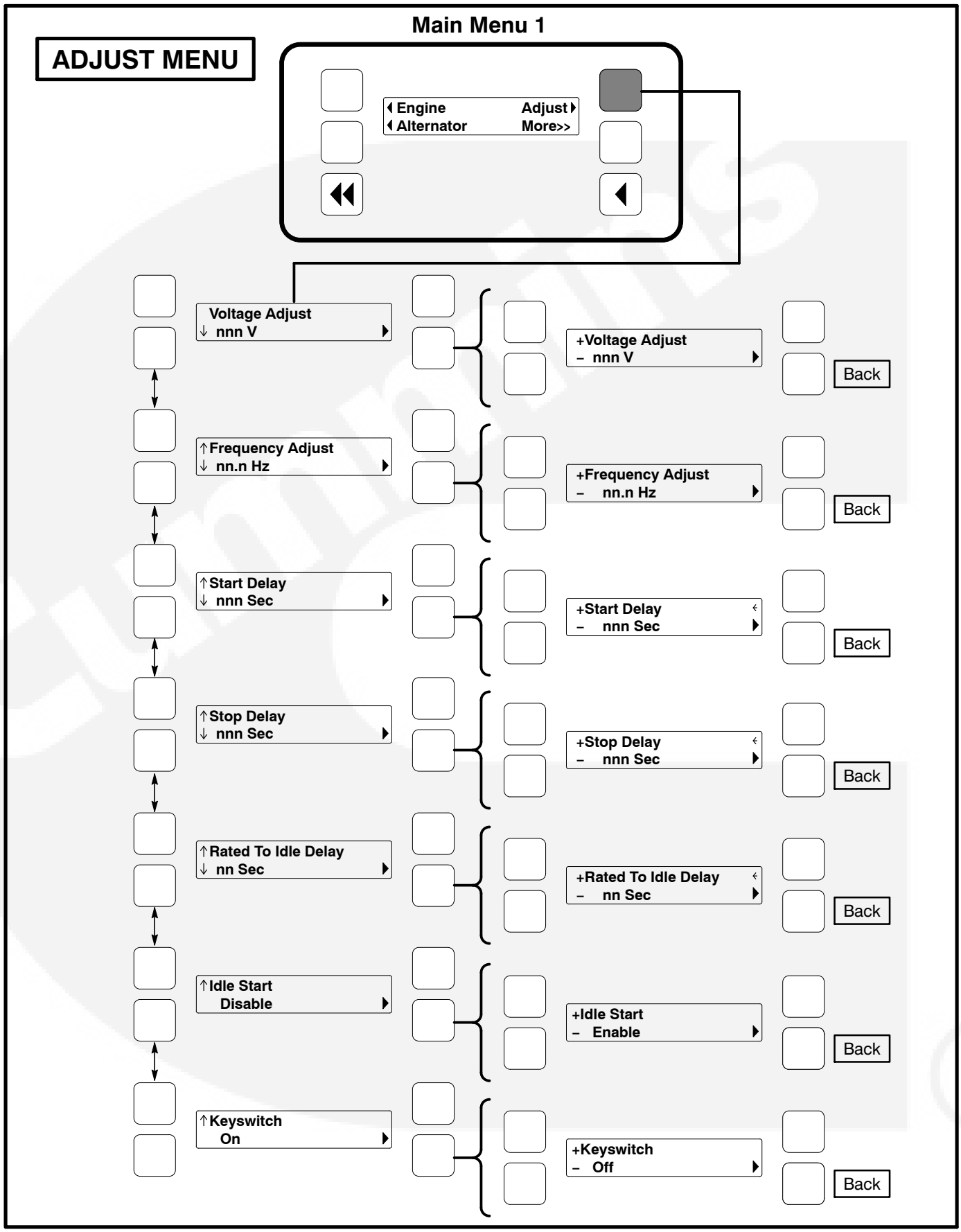

FIGURE 2-7. ADJUST MENU

FAULTS MENU

Figure 2-9 shows a block representation of the Faults menu. Up to 20 of the most recent faults can be viewed. An example of how a fault code is displayed is shown in Figure 2-8.

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

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

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

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

Current Fault submenu: From the Faults Main Menu, press the button next to the word “Current” in the display to view up to twenty of the most recent unacknowledged faults. Press the Previous Main Menu button to return to the Faults Main Menu.

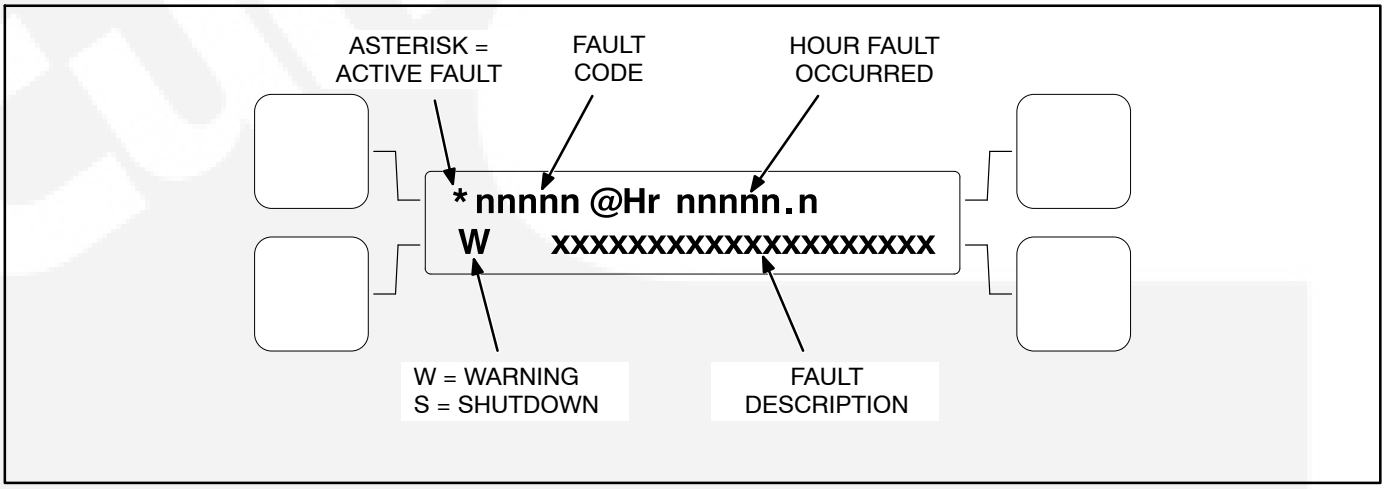

FIGURE 2-8. HISTORY/CURRENT FAULT SUBMENU

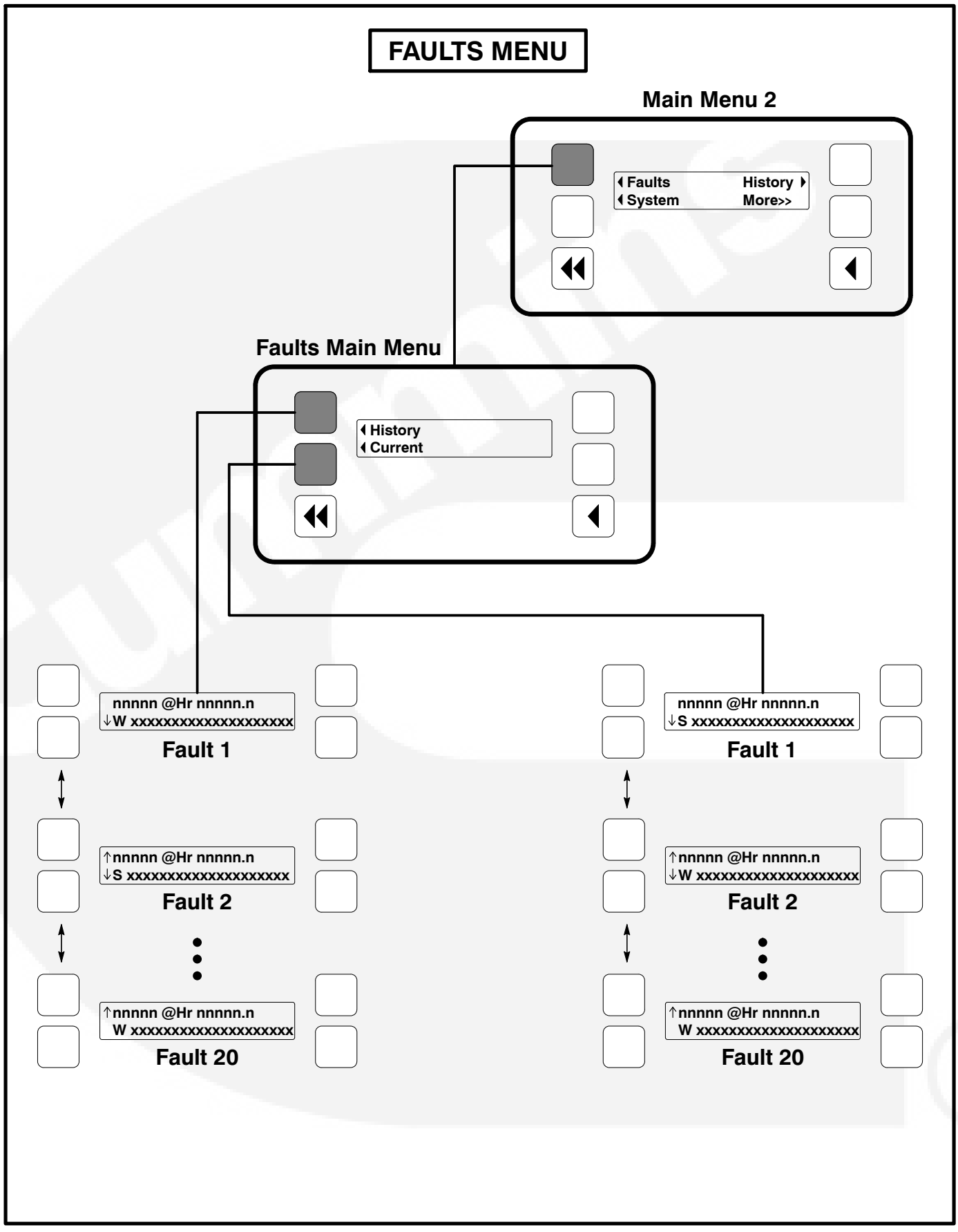

FIGURE 2-9. FAULTS MENU

SYSTEM MENU

Figure 2-10 shows a block representation of the System menu. If you press the button next to the word “System” in the display, the System Main Menu is displayed. This menu is displayed only if the network communications module (NCM) feature is installed. The System Main Menu allows you to view the status and load of other PCC equipment connected on a common network with the PCC 2100 control.

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

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

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

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

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

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

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

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

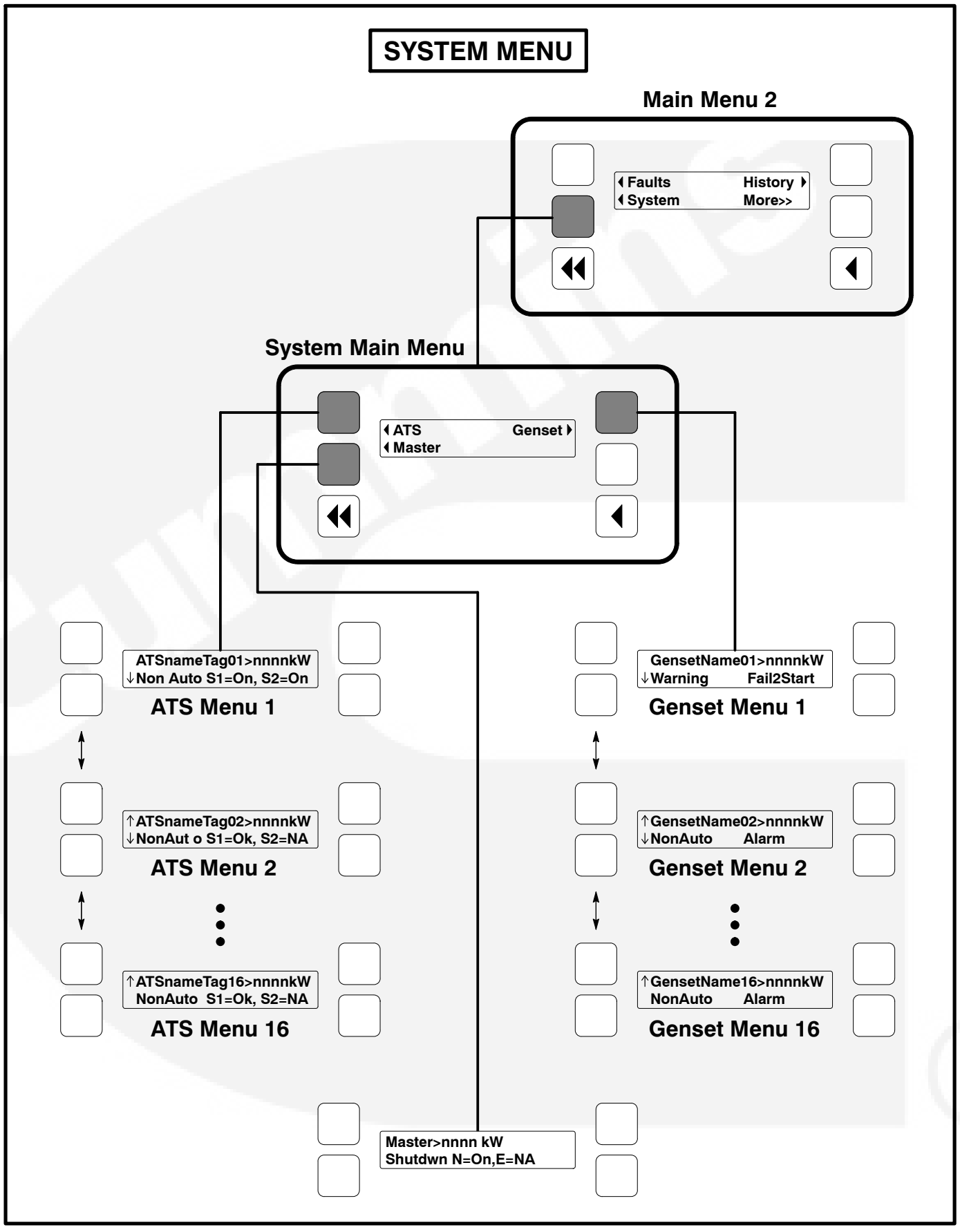

FIGURE 2-10. SYSTEM MENU

HISTORY MENU

Figure 2-11 shows a block representation of the History menu. If you press the button next to the word “History” in the display, the first History submenu is displayed.

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

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

Number of Starts submenu: This submenu shows the number of engine starts.

Engine Hours submenu: This submenu shows the number of operating hours for the engine.

Control Hours submenu: This submenu shows the number of operating hours for the control.

Kilowatt Hours submenu: This submenu shows the number of kilowatt (kW) or megawatt (MW) hours.

Genset Duty Cycle submenu: This submenu shows the percent of genset operating hours that are less than 30 percent of rated load and percent of hours that are greater than 90 percent.

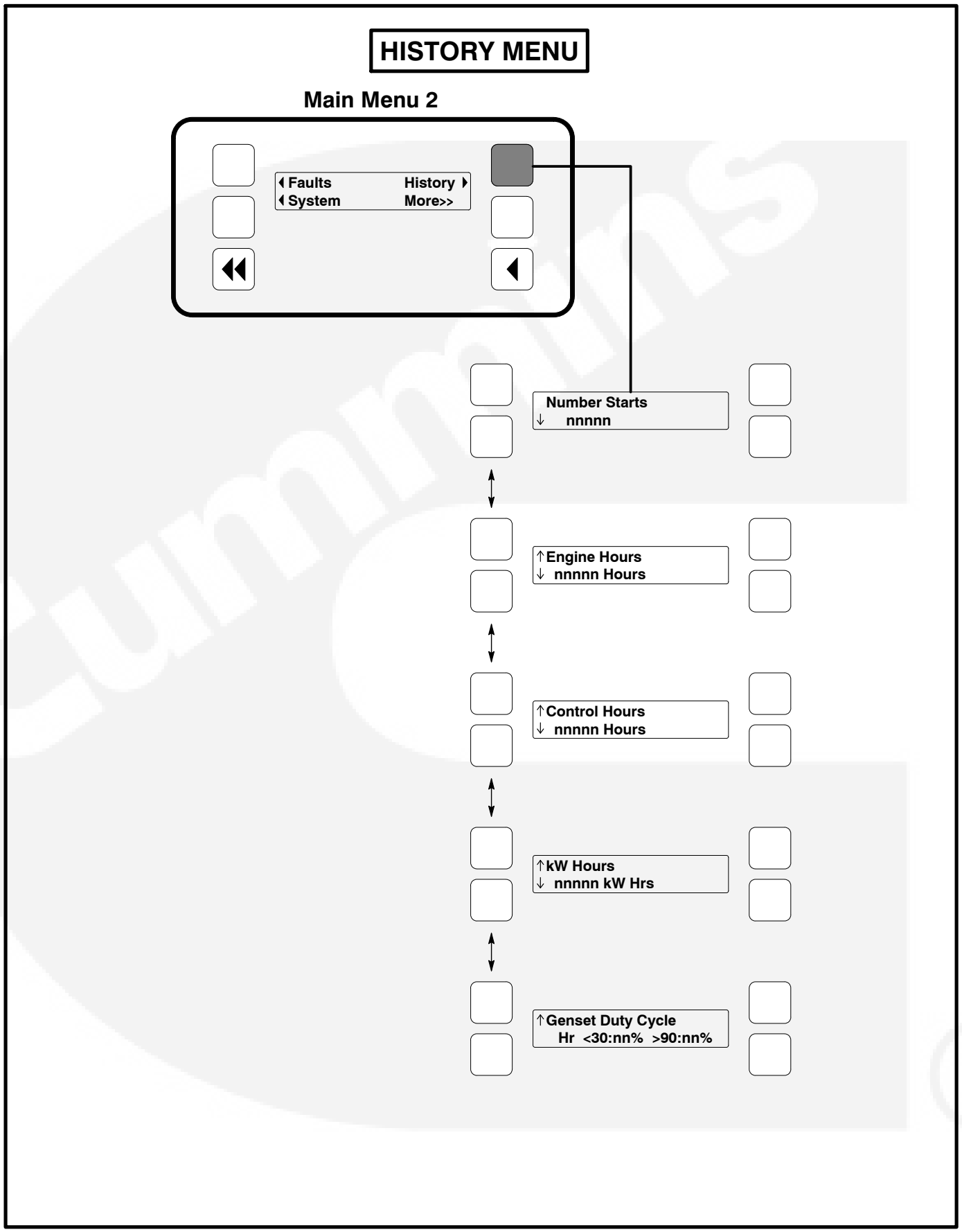

FIGURE 2-11. HISTORY MENU

ABOUT MENU

Figure 2–12 shows a block representation of the About menu. If you press the button next to the word “About” in the display, the first About submenu is displayed.

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

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

Model submenu: This submenu shows the genset model.

Rating submenu: This submenu shows the configured product application type (Standby or Prime) and product rating (kW) in the application type.

Software Version submenu: This submenu shows the software version level. This information is required to service the generator set.

ABOUT MENU

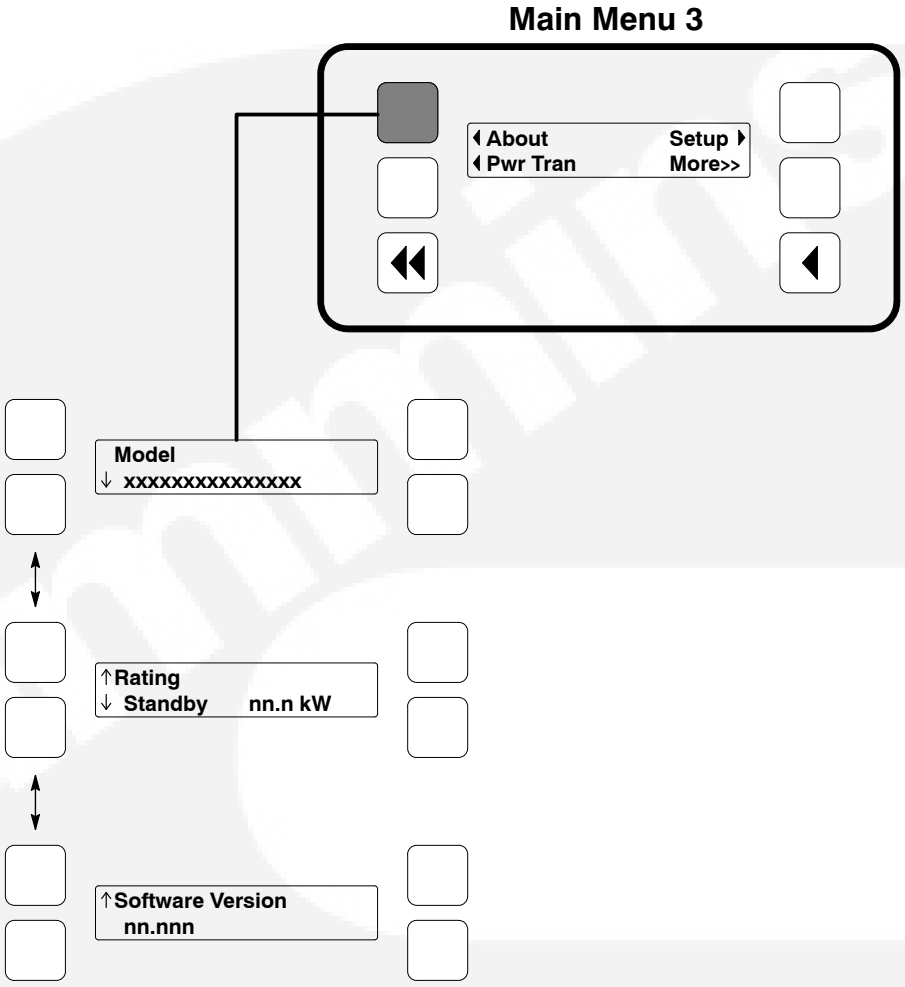

FIGURE 2-12. ABOUT MENU

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3. Circuit Boards

GENERAL

⚠WARNING ***HAZARDOUS VOLTAGE. Touching uninsulated parts inside the control panel box can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.***

Stand on a clean dry wooden platform or clean rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and use tools with insulated handles.

This section describes the function of the PowerCommand® 2100 Control (PCC) base circuit board that is contained in the control panel box (Figure 3-1). The block diagram in Figure 3-2, shows the external connections of the PCC system. The system schematics are provided in *Section 8* of this manual.

⚠ CAUTION ***Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when touching or handling circuit boards.***

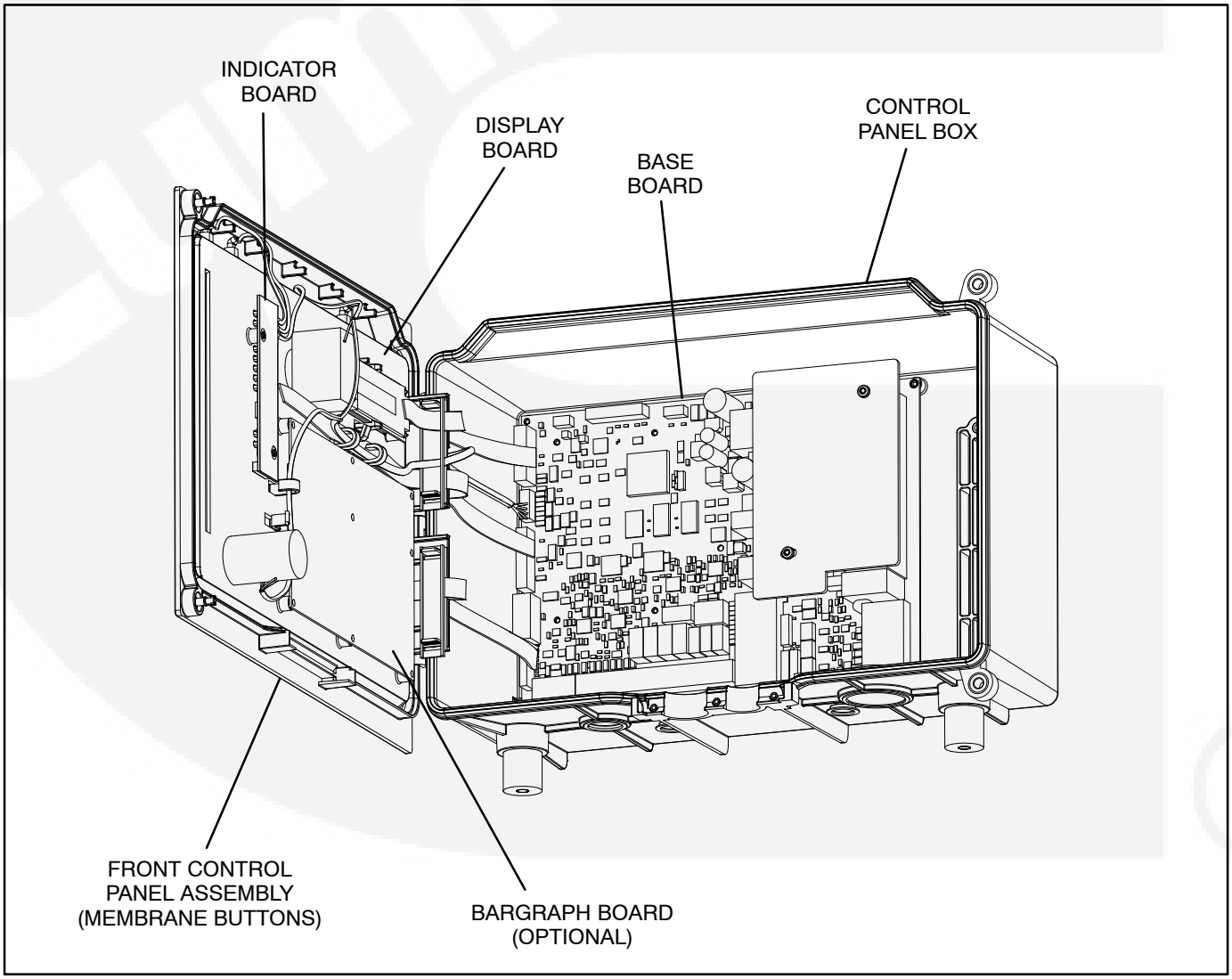

FIGURE 3-1. CIRCUIT BOARD LOCATIONS

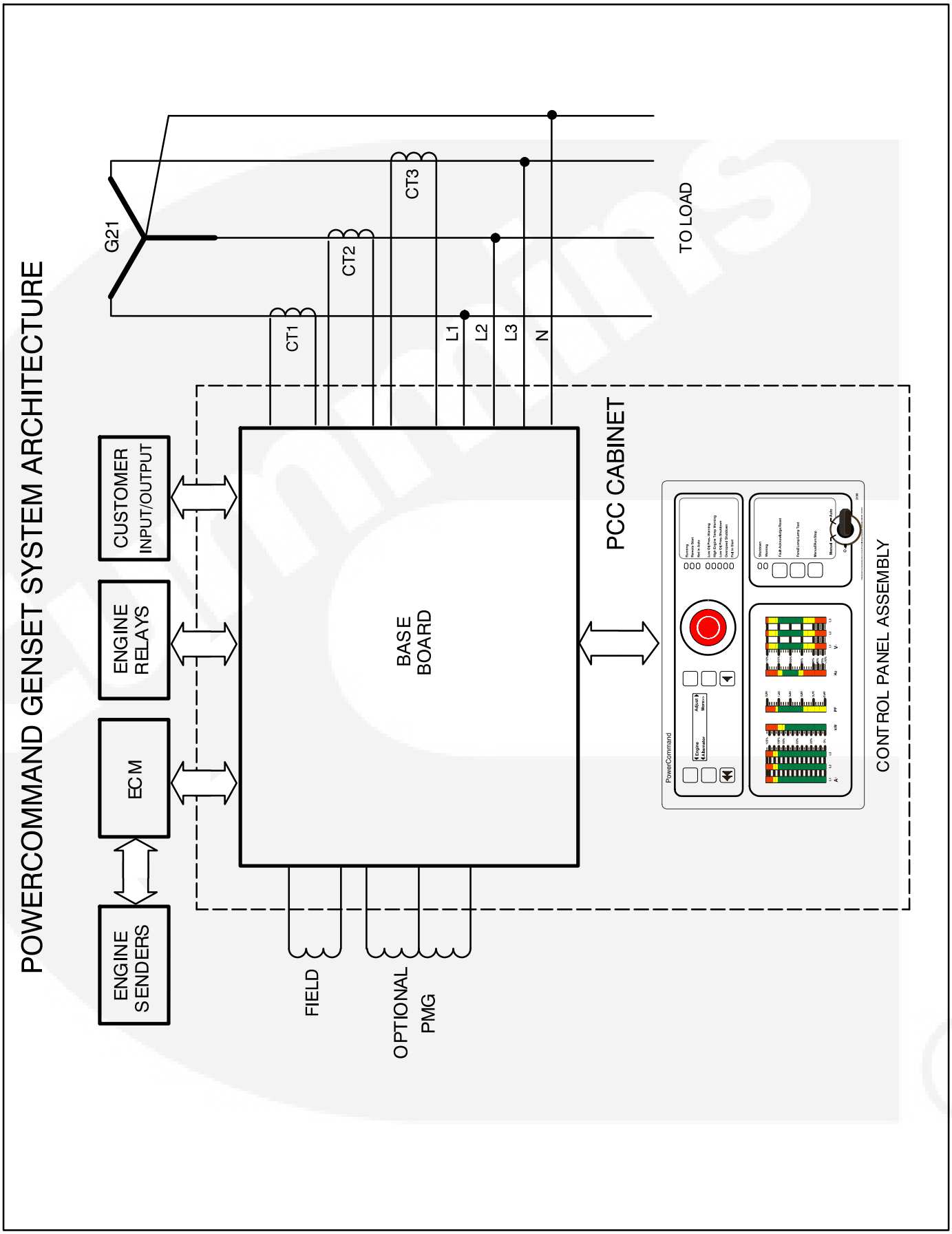

FIGURE 3-2. BLOCK DIAGRAM

CONTROL SYSTEM OVERVIEW

The generator set control system consist of the PCC control and the engine control module (ECM). The block diagram in Figure 3-3 shows the external connections between the PCC Base board and the ECM.

The PCC provides:

- Voltage regulation,
- Alternator/genset protection and diagnostics,
- Starter control

The ECM provides:

- Fuel system/combustion control
- Engine protection and diagnostics
- Speed governing
- Speed sensor processing

CAN/J1939 Datalink

Information transferred over the data link is used by the PCC to display engine status (sensor, warning and shutdown conditions). The datalink must remain active at all times. If not, the PCC will detect the inactive datalink and display a datalink error shutdown condition.

Keyswitch Control

The Keyswitch input to the ECM remains active during all controller modes (Emergency Stop, O/Manual/Auto) other than when the PCC Sleep Mode is active. The Keyswitch input is controlled by the Keyswitch Relay which is energized by the PCC Keyswitch Relay Driver.

The Keyswitch input is required to be independent of the Emergency Stop switch in order to maintain transmission of engine data during the emergency shutdown. When resetting the PCC after the emergency stop, the PCC will de-energize the Keyswitch Relay for a predetermined time. This will reset any E-stop conditions in the ECM.

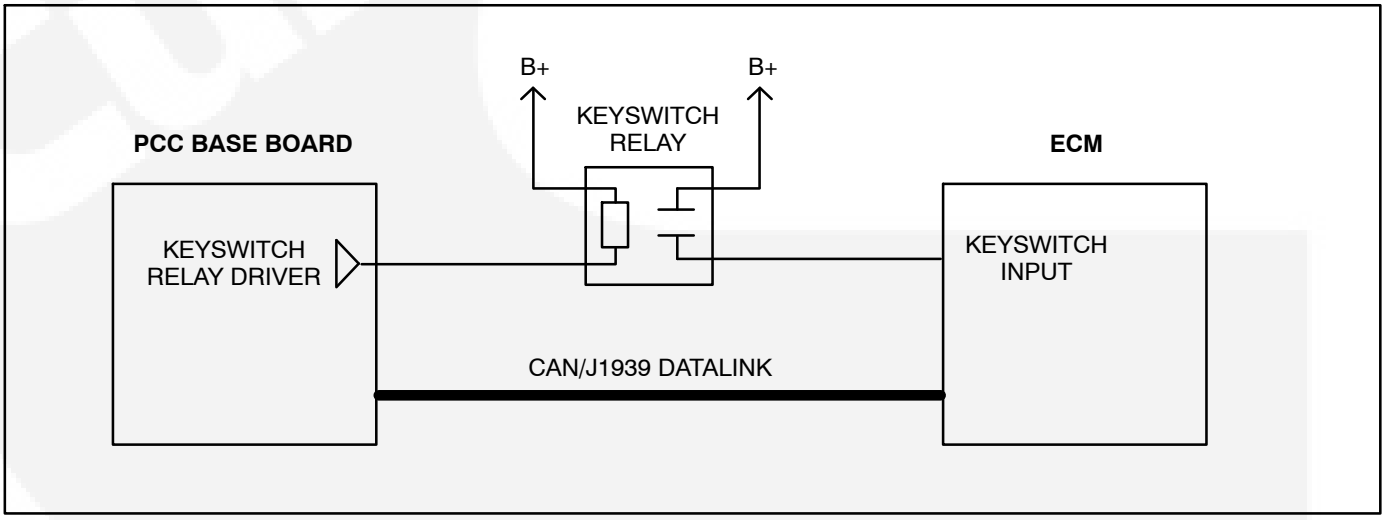

FIGURE 3-3. CONTROL SYSTEM BLOCK DIAGRAM

BASE BOARD

The following paragraphs describe the Base board connectors (J), fuses (F) and terminal boards (TB) shown in Figure 3-3.

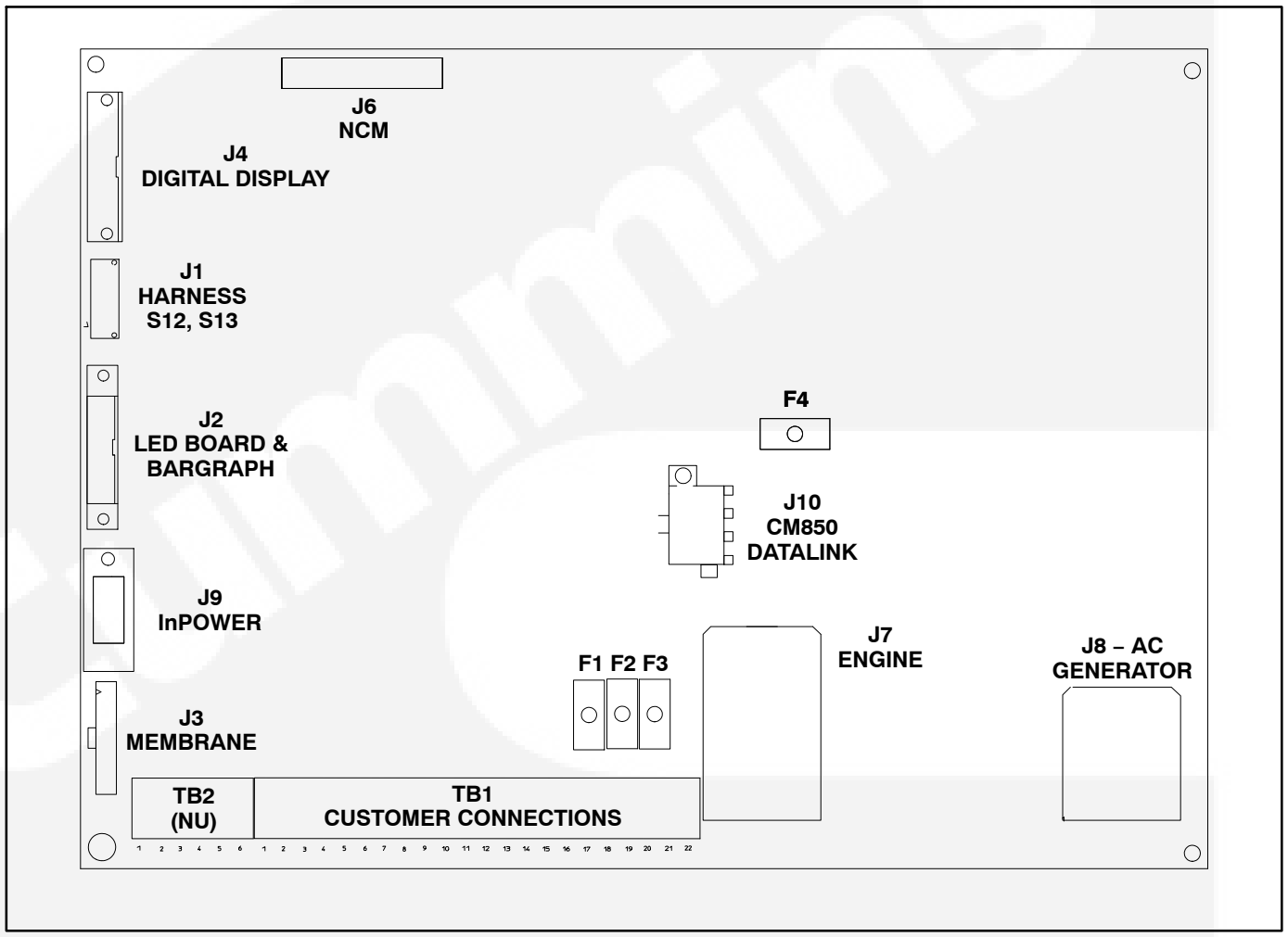

FIGURE 3-3. BASE BOARD

Connector J1

J1 connects to the Emergency Stop switch (S13) and the O/Manual/Auto control panel switch (S12).

WIRE TABULATION		
SIGNAL	**FROM**	**TO**
GND	S12-4	J1-8
OFF (O)	S12-1	J1-7
MANUAL	S12-3	J1-6
AUTO	S12-5	J1-5
ESTOP-NC1	S13-1	J1-2
ESTOP-NC2	S13-2	J1-1
ESTOP-NO1	S13-3	J1-3
ESTOP-NO2	S13-4	J1-4

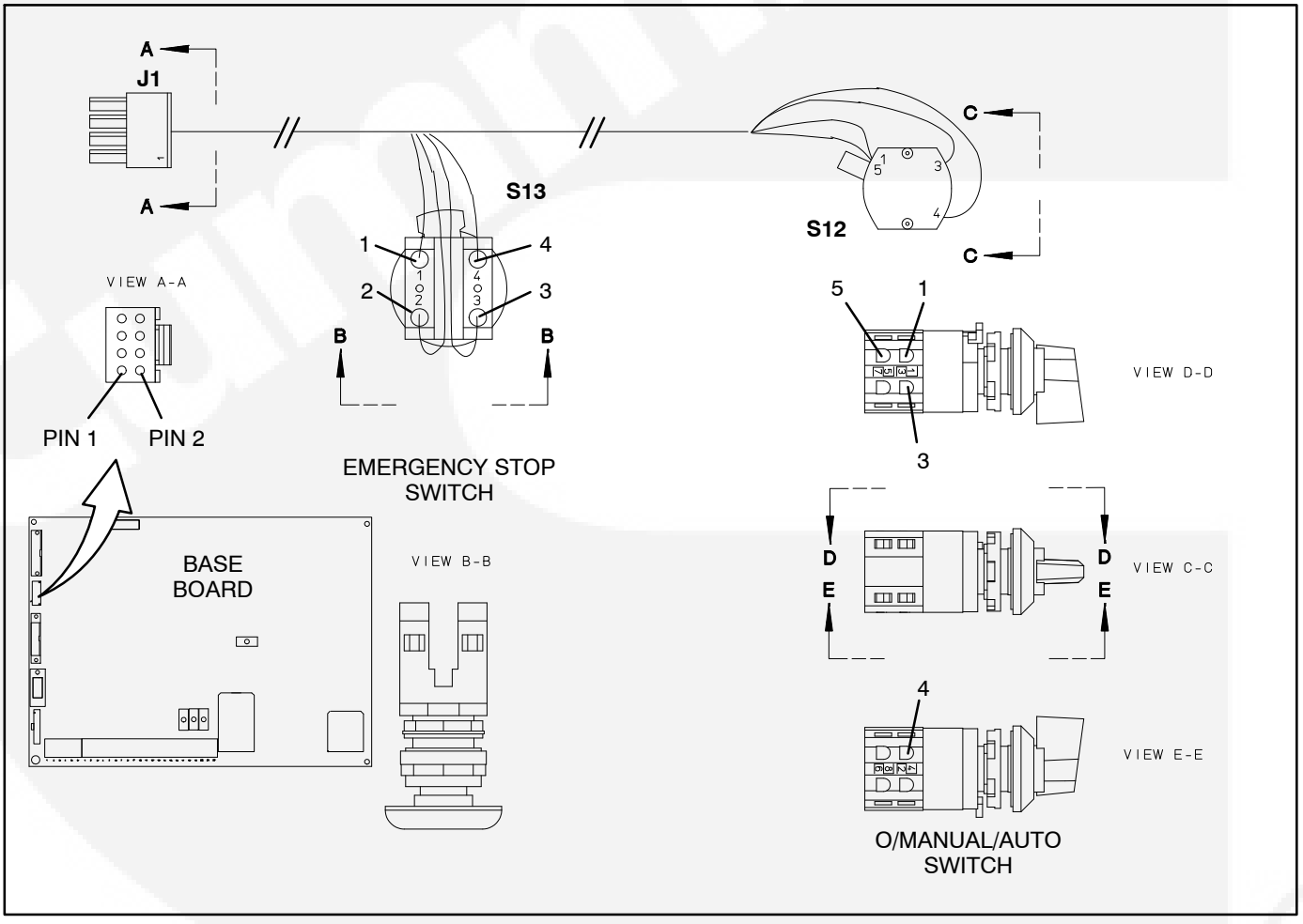

FIGURE 3-4. CONNECTOR J1 (CONTROL HARNESS)

Connector J2

J2 connects to LED (indicator) board and bargraph board of front control panel assembly.

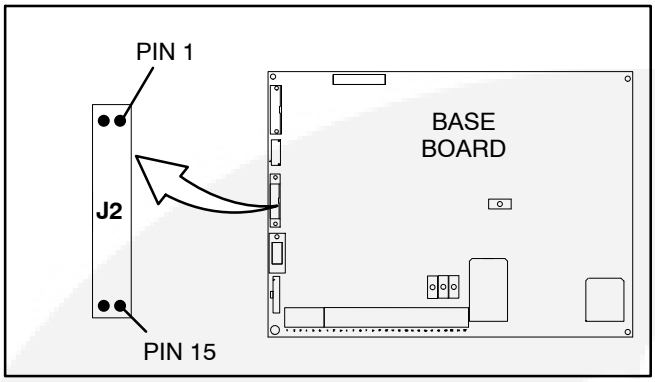

FIGURE 3-5. J2 LED/BARGRAPH CONNECTOR

CONNECTOR J2	
PIN	**SIGNAL**
1	MOSI
2, 4, 6, 16	GND
3	SCK
5	SEL_A
7	SEL_B
10, 14, 15	VCC
9	SEL_C
11	SEL_D
13	BAR_ENABLE

Connector J3

J3 connects to membrane buttons of front control panel assembly.

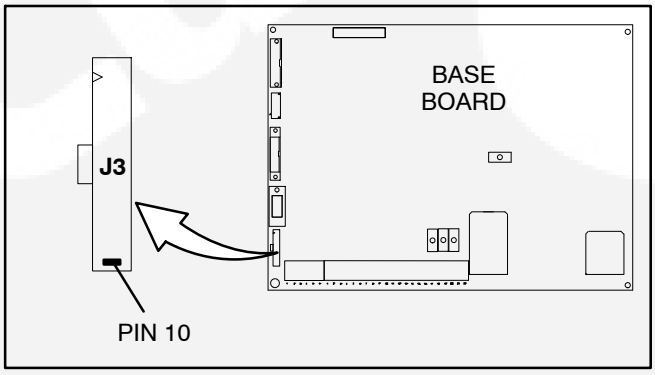

FIGURE 3-6. J3 MEMBRANE CONNECTOR

CONNECTOR J3	
PIN	**SIGNAL**
1	HOME MENU <<
2	PREVIOUS MENU <
3	UPPER LEFT
4	LOWER LEFT
5	UPPER RIGHT
6	LOWER RIGHT
7	FAULT ACK/RESET
8	PANEL LAMP
9	MANUAL RUN/STOP
10	COMMON (GND)

Connector J4

J4 connects to display menu of front control panel assembly.

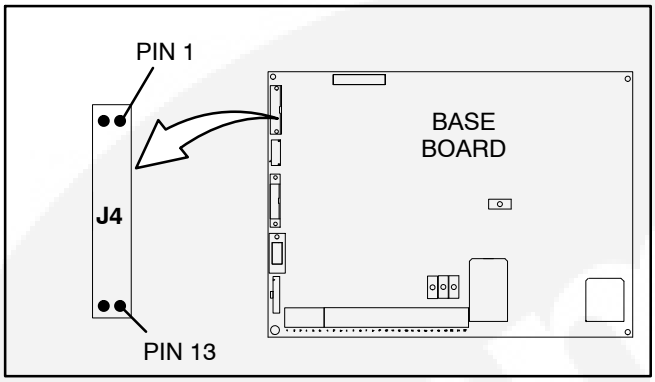

FIGURE 3-7. J4 DISPLAY MENU CONNECTOR

CONNECTOR J4	
PIN	**SIGNAL**
1	GND
2	VCC
3	N.U.
4	RS
5	R/W
6	ENABLE DISPLAY
7	D[0]
8	D[1]
9	D[2]
10	D[3]
11	D[4]
12	D[5]
13	D[6]
14	D[7]

Connector J7

J7 connects to the generator CT's, engine battery, K4 (starter) and K10 (fuel) pilot relays.

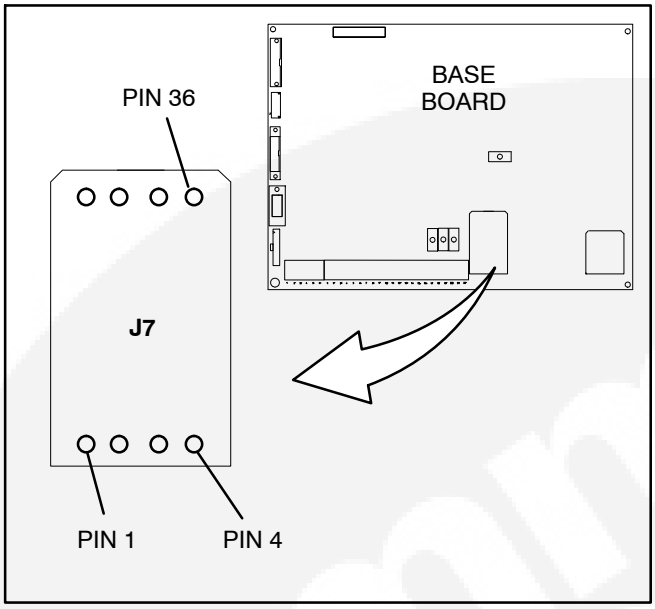

FIGURE 3-8. J7 HARNESS CONNECTOR

CONNECTOR J7	
PIN	**SIGNAL**
1, 2, 3, 4	B+ IN (Base Bd)
5, 6, 7, 8	GND (Base Bd)
9	P3 HEATER (Ter. B)
10	FSO Pilot Relay (K10-6)
11 12	CT1 CT1–COM
15 16	CT2 CT2–COM
18	ALT FLASHOUT
19 20	CT3 CT3–COM
23 27	GEN SW B+ (K4-S1) SW GND (K4-S2)

Connector J8

J8 connects directly to the generator to monitor and control AC output of the genset.

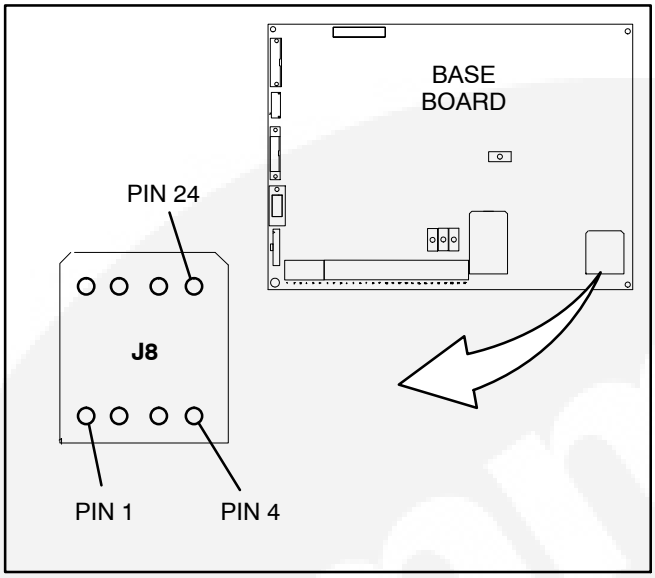

FIGURE 3-9. J8 AC GENERATOR CONNECTOR

CONNECTOR J8		
PIN	**SIGNAL**	**COMMENTS**
4 12 20 7	U1 (T1) V2 (T2) W3 (T3) N (T4)	Used for alternator voltage sensing and power factor angle sensing
13 5	FIELD + FIELD –	Excitation drive output
21 22 23	AC1 (PMG2) AC2 (PMG3) AC3 (PMG4)	Used for excitation power (Shunt connection – pins 21 & 22 only)

TABLE 3-1. BASE BOARD FUSES

REFERENCE DESIGNATION	RATING	FUNCTION
F1	10A	Customer B+ (to TB1 customer terminal block)
F2	5A	Customer switched B+ (to TB1 customer terminal block)
F3	2A	Switched B+ (to K4 Starter Pilot relay)
F4	5A	Base board power supply fuse

TB1 Customer Connections

Customer monitor/control connections are attached to terminal board TB1. Optional equipment such as sensing devices used to monitor genset operation, remote start/stop switches and etc. are attached to this terminal. Refer to Customer Connections diagram in *Section 8* for TB1 connections.

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4. Troubleshooting

GENERAL

The PowerCommand® 2100 Control (PCC) continuously monitors the generator set for abnormal conditions, such as high or low frequency, voltage, current and also engine faults via the engine control module (ECM). 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.

INPOWER SERVICE TOOL

The InPower service tool can be used in troubleshooting to perform tests, verify control inputs and outputs, and test protective functions. Refer to the InPower User's Guide, provided with the InPower software for test procedures.

InPower, when used improperly, can cause symptoms like warnings and shutdowns that appear to be a defective base board. When these problems occur, always verify that a self-test or fault simulation (override) have not been left enabled with InPower. If you do not have InPower, or the enabled fault simulation(s) can not be found using InPower, disconnect battery power to disable the test or override condition.

Make sure that parameter adjustments and time delays, related to the fault condition, have been appropriately set for the application. It may be necessary to write the initial capture file to the device or update the calibration file to correct the fault condition.

Updating a calibration file requires the InPower Pro version. Confirm that the installed calibration part number matches the serial plate information.

⚠ CAUTION ***Using the wrong calibration file can result in equipment damage. Do not swap Base boards from another genset model and only use the calibration file shown on the nameplate.***

Some features are not available until the hardware for that feature is installed and InPower Pro is used to update (enable) that feature. Confirm that the feature is installed and enabled prior to troubleshooting the base board for symptoms related to a feature.

InPower Calibration Procedure (PCC w/CAN Data Link)

The following procedure must be used when connecting the PC to the PCC2100 with CAN data link.

1. Move the O/Manual/Auto switch on the control panel to the O position.
2. Turn off or remove AC power from the battery charger.
3. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (–) battery cable from the generator set starting battery.
5. Remove 4 pin power connector (C02) from ECM on engine.
6. Remove 6 pin (white) datalink connector (P10) from PCC2100 Base board.
7. Reconnect battery.
8. Connect PC to Base board and perform calibration. Refer to InPower User's Guide.
9. Remove PC connection from Base board when calibration is complete.
10. Disconnect battery. Complete steps 3 and 4.
11. Reconnect connectors removed in steps 5 and 6.
12. Reconnect battery and power to the battery charger (if applicable).

NETWORK APPLICATIONS AND CUSTOMER INPUTS

In applications with networks and remote customer inputs, the genset may start unexpectedly or fail to crank as a result of these inputs. These symptoms may appear to be caused by the base board. Verify that the remote input is not causing the symptom or isolate the control from these inputs before troubleshooting the control.

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 genset is running. Do not open the generator output box while the genset is running.

⚠ CAUTION ***Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Fault code 1117 may display and engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. See fault code 1117 in Section 4 to reset ECM.***

⚠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 genset.***

⚠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 generator set that is shut down, 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 position.
2. Turn off or remove AC power from the battery charger.
3. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (–) battery cable from the generator set starting battery.

TROUBLESHOOTING PROCEDURE

The following tables are a guide to help you evaluate problems with the generator set. You can save time if you read through the manual ahead of time and understand the system.

Try to think through the problem. Go over what was done during the last service call. The problem could be as simple as a loose wire, an opened fuse or a tripped circuit breaker.

NOTE: Each fault code "warning" can be changed to "shutdown" using InPower. Default settings are used in this manual. It is recommended that all changes to settings be recorded at each site to aid in the troubleshooting of the genset.

This section contains the following information:

- **Table 4-1 and 4-2:** Describes how to troubleshoot a local/remote fail to crank problem when control panel does not indicate fault condition.
- **Table 4-3:** Provides a list of the ECM fault codes that are sent to the PCC2100. Troubleshooting procedures for these faults are found in the engine service manual.
- **Table 4-4:** Describes each generator status, warning and shutdown code, warning and shutdown limits where applicable, and basic corrective actions, such as, control reset functions, battery connections, etc.
- **Fault Code Tables:** Provide detailed troubleshooting procedures for generator faults listed in Table 4-4. In the following tables, the fault codes are used as the table reference number and are arranged in numeric order.

Figure 4-1 shows the location of the components within the control panel that are referenced in the following troubleshooting procedures. Connector locations for each circuit board are provided in *Section 3*. The control wiring and circuit board connections are shown in *Section 8*.

⚠ CAUTION ***Always set the O/Manual/Auto switch to the O position before disconnecting or connecting harness connectors. Otherwise, disconnecting the harness connectors can result in voltage spikes high enough to damage the DC control circuits of the set.***

⚠ CAUTION ***Electrostatic discharge will damage circuit boards. Always wear a wrist strap when handling circuit boards or when disconnecting or connecting harness connectors. See Circuit Board Removal/Replacement in Section 5.***

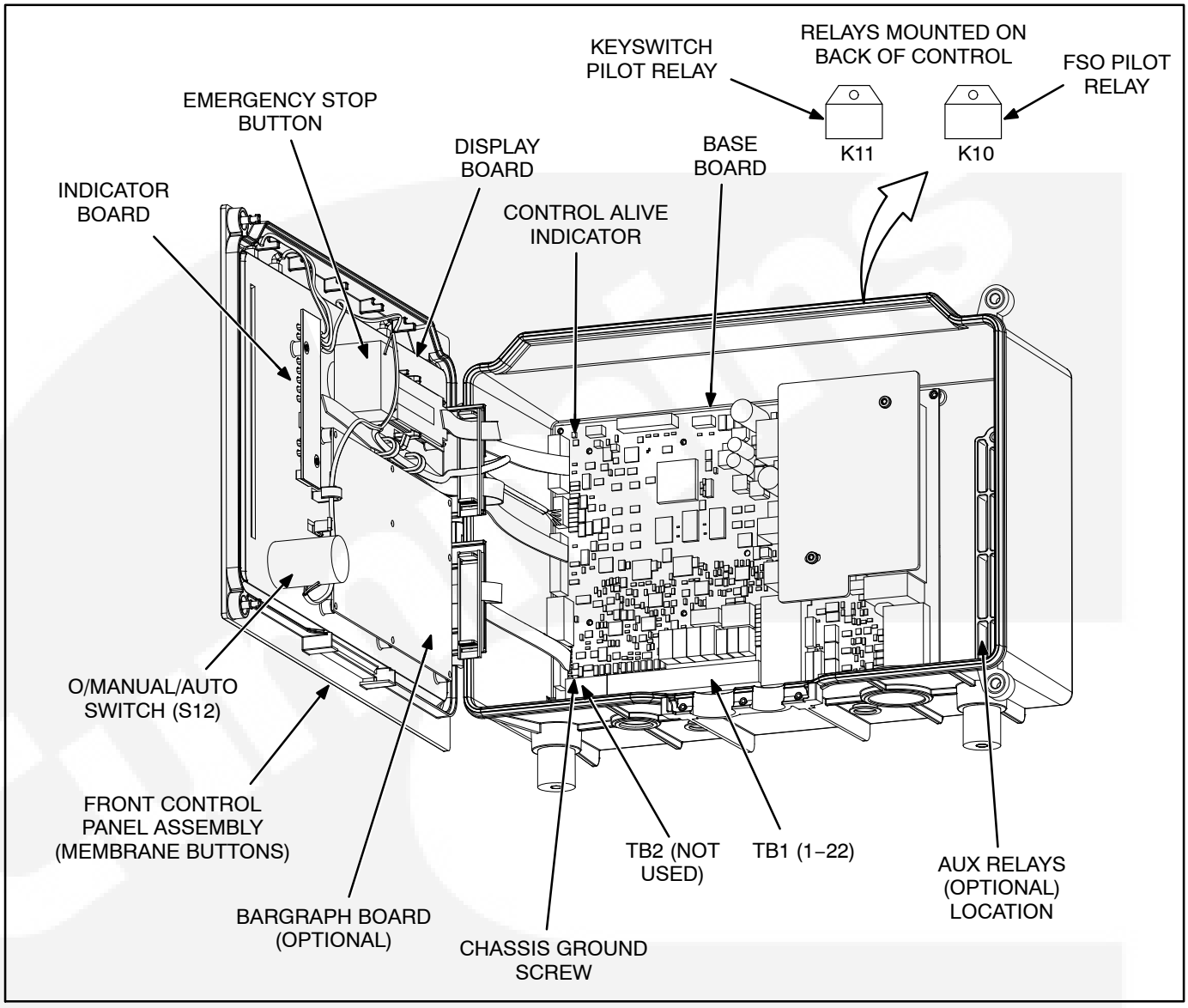

FIGURE 4-1. PCC CONTROL COMPONENTS

Relay K10

Fuel Shutoff (FSO) relay is used by the PCC Base board to control the operation of the fuel shutoff valve. B+ to the relay is routed through the E-Stop switch, which provides immediate fuel shutoff for emergency shutdowns. K10 is part of the genset harness assembly.

Relay K11

The Keyswitch Pilot relay, which is energized by the PCC Base board, controls the Keyswitch input to the ECM. K11 is part of the genset harness assembly.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

TABLE 4-1. ENGINE DOES NOT CRANK IN MANUAL MODE (NO FAULT MESSAGE)

Reason: This indicates that the PCC has not received or recognized a manual start signal.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. No power supplied to control. (Control Alive indicator on Base board is not flashing.)	a. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. b. Remove F4 and check continuity. If open, replace the fuse with one of the same type and amp rating (5 Amps). If F4 is OK, remove connector P7 and check for B+ at P7-1 through P7-4 and GND at P7-5 through P7-8. If B+ or ground missing,isolate to harness and TB BAT terminal mounted on engine block. If B+ and ground check OK, Base board may be defective. Cycle power to Base board by reconnecting P7. If Control Alive indicator does not blink, replace Base board.
2. Base board not properly calibrated or corrupt calibration. (Control Alive indicator flashes every 1/2 second.)	Confirm that the installed calibration part number matches the serial plate information. Re-enter calibration file if necessary. (When properly installed, Control Alive indicator flashes every second.)
3. The Emergency Stop switch or wiring is defective.	With Emergency Stop push button not activated, remove connector P1 and check for continuity between P1-1 (ESTOP-NC-2) and P1-2 (ESTOP-NC-1). (If circuit is open, the control will detect a local E-Stop condition but will not display the E-Stop condition.) If circuit is open, isolate to Emergency Stop switch and wiring. If there is continuity, go to next step.
4. The Manual input is not getting from the Manual select switch (S12) to the Base board indicting that S12, Base board or the harness is bad.	With S12 in Manual, remove connector P1 from the Base board and check for continuity from P1-6 (MAN) to P1-8 (GND). If no continuity, isolate to switch and wiring. If there is continuity, go to next step.
5. The Manual Run/Stop button, harness or the Base board is bad.	Remove connector P3 from the Base board and check for continuity from P3-9 (MAN RUN/STOP) to P3-10 (GND). If no continuity when pressing the Manual Run/Stop button, replace front membrane panel. If there is continuity (200 ohms or less), the Base board is bad.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

TABLE 4-2. ENGINE DOES NOT CRANK IN REMOTE MODE (NO FAULT MESSAGE)

Reason: This indicates that the PCC has not received or recognized a remote start signal.
Effect: Engine will not start in remote mode, but starts in manual mode.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. The remote start switch or customer wiring is faulty.	Reset the control. Attempt to start, and check for ground at TB1-1. If ground level is not present, isolate to the remote switch or customer wiring. Repair as necessary. If ground is present, go to next step.
2. The Auto mode input is not getting from the Auto select switch (S12) to the Base board indicting that S12, Base board or the harness is bad.	With S12 in Auto, remove connector P1 from the Base board and check for continuity from P1-5 (AUTO) to P1-8 (GND). If no continuity, isolate to switch or wiring harness. If there is continuity, the Base board is bad.

TABLE 4-3. ENGINE CONTROL MODULE FAULT CODES *

CODE	LAMP	FAULT DESCRIPTION
111	Shtdn	Internal ECM error
115	Shtdn	Speed signal lost
122	Wrng	Manifold air press sensor high
123	Wrng	Manifold air press sensor low
124	Wrng	High manifold pressure
135	Wrng	Oil pressure sensor high
141	Wrng	Oil pressure sensor low
143	Wrng	Low oil pressure
144	Wrng	Coolant temp sensor high
145	Wrng	Coolant temp sensor low
146	Wrng	High coolant temp warning
151	Shtdn	High coolant temp alarm
152**	Wrng	Low coolant temp
153	Wrng	Manifold air temp sensor high
154	Wrng	Manifold air temp sensor low
155	Shtdn	Manifold air temp alarm
187	Wrng	Sensor supply 2 low
212	Wrng	Oil temp sensor high
213	Wrng	Oil temp sensor low
214	Shtdn	High oil temp
221	Wrng	Air pressure sensor high
222	Wrng	Air pressure sensor low
227	Wrng	Sensor supply 2 high
231	Wrng	Coolant pressure sensor high
232	Wrng	Coolant pressure sensor low
233	Wrng	Coolant pressure fueling error
234	Shtdn	Overspeed
235	Wrng	Coolant level alarm
238	Wrng	Sensor supply 3 low
239	Wrng	ESP main supp high
254	Shtdn	FSO PWM high control error
255	Wrng	FSO PWM low control error
285	Wrng	J1939 time out error
286	Wrng	J1939 config error
287	Wrng	J39 MUX accel data error
288	Shtdn	J39 MUX rem accel data error
295	Wrng	Ambient air press keyon error
311	Wrng	Injector sol 1 H current
312	Wrng	Injector sol 5 H current
313	Wrng	Injector sol 3 H current
314	Wrng	Injector sol 6 H current
315	Wrng	Injector sol 2 H current
319	Wrng	RTC power interrupt error
321	Wrng	Injector sol 4 H current
322	Wrng	Injector sol 1 L current
323	Wrng	Injector sol 5 L current
324	Wrng	Injector sol 3 L current
325	Wrng	Injector sol 6 L current
331	Wrng	Injector sol 2 L current
332	Wrng	Injector sol 4 L current
341	Wrng	ECM data lost, data erratic
343	Shtdn	Internal ECM error
351	Wrng	Bad injector pwr supply
352	Wrng	Sensor supply 1 low
386	Wrng	Sensor supply 1 high
415	Shtdn	Low oil pressure alarm
418	Wrng	High H2O in fuel
421	Wrng	High oil temp
422	Wrng	Coolant level sen data error
425	Wrng	Oil temp in range error
427**	Wrng	CAN data link lost messages
434**	Wrng	ECM power lost
435	Wrng	Oil pressure data error
441**	Wrng	Low battery voltage
442**	Wrng	High fuel supply pressure
488	Wrng	High intake manifold temp
546	Wrng	Fuel pres sens high
555	Wrng	High crankcase pressure
556	Shtdn	High crankcase pressure
686	Wrng	Turbocharger 1 speed high

***** **Refer to engine service manual for troubleshooting.**

****** **Also refer to warning/shutdown code table and detailed troubleshooting procedure in this section.**

TABLE 4-3. ENGINE CONTROL MODULE FAULT CODES * (CONT.)

CODE	LAMP	FAULT DESCRIPTION
687	Wrng	Turbocharger 1 speed low
689	Wrng	Eng crnkshft speed/position data
697	Wrng	ECM internal temp sen high
698	Wrng	ECM internal temp sen low
757	Wrng	All persistent data lost error
778	Wrng	EPS backup lost sync error
778	Wrng	Camshaft sensor
951	Wrng	Cylinder power imbalance
1117	Wrng	Power lost with ignition ON - data erratic
1244	Shtdn	CAN – Engine normal shutdown
1245**	Shtdn	CAN – Engine shutdown
1246	Wrng	CAN – Unknown engine fault
1247	Wrng	CAN – Engine unannounced fault
1248	Wrng	CAN - Engine warning condition
1256	Wrng	Harness key least severe error
1257	Shtdn	Control model identification input state error
1376	Wrng	Eng camshaft speed/position sensor data erratic
1411	Wrng	Gen freq adj high
1412	Wrng	Droop pot adj high
1418	Wrng	Gain pot adj high
1695	Wrng	Sens supply 5 OOR high
1696	Wrng	Sens supply 5 OOR low
1843	Wrng	Crankcase press circuit high
1844	Wrng	Crankcase press circuit low
1845	Wrng	Water in fuel sen high
1846	Wrng	Water in fuel sen low
1847	Shtdn	Engine coolant temp, instructions
1852	Wrng	High water in fuel indicator
1866	Wrng	EGR DP autozero error
1893	Wrng	J39 EGR valve comm timeout error
1895	Wrng	EGR DL mismatch error
1896	Wrng	EGR DL valve stuck error
1899	Wrng	EGR delta P IR low error

CODE	LAMP	FAULT DESCRIPTION
1933	Wrng	EGR DL voltage high error
1934	Wrng	EGR DL voltage low error
1935	Wrng	EGR DL command source error
1936	Wrng	EGR DL PS low error
1937	Wrng	EGR DL PS high error
1942	Wrng	Beyond thd AZ error
1961	Wrng	EGR DL DDU temp high error
1974	Wrng	High crankcase pressure
1978	Wrng	Gen speed/load gov bias cir high
1979	Wrng	Gen speed/load gov bias cir low
1992	Shtdn	Eng crankshaft speed/position
2185	Wrng	Sensor supply 4 circuit high
2186	Wrng	Sensor supply 4 circuit low
2271	Wrng	EGR position OOR high error
2272	Wrng	EGR DL pos sensor error
2273	Wrng	EGR delta P OOR high error
2274	Wrng	EGR delta P OOR low error
2345	Wrng	Turbo speed invalid rate
2349	Wrng	EGR DL motor open error
2351	Wrng	EGR DL motor short error
2357	Wrng	EGR DL motor lock error
2359	Wrng	EGR delta P IR high error
2373	Wrng	Exhaust pressure OOR high error
2374	Wrng	Exhaust pressure OOR low error
2375	Wrng	EGR orifice temp OOR high error
2376	Wrng	EGR orifice temp OOR low error
2554	Wrng	Exhaust press keyon error
2336	Wrng	J39 VGT comm timeout error
2646	Wrng	High coolant temp AECD7 error
2661	Shtdn	Unacknowledged fault exists
2662	Wrng	Unacknowledged fault exists
2764	Wrng	EP rpm derate error
2774	Wrng	EGR DP clogged tubes error
2962	Wrng	EGR rpm derate error
2973	Wrng	Charge press IR error

*** Refer to engine service manual for troubleshooting.**

**** Also refer to warning/shutdown code table and detailed troubleshooting procedure in this section.**

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TABLE 4-4. WARNING AND SHUTDOWN CODES

FAULT CODE	CORRECTIVE ACTION
152 **LOW COOLANT TEMP** Lamp: Warning Set is not operating. Warning occurs when engine coolant temperature is 70° F (21° C) or lower. **NOTE: In applications where the ambient temperature falls below 40° F (4° C), Low Coolant Temp may be indicated even though the coolant heaters are operating.**	Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions: a. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required. b. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required. c. *Refer to detailed troubleshooting procedure in this section*. Coolant temperature must be below 70° F (default setting) for one minute to activate warning and be above 70° F for five minutes before the warning can be cleared.
197 **LOW COOLANT LEVEL** Lamp: Warning (Optional)	Indicates engine coolant level has fallen below the warning trip point. Allow engine to cool down completely before proceeding. a. Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. b. Reset control and restart after locating and correcting problem. (*Refer to detailed troubleshooting procedure in this section*.)
235 **LOW COOLANT LEVEL** Lamp: Shutdown	Indicates engine coolant level has fallen below the shutdown trip point. See code **197** for corrective action.
359 **FAIL TO START** Lamp: Shutdown	Indicates possible fuel system or air induction problem. Engine cranks but fails to start. (*Refer to detailed troubleshooting procedure in this section*.)
427 **CAN DATALINK LOST MESSAGES** Lamp: Warning	Datalink fault. Indicates that important data was lost between the base board and the ECM. (*Refer to detailed troubleshooting procedure in this section*.)
434 **ECM POWER LOST** Lamp: Warning	Indicates that “Keyswitch” to the ECM was NOT removed for 30 seconds before removing battery power to the ECM (removing connectors or battery cable). To reset, place the O/Manual/Auto switch in the O position and press E-Stop and wait 30 seconds. Remove E-Stop and press the Fault Reset button.
441 **LOW BAT VOLTAGE** Lamp: Warning	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation will occur. (*Refer to detailed troubleshooting procedure in this section*.)
442 **HIGH BAT VOLTAGE** Lamp: Warning	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur. Check float level on battery charger if applicable (lower float level). Check battery wiring/calibration. (*Refer to detailed troubleshooting procedure in this section*.)
1117 **ECM POWER LOST** Lamp: Warning	Indicates that “Keyswitch” to the ECM was NOT removed for 30 seconds before removing battery power to the ECM (removing connectors or battery cable). To reset, place the O/Manual/Auto switch in the O position and press E-Stop and wait 30 seconds. Remove E-Stop and press the Fault Reset button.

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TABLE 4-4. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
1124 **DELAYED SHUTDOWN** Lamp: Warning	A shutdown fault became active while the Delayed Shutdown feature was enabled. The shutdown will be delayed by the delayed shutdown time entered. Review Fault History and perform corrective action.
1245 **CAN–ENGINE SHUTDOWN** Lamp: Shutdown	The ECM indicated to the PCC that it is shutting down the engine but did not send any other fault condition over the datalink. (*Refer to detailed troubleshooting procedure in this section*.)
1311, 1312, 1317, 1318 **CUSTOMER INPUT #1 – #4** Lamp: Warning/Shutdown or none for status message.	The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, Low Starting Hydraulic Pressure, Low Starting Air Pressure, etc. Each of the fault functions can be programmed (using service tool), as follows: • Enable/disable input (Default: enable) • Status, Warning or Shutdown (Default: #1–None, #2 thru #4–Warning) • Active closed or open (Default: closed [ground]) • Change display name using up to 19 characters (Default: #1– Customer Fault 1, #2–Ground Fault, #3–Low Fuel, #4–Rupture Basin Fault) (*Refer to detailed troubleshooting procedure in this section*.)
1313 – 1316 **NETWORK FAULT 1 thru 4** Lamp: Warning/Shutdown or none for status message.	Indicates network input (#1–#4) is in an active state. Each of the fault functions can be programmed (using service tool), as follows: • Status, Warning or Shutdown • Change display name using up to 19 characters
1417 **POWER DOWN ERROR** Lamp: Warning	Indicates that the controller can not power down because of some unknown condition. Possible drain on battery. Replace Base board.
1433 **EMERGENCY STOP** Lamp: Shutdown	Indicates local Emergency Stop. To reset the local/remote Emergency Stop button: 1. Pull the Emergency Stop button out. 2. Move the O/Manual/Auto switch to O. 3. Press the front panel Fault Acknowledge/Reset button. 4. Return O/Manual/Auto switch to desired position.
1434 **REMOTE E-STOP** Lamp: Shutdown	Indicates remote Emergency Stop. See code **1433** to reset.
1438 **FAIL TO CRANK** Lamp: Shutdown	Indicates possible fault with control, speed sensing or starting system. (*Refer to detailed troubleshooting procedure in this section*.)
1442 **WEAK BATTERY** Lamp: Warning	Indicates that during cranking, the battery voltage is at or below the weak battery warning trip point for a time greater than or equal to the weak battery set time. See code **441** for corrective action.

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TABLE 4-4. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
1443 **BATTERY FAILED** Lamp: Shutdown	Dead battery – engine will not start. See code **441** for corrective action.
1444 **KW OVERLOAD** Lamp: Warning	Indicates that generator output power exceeded 105% of genset rating. Check load and load lead connections. (*Refer to detailed troubleshooting procedure in this section*.)
1445 **SHORT CIRCUIT** Lamp: Shutdown	Indicates that generator output current has exceeded 175% of rated. Check load and load lead connections. (Fault may not reset for several minutes.) Also, see code **1444** for corrective action.
1446 **HIGH AC VOLTAGE** Lamp: Shutdown	Indicates that one or more of the phase voltages has exceeded 130% of nominal, or has exceeded 110% of nominal for 10 seconds. (*Refer to detailed troubleshooting procedure in this section*.)
1447 **LOW AC VOLTAGE** Lamp: Shutdown	Indicates that one or more of the phase voltages has dropped below 85% of nominal for 10 seconds. (*Refer to detailed troubleshooting procedure in this section*.)
1448 **UNDER FREQUENCY** Lamp: Shutdown	Indicates that engine speed has dropped below 90% of nominal for 10 seconds. Check fuel supply, intake air supply and load. (*Refer to detailed troubleshooting procedure in this section*.)
1449 **OVER FREQUENCY** Lamp: Warning	Indicates frequency is 10% above base frequency for 20 seconds. (Refer to detailed troubleshooting procedure in this section.)
1459 **REVERSE POWER** Lamp: Shutdown	Indicates improper CT phasing. Check wiring to voltage sense circuit. Refer to CT Installation in *Section 5*.
1461 **LOSS OF FIELD** Lamp: Shutdown	Indicates loss of field (electric) due to reverse kVAR.
1466 **MODEM FAILURE** Lamp: Warning	Indicates that control can not communicate with the modem. Check for open, short circuit to ground, and loose connections to the modem.
1468 **NETWORK ERROR** Lamp: Warning	Indicates momentary loss of communication from the LonWorks Network. Refer to the LonWorks Network publications for more specific troubleshooting methods.
1469 **SPEED/HZ MATCH** Lamp: Shutdown	Indicates that measured speed and measured AC output frequency do not agree. Check calibration file.
1471 **OVER CURRENT** Lamp: Warning	Indicates that generator output current has exceeded 110% of rated for 60 seconds. Check load and load lead connections. Also, see code **1444** for corrective action.

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TABLE 4-4. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
1472 **OVER CURRENT** Lamp: Shutdown	Indicates that generator output current has exceeded 110% of rated, and that a control time/current calculation has initiated an overcurrent shutdown. Check load and load lead connections. (Fault may not reset for several minutes.) Also, see code **1444** for corrective action.
2323 – 2326 **NETWORK FAULT 5 thru 8** Lamp: Warning/Shutdown or none for status message.	Indicates network input (#5–#8) is in an active state. See **1313–1316** fault code corrective action.
2335 **EXCITATION FAULT** Lamp: Shutdown	Indicates a loss of all three voltage sense leads or failure in excitation circuit. Check field wiring (X1 and X2) for shorts or opens.
2336 **MEMORY ERROR** Lamp: Shutdown	Indicates control memory error. Data corruption of critical operating parameters. Try reloading calibration file.
2341 **HIGH CONTROL TEMP** Lamp: Warning	Control temperature is above normal (158° F [70° C]) for a time greater than control temperature set time. Check genset room air flow.
2342 **TOO LONG IN IDLE** Lamp: Warning	Indicates genset has been in Idle mode too long. Exit idle mode.
2968 **AVR FAULT** Lamp: Warning	Indicates AVR hardware contains a fault condition.
2969 **LON FAILURE** Lamp: Warning	Indicates no communications with LonWorks board.
2972 **FIELD OVERLOAD** Lamp: Shutdown	AVR Field has been at Max Field for a time greater than the allowed Max Field Time.

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CODE 152 – LOW COOLANT TEMPERATURE (WARNING)

Reason: Engine coolant temperature has dropped below the warning threshold for low coolant temperature.
Effect: No action is taken by the PCC. Engine may not start due to slow cranking speed.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.
3. The engine coolant heater could be bad. (Radiant heat should be felt with hand held close to outlet hose.)	Coolant heater not operating due to: • Coolant heater not connected to power. Check for blown fuse, or disconnected heater cord and correct as required. • Low coolant level. Look for possible coolant leakage points and repair as required. • Open heater element. Check current draw of heater. • Defective heater element/thermostat. With coolant heater removed from engine and power disconnected, flush with cold tap water for two minutes to close internal heater thermostat (opens at 100° F and closes at 80° F). Check resistance across input power leads: a. Open – replace coolant heater. b. Closed – coolant heater OK (coil resistance of 10 to 60 ohms)
4. The sensor/connections could be bad.	Inspect the sensor and genset harness connector pins. Repair or replace as necessary. Refer to engine service manual for troubleshooting.

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CODE 197/235 – LOW COOLANT LEVEL (WARNING/SHUTDOWN)

Reason: Engine coolant level has dropped below the warning/shutdown threshold for low/high coolant level.
Effect: No action is taken by the PCC for code **197**. Engine will shut down for code **235**.

POSSIBLE CAUSE	CORRECTIVE ACTION
The sensor, harness or Base board could be bad.	If the coolant level is normal, isolate the source of the low coolant signal. (This is a ground signal.) Disconnect the signal lead at the sender and reset the control. 1. If the **197**/**235** message drops out and does not reappear, replace the sender. 2. If the **197**/**235** message reappears and remains after control reset, remove connector P7 from Base board and check continuity from P7-32 to ground. • If there is continuity, replace the harness. • If there is not continuity, replace the Base board.

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CODE 359 – FAIL TO START (SHUTDOWN)

Reason: This indicates that the engine failed to start after expiration of last crank time.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Restricted fuel supply.	a. Check for empty fuel tank, fuel leaks, or plugged fuel lines and correct as required. Prime the fuel system. b. Open any closed shutoff valve in the fuel line supplying the engine. c. Check for dirty fuel filter and replace if necessary. d. Check for dirty or plugged air filter and replace if necessary. e. Bleed air from fuel system. Refer to engine service manual.
2. Engine fuel shutoff actuator is not energized due to: a. The Emergency Stop switch or wiring is bad. b. FSO relay (K10)/wiring or Base board is bad. c. The ECM is bad. **Note: Fault code 255 (Warning) may be displayed prior to fault code 359 (Shutdown).**	Isolate to Emergency Stop switch/circuitry, K10 relay/circuitry or Base board. a. With the Emergency Stop push button not activated, check for B+ at K10–5. • If there is no B+, isolate to defective Emergency Stop button/circuitry. • If there is B+, continue with step b. b. Check relay coil resistance between K10-5 & 6. If open, relay is bad. c. Attempt to start and check for B+ at K10-5. • If there is no B+, the Base board is bad. • If there is B+, continue with step d. d. Check for B+ at K10-1. • If there is no B+, the circuit to K10-1 is open. If circuit is OK, the ECM is bad. • If there is B+, continue with step e. e. Energize relay K10 by grounding K10-6. • If there is no B+ at K10-4, K10 is bad. • If there is B+ at K10-4, continue with step 3.
3. The engine fuel system is worn or malfunctioning or has lost prime (fuel lift pump, injection pump, injectors, timing).	Service according to the engine service manual.
4. The engine is worn or malfunctioning mechanically.	Service according to the engine service manual.

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CODE 427 – CAN DATALINK LOST MESSAGES (WARNING)

Reason: Important data was lost between the Base board and the ECM or keyswitch to ECM was removed during genset operation.
Effect: Engine will not start (If fault occurred during genset operation, genset may continue to operate).

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Power removed from ECM (keyswitch) during genset operation. O pressed on control during genset operation. (This is a nuisance fault only, not a critical fault.)	Reset control by pressing Fault Reset button with O/Manual/Auto switch in O (Off) position.
2. Defective Datalink harness assembly.	a. Inspect the Datalink harness P10 and C06 connector pins. Repair or replace as necessary. b. Check for resistive circuit in lead P10-1 to C06-A and P10-2 to C06-B (10 ohms or less OK). c. Check terminating resistors. With connectors P10 and C06 removed, measure resistance between pins P10-1 and P10-2 (60 ohms OK).
3. No B+ at Keyswitch input to ECM module. (With battery connected, B+ should always be supplied to Keyswitch input of ECM module, other than when PCC Sleep Mode is active.) a. Fuse F2 located on genset harness may be open. c. Keyswitch Pilot relay K11, Base board or ECM may be bad.	a. Remove F2 and check continuity. If open, replace the fuse with one of the same type and amp rating (5 Amps). b. With power supplied to the control, check for B+ at K11-4. • If there is B+ at K11-4, the Base board or the ECM is bad, refer to step 4. • If there is no B+ at K11-4, circuit to K11-1 is open. If circuit is OK, go to step c. c. Check for B+ at K11-5. • If there is B+ at K11-5, circuit to K11-5 is open or relay K11 is bad. • If there is no B+ at K11-5, the Base board is bad.
4. The Base board or ECM is bad.	a. Verify connection to Base board using InPower. If connection does not exist, replace Base board. b. Verify connection to ECM using InSite. Check for faults (refer to engine service manual). The Base board/module is bad if it fails to acknowledge message.
5. Fault Code 427 activates after a shutdown on the gen set. The PCC 2100 controller does not receive the expected PGN message over the Can–Link within a specified time. Once this time expires, and the message has not been received, the controller will annunciate FC 427.	a. Connect to the PCC 2100 control with InPower. b. Navigate to CAN Control > Settings c. Change the CAN Failure Delay from 3 seconds (default) to 6 seconds. d. Save settings with InPower e. Start and stop the generator set with a Normal Shutdown to confirm that Fault Code 427 no longer activates.

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CODE 441 – LOW BATTERY VOLTAGE (WARNING)

Reason: Low voltage has been detected for battery.
Effect: PCC voltage supply approaching level at which unpredictable operation may occur.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Weak or discharged battery.	Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C).
2. Low electrolyte level in battery.	Replenish electrolyte and recharge battery.
3. Battery connections loose or dirty.	Clean and tighten or replace the battery cable connectors and cables at the battery and the set.
4. Wrong battery voltage.	Verify that battery voltage 12 or 24 matches calibration.
5. Insufficient battery charging voltage.	Adjust charge rate of AC powered battery charging circuit, according to manufactures instructions.
6. Engine DC alternator could be bad.	Replace engine DC alternator if normal battery charging voltage (12 to 14 or 24 to 26 VDC) is not obtained.
7. If the batteries are OK, the problem may be the harness or the Base board.	Remove connector P7 from Base board and check battery voltage at P7–1 through P7-4 (B+) to P7-5 through P7-8 (GND). • If the voltage at P7 is not the same as the battery voltage, the harness is bad. • If the voltage at P7 is OK, the Base board is bad.

CODE 442 – HIGH BATTERY VOLTAGE (WARNING)

Reason: High voltage has been detected for battery.
Effect: PCC damage will occur.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Excessive battery charging voltage.	Adjust charge rate of AC powered battery charging circuit according to manufacturers instructions.
2. Engine DC alternator could be bad.	Replace engine DC alternator if normal battery charging voltage (12 to 14 or 24 to 26 VDC) is not obtained.
3. Wrong battery voltage.	Verify that battery voltage 12 or 24 matches calibration.

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CODE 1245 – CAN ENGINE SHUTDOWN (SHUTDOWN)

Reason: The PCC received a shutdown message from the ECM.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. No B+ at Keyswitch input to ECM.	Refer to code **427** instructions.
2. Fuse F1 or F2 located on genset harness may be open.	Remove F1 (30 Amp) and F2 (5 Amps) and check continuity. If open, replace the fuse with one of the same type and amp rating.
3. ECM/engine fault.	Refer to engine service manual.

CODE 1311, 1312, 1317, 1318 – CUSTOMER INPUT (WARNING/SHUTDOWN)

Reason: The nature of the fault is an optional customer selection.
Effect: Status, warning or shutdown.

POSSIBLE CAUSE	CORRECTIVE ACTION
If there is no actual fault, the problem may be an external wiring problem, active input (closed or open) selection is incorrect.	Disconnect the signal lead from TB1 and reset the control. • CUST_IN1 – TB1-4 • CUST_IN2 – TB1-5 • CUST_IN3 – TB1-6 • CUST_IN4 – TB1-7 If the message drops out, the external wiring has a short or open circuit, or the active input selection (closed/open) is not correct for customer input (use service tool to check selection).

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CODE 1438 – FAIL TO CRANK (SHUTDOWN)

Reason: This indicates that the engine failed to crank after the PCC received a start signal.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Starter is bad.	Reset the control. Attempt to start, and test for B+ at starter terminal S. If there is B+ at the starter, the starter could be bad. Test starter (see engine service manual). Replace the starter. If B+ is not present at the starter, go to next step.
2. Base board is bad or fuse F3 on the Base board may be open.	Remove F3 and check continuity. If open, replace the fuse with one of the same type and amp rating (2 Amps). If F3 is OK, install harness tool between Base board P7 connector. Attempt to start and check for B+ at P7-23 (GEN SW B+) and P7-27 (START SOL–). (These are leads to the K4 coil.) • If there is no B+ signal, the Base board is bad. • If there is a B+ signal, the Start Pilot Relay K4 or starter circuitry is bad. Go to next step.
3. Start Pilot Relay K4 or starter circuitry could be bad.	Check for B+ at K4-1 (directly connected to battery B+). If not present, check for open circuit. If there is B+, attempt to start and test for B+ at K4-4. • If there is no B+ at K4-4, K4 is bad. • If there is B+ at K4-4, check for open circuit between K4-4 and starter terminal S.
4. The Emergency Stop switch or wiring is defective.	With Emergency Stop push button not activated, remove connector P1 and check for continuity between P1-1 (ESTOP-NC1) and P1-2 (ESTOP-NC2). (If circuit is open, the control will detect a local E-Stop condition but will not display the E-Stop condition.) If circuit is open, isolate to Emergency Stop switch and wiring.
5. CAN Datalink error.	CAN Datalink error was detected prior to genset receiving start command. Review fault codes. Refer to code **427** instructions.

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 1442 – WEAK BATTERY (WARNING)

Reason: Battery is weak.
Effect: No action is taken by the PCC.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **441**.	Refer to code **441** instructions.

CODE 1443 – BATTERY FAILED (SHUTDOWN)

Reason: Battery is dead.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **441**.	Refer to code **441** instructions.

CODE 1444 – KW OVERLOAD (WARNING)

Reason: The indicated kW load has reached overload. The threshold for indicated kW overload is 3 seconds at 110 percent of rated power output.
Effect: No action taken by the PCC.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault threshold is not set correctly with InPower.	Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
2. Short or overload.	Check the load and load cables. Repair if necessary. Check operation by disconnecting load and restarting generator set.
3. Incorrect CT's or CT connections.	Check CT's and CT connections. Correct if necessary. Refer to *Current Transformer Installation* in *Section 5*.
4. The problem may be the Base board or harness connections.	Remove connector P7 from Base board. Check continuity from P7 to CT's. P7-11 (CT1) to P7-12 (CT1-COM) P7-15 (CT2) to P7-16 (CT2-COM) P7-19 (CT3) to P7-20 (CT3-COM) Repair connections.

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 1445 – SHORT CIRCUIT (SHUTDOWN)

Reason: This indicates that the generator output current has exceeded 175% of rated.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **1444**.	Refer to code **1444**.

CODE 1446 – HIGH AC VOLTAGE (SHUTDOWN)

Reason: One or more of the phase voltages has exceeded 130% of nominal, or has exceeded 110% of nominal for 10 seconds.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Single step large block load removal.	Clear fault and restart genset.
3. Fault threshold is not set correctly with InPower.	Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
4. Improper connections have been made at the generator output terminals.	Reconnect according to the appropriate reconnection diagram. See *Section 8*.
5. AC harness wiring connections could be incorrect.	Check all AC harness connections (*refer to Section 8*).
6. Base board or generator is bad.	Refer to *Generator/Base Board Isolation Procedure* in *Section 6* to determine if the generator or the Base board is causing the high AC voltage shutdown fault.

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 1447 – LOW AC VOLTAGE (SHUTDOWN)

Reason: One or more of the phase voltages has dropped below 85% of nominal for 10 seconds.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.
3. Overload.	Check the load and correct any overload. Check operation by disconnecting load and restarting generator set.
4. Improper connections have been made at the generator output terminals.	Reconnect according to the appropriate reconnection diagram. See *Section 8*.
5. AC harness wiring connections could be incorrect.	Check all AC harness connections (*refer to Section 8*).
6. The rotating rectifier assembly (diodes CR1 through CR6) is faulty.	Check each diode (*refer to Section 6*).
7. Loose connector or Base board is bad.	Repair connections (P8) or replace the Base board if necessary.

CODE 1448 – UNDER FREQUENCY (SHUTDOWN)

Reason: Generator AC output frequency is low.
Effect: Generator set will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.
3. Overload.	Check the load and correct any overload. Check operation by disconnecting load and restarting generator set.
4. Fuel or air delivery problem.	Refer to the engine service manual.
5. Loose connector or Base board is bad.	Repair connections (P8) or replace the Base board if necessary.

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 1449 – OVER FREQUENCY (WARNING)

Reason: Generator AC output frequency is high.
Effect: No action taken by the PCC.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
3. Fuel or air delivery problem.	Refer to the engine service manual.
4. Loose connector or Base board is bad.	Repair connections (P7/P8) or replace the Base board if necessary.

CODE 1471/1472 – OVER CURRENT (WARNING/SHUTDOWN)

Reason: This indicates that the indicated generator output current has exceeded 110% of rated.
Effect: No action is taken by the PCC for code **1471**. Engine will shut down for code **1472**.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **1444**.	Refer to code **1444**.

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5. Control Adjustment and Service

GENERAL

This section contains circuit board removal and replacement procedures and adjustment procedures for the genset control.

This section also describes the function and operation of engine sensors, genset options, and other special features of the genset control system, such as, customer connection points, optional run relays, etc. Installation information is also provided for these items where necessary.

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service.***

⚠WARNING ***HAZARDOUS VOLTAGE. The PCC2100 control box must be opened only by technically qualified personnel. Site power for optional equipment and genset voltages of up to 600 VAC are present in the PCC box. These voltages can cause electrical shock, resulting in personal injury.***

CIRCUIT BOARD REMOVAL/REPLACEMENT

No special tools (other than a grounding wrist strap and InPower Service tool) are required to remove a circuit board from inside the control box. The InPower Service tool is required when replacing the Base board.

Before replacing the Base board, make sure that a capture file of the genset's parameter values has been created using InPower. (During genset installation, it was suggested that a capture file be made before and after changes were made to the genset operating parameters.)

After replacing the Base board, use the capture file as a template to write the previous settings to the new Base board software.

Refer to INPOWER User's Guide for specifics.

Circuit Board Removal Safety Precautions

⚠ CAUTION ***Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Fault code 1117 may display and engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. See fault code 1117 in Section 4 to reset ECM.***

⚠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.***

⚠ CAUTION ***Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when handling circuit boards or socket-mounted IC's.***

Before starting, disconnect the negative (–) cable from the battery. This is to make sure the set will not start while working on it and to avoid circuit board damage, caused by voltage spikes when removing and replacing circuit board connectors.

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. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (–) battery cable from the generator set starting battery.
5. To prevent circuit board damage due to electrostatic discharge (ESD), a grounding wrist strap must be worn when handling circuit boards or socket-mounted IC's. (The wrist strap **does not** provide a direct short to ground, but is typically rated at approximately 1 megohm to ground.)
6. Attach the clip to the chassis ground screw in the control box and place the strap around your wrist before handling a circuit board.

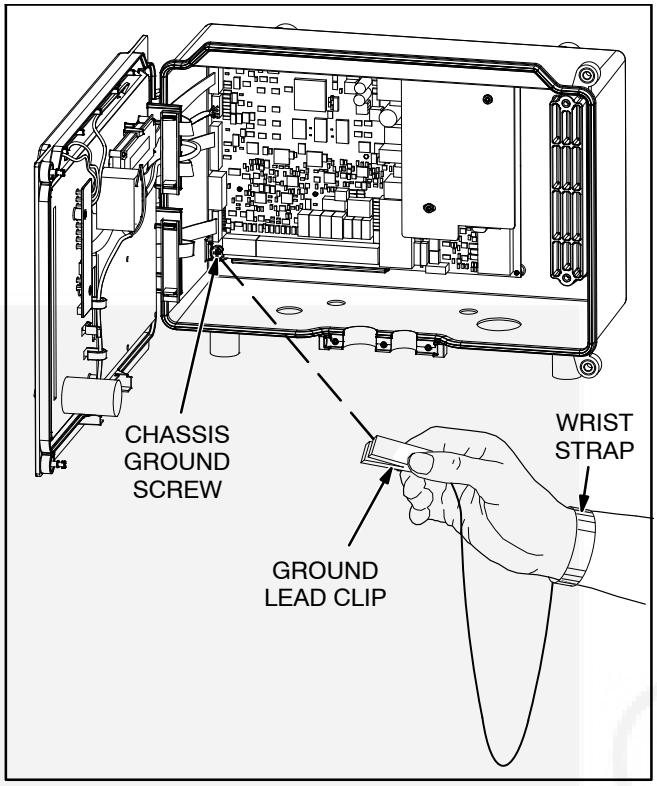

FIGURE 5-1. WRIST STRAP

MODIFYING SETUP SUBMENUS

The Setup submenus allow you to adjust system parameters.

There are two setup menus that are selectable from the Setup Main Menu:

- Crank/Idle Setup Menu
- Governor/Regulator Setup Menu

These two menus are intended for qualified service personnel only. For this reason, a three-digit access code (password) must be entered before you can proceed to those menus.

⚠ CAUTION ***Improper adjustment of the control can cause equipment malfunction or damage. Adjustment must be performed by technically qualified personnel only.***

PASSWORD SUBMENU

Figure 5-2 shows a block representation of the Set-up Main menu. If you press the button next to the word “Setup” in the display, the Setup Password submenu is displayed. Use of Setup menus is restricted to service personnel.

Press the Previous Main Menu button to return to Main Menu 3. Press the Home button to return to Main Menu 1.

Password submenu: If you enter the correct password, the Setup Main Menu is displayed. When the Password submenu is displayed, the first numeric character (0) is flashing. The access code for your PCC is: **574**. To enter the password:

1.. Press the button next to the + symbol until the value reads “5.”

2.. Press the button next to the → symbol to move to the next numeric character.

3.. Press the button next to the + symbol until the value reads “7.”

4.. Press the button next to the → symbol to move to the next numeric character.

5.. Press the button next to the + symbol until the value reads “4.”

6.. After you have completed entering the password, press the button next to the ▶ symbol. The Setup Main Menu is displayed.

If a wrong number is entered into any of the numeric character fields, use the buttons next to the ↓ and ↑ symbols until the correct value is entered.

If the wrong character field is selected, use the buttons next to the ← and → symbols to move to the character field you wish to change.

SETUP MAIN MENU

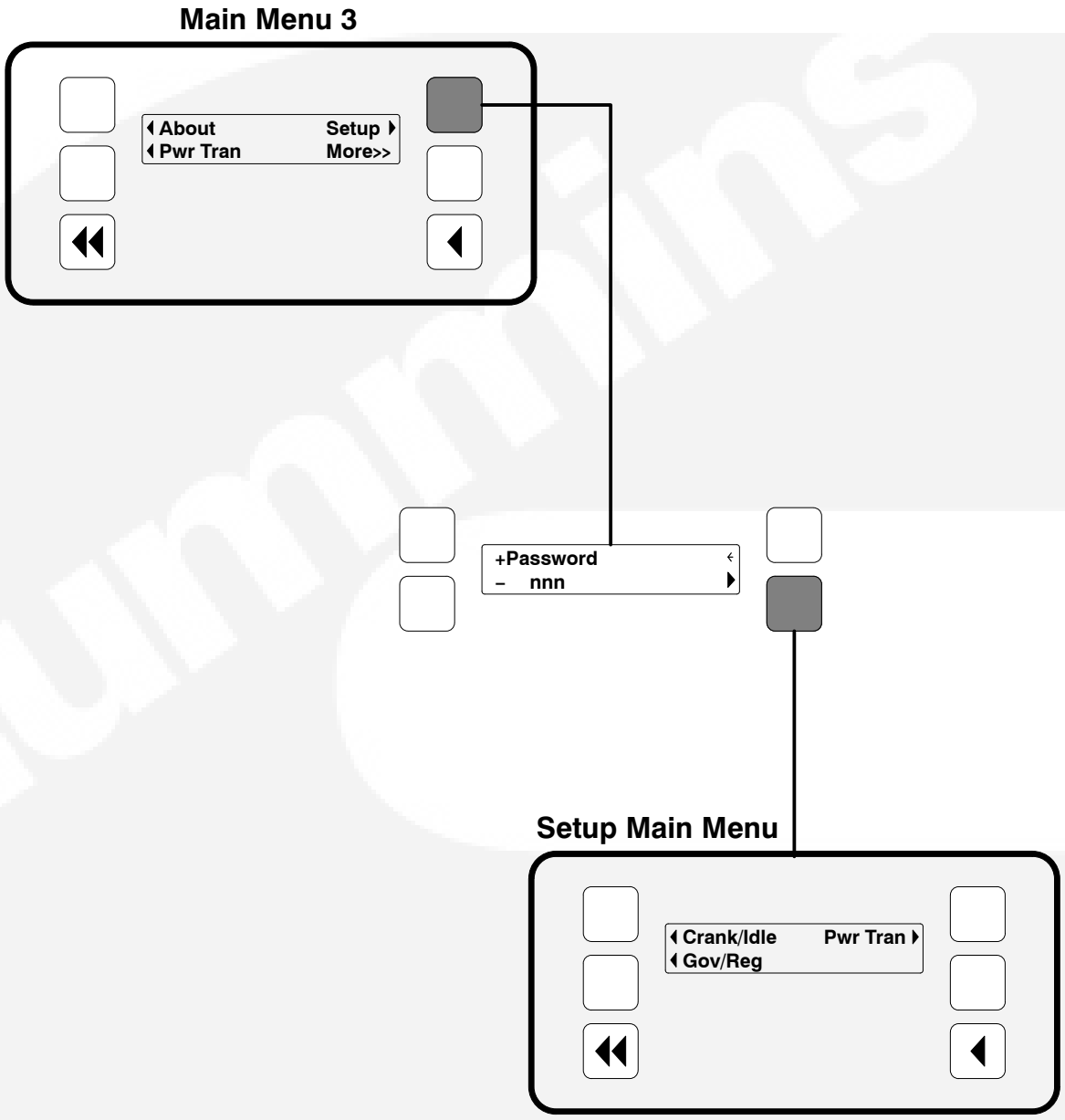

FIGURE 5-2. SETUP MAIN MENU

CRANK/IDLE SETUP MENU

Figure 5-3 shows a block representation of the Crank/Idle Setup menu. If you press the button next to the word “Crank/Idle” in the display, the first Crank/Idle Setup submenu is displayed.

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

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

Adjusting Values/Parameters:

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

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

Cycle Crank submenu: Cycle Crank can be enabled or disabled (default = Disable).

Number of Crank Attempts submenu: This value can be adjusted from 2 to 7 attempts (default = 3 attempts).

Crank Time submenu: This value can be adjusted from 2 to 20 seconds (default = 15 seconds).

Rest Time submenu: This value can be adjusted from 7 to 40 seconds (default = 15 seconds).

Idle Speed Adjust submenu: This value can be adjusted from 700 to 1100 RPM (default = 800 RPM).

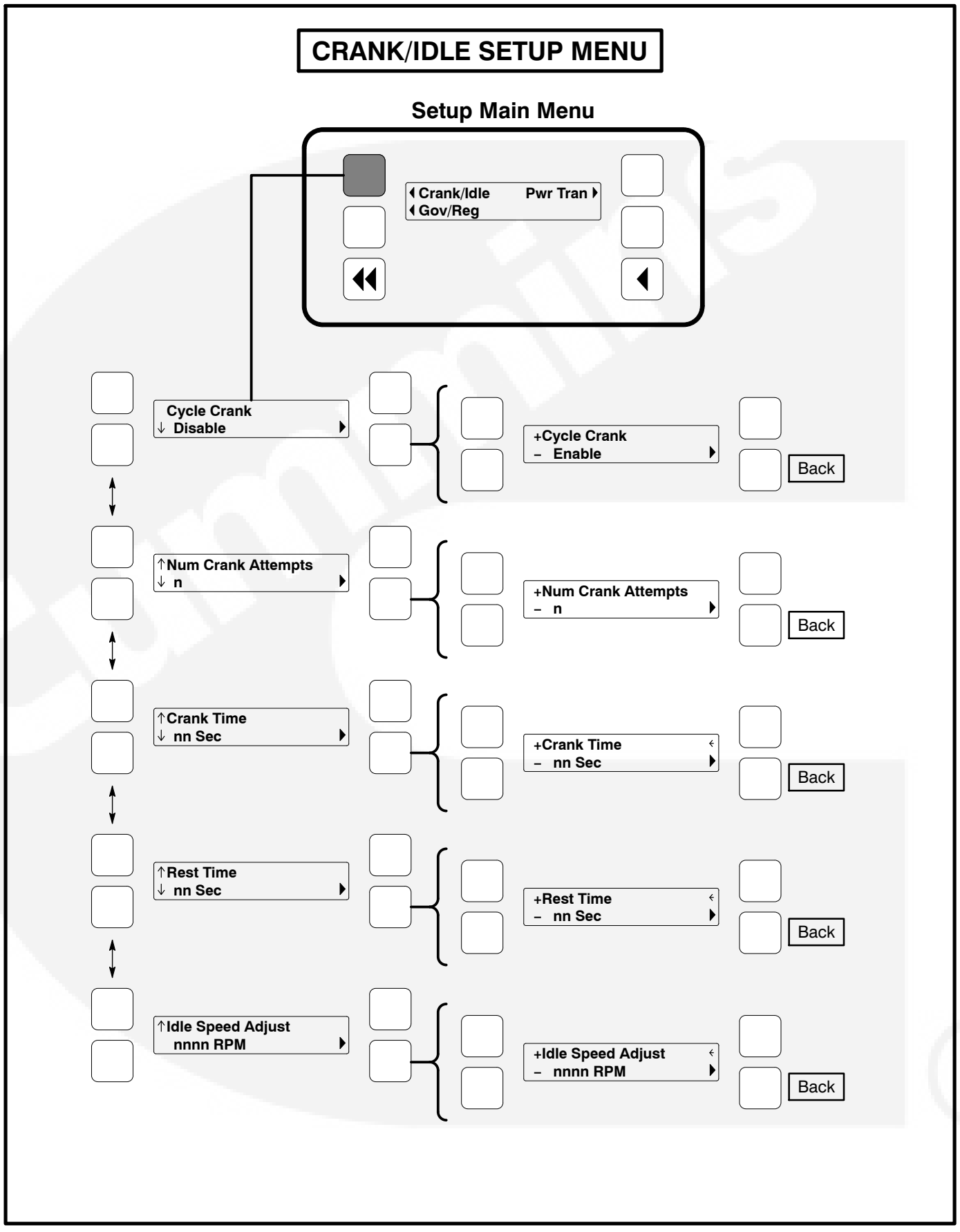

FIGURE 5-3. CRANK/IDLE SETUP MENU

GOVERNOR/REGULATOR SETUP MENU

The governor setup menus are not required and are noted as NOT USED in this section. Engine governing is provided by the ECM.

Figure 5-4 shows a block representation of the Governor/Regulator Setup menu. If you press the button next to the word "Gov/Reg" in the display, the first Governor/Regulator Setup submenu is displayed.

The GOV/REG menu values will display "100%". The expression "100%" represents the factory setting (default value) for the selected set. When increasing or decreasing the value, you are increasing or decreasing from the factory default value. (For example, entering "200%" will double the value; "50%" will decrease the value by one half.)

Default values are preset by the factory. Due to site variables, the default values may need to be adjusted to attain peak performance.

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

⚠ CAUTION ***Improper adjustment of the PowerCommand control can cause equipment malfunction or damage. Adjustment must be performed by technically qualified personnel only.***

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

Adjusting Values/Parameters:

1.. Press the button next to the ▶ symbol in the display until the + and – symbols are displayed.

2.. If necessary, press the button next to the ← or → symbols to move to the numeric character you wish to change.

3.. Press the button next to the + symbol to increase the value or select parameter; press the button next to the – symbol to decrease the value or select parameter.

4.. After adjusting values/selecting parameters, pressing the ▶ symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ▶ symbol).

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

Voltage Configuration submenu: The phase, voltage, and wire fields can simultaneously be adjusted. If phase = 1, the line-to-line voltage can be 200, 220, 230, or 240 volts with 3 wires. If phase = 3, the line-to-line voltage can be 190, 200, 208, 220, 230, 240, 380, 416, 440, 460, or 600 volts with either 3 or 4 wires. The default = 3Ph 208V 4W.

Alternator Frequency submenu: This value can either be 50 or 60 Hz (default = 60 Hz).

Regulator Gain Adjustment submenu: This value can be adjusted from 5 to 1000 percent (default = 100 percent).

If the gain adjustment is set too high, output voltage will be unstable. If gain is set too low, the output voltage will respond sluggishly to changes in load and voltage overshoot may result.

NOT USED - *Governor Ramp Time submenu:* This value can be adjusted from 0 to 30 seconds (default = 0 seconds).

This adjustment sets the time for the engine to ramp to full operating speed. This adjustment applies only to genset start up and does not affect the product performance with load changes.

NOT USED - *Governor Gain Adjustment submenu:* This value can be adjusted from 5 to 1000 percent (default = 100 percent).

If the gain adjustment is set too high, engine speed will "hunt" or oscillate. If gain is set too low, the engine will respond too slowly to changes in load – overspeed may result.

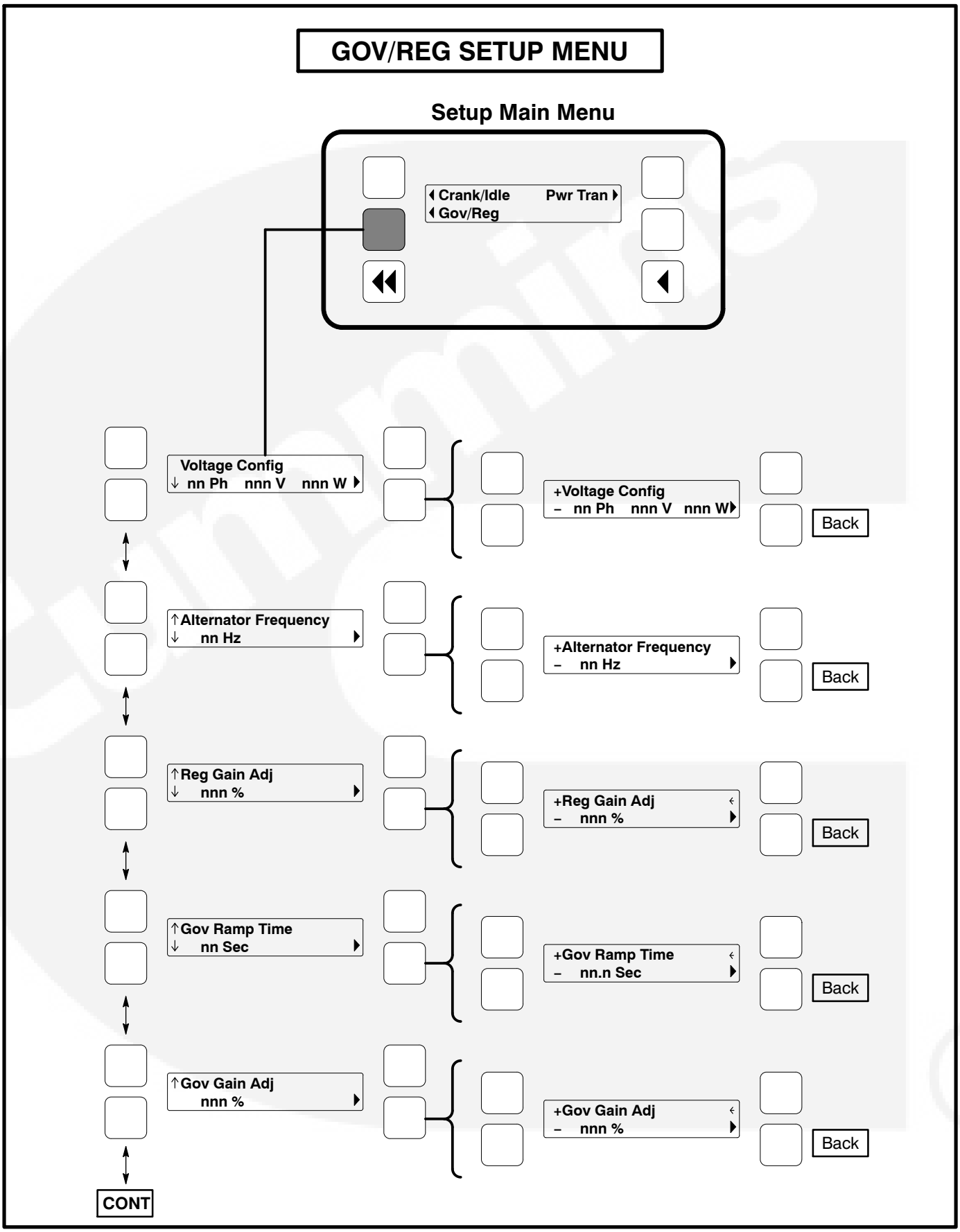

FIGURE 5-4. GOVERNOR/REGULATOR SETUP MENU

GOVERNOR/REGULATOR SETUP MENU (CONT)

Speed Droop Mode submenu: Select between Isochronous and Droop kW Sharing droop modes (default = Isochronous).

Speed Droop Percent submenu: This value can be adjusted from 0 to 10 percent (default = 5%). This adjustment sets the amount of speed droop for a full standby/prime rated kW load.

Voltage Droop Mode submenu: Select between Constant and Droop kVAR Sharing Droop modes (default = Constant).

Voltage Droop Percent submenu): This value can be adjusted from 0 to 10 percent (default = 4%). This adjustment sets the amount of voltage droop for a 0.8 pf full standby rated load.

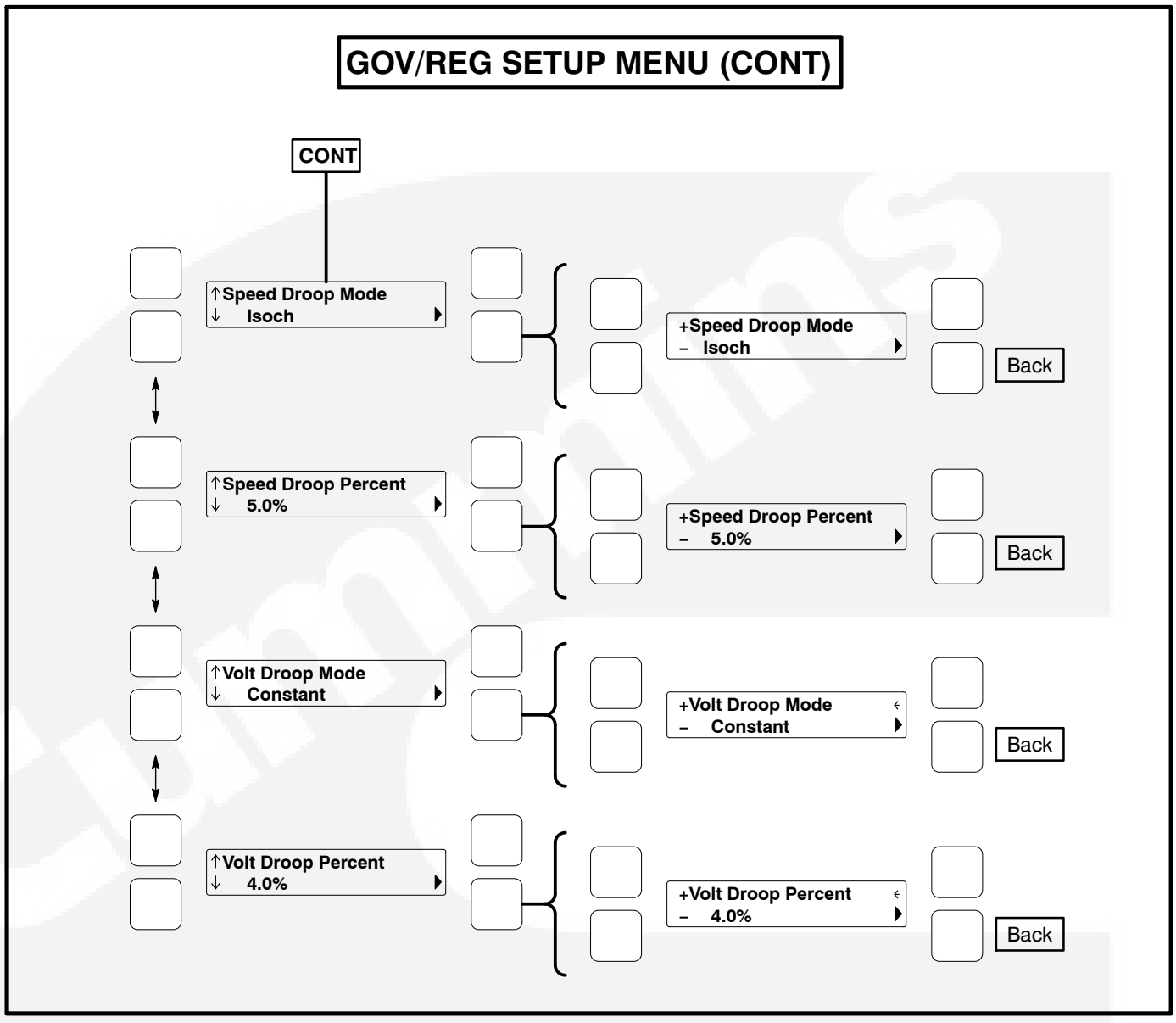

FIGURE 5-4. GOVERNOR/REGULATOR SETUP MENU (CONT)

PCC CONTROL PANEL BOX COMPONENTS (STANDARD/OPTIONAL)

The PCC control panel box (Figure 5-6) contains components that provide connection points for remote control and monitor options. The control panel box can be equipped with one or more of the following components.

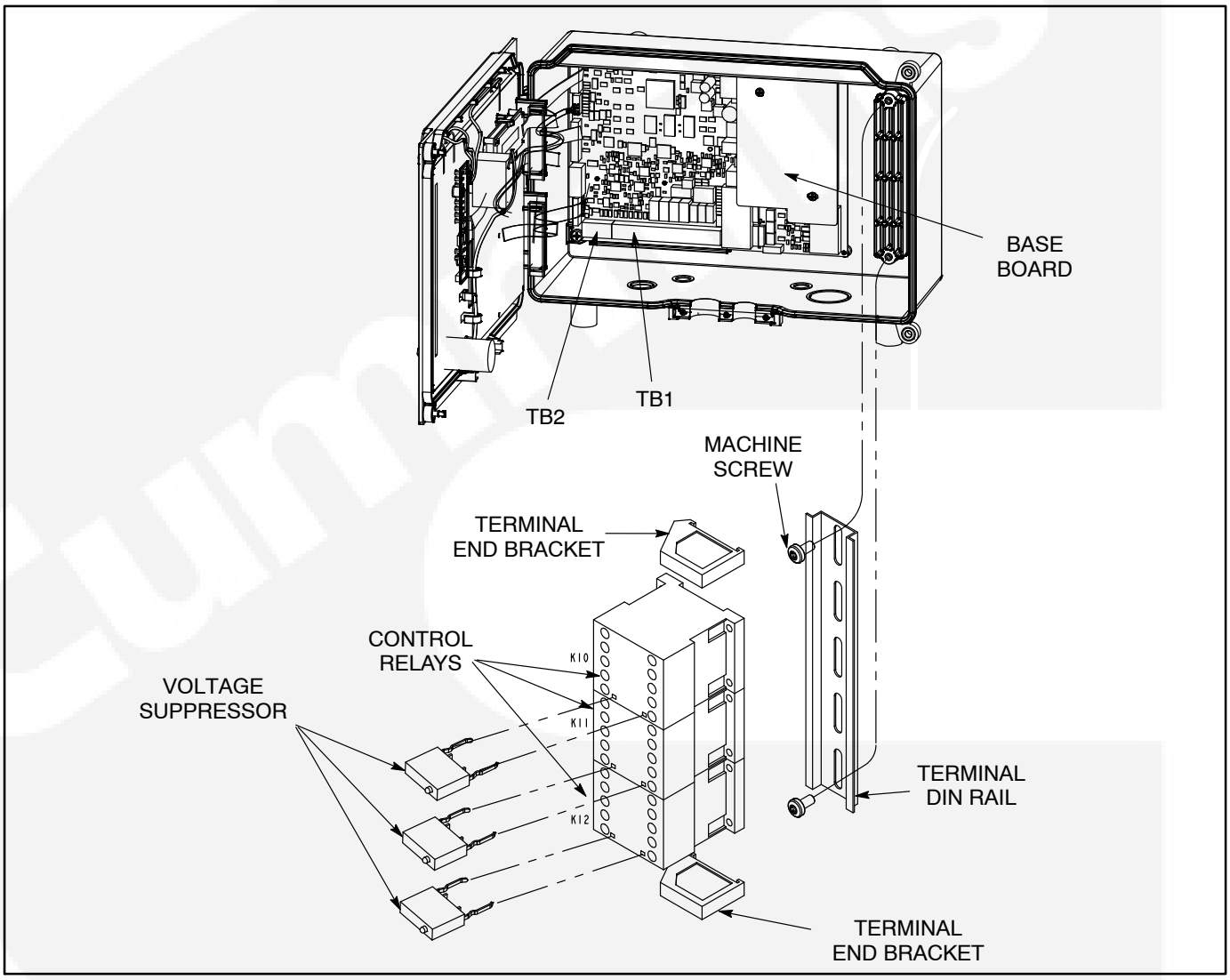

FIGURE 5-6. CONTROL PANEL BOX

Network Communications Module (Optional)

The Network Communications Module (NCM) provides an interface for data from the genset to other modules on the network. It communicates with the PCC 2100 baseboard providing complete monitoring and control of the genset. Refer to the *PowerCommand Network Installation and Operator's Manual (900–0529)* for instructions on network wiring and network software information.

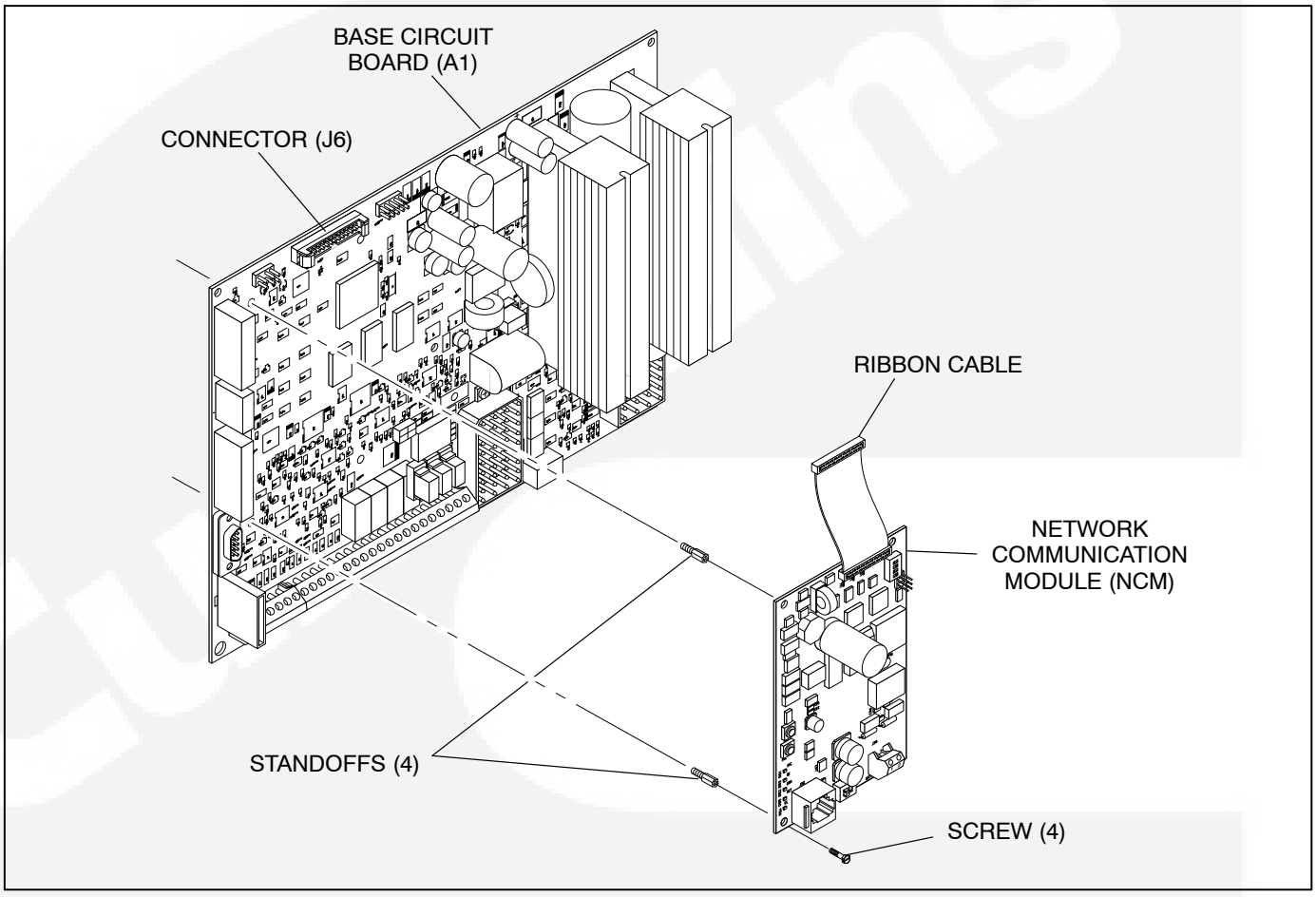

FIGURE 5-7. NETWORK COMMUNICATION MODULE

TB1 Customer Inputs

Refer to Page 8-7 for typical connections to TB1 and terminal torque specifications.

Remote Start: When the O/Manual/ Auto switch is in the Auto position, grounding this input initiates the generator set start sequence. This circuit must be opened to permit resetting a shutdown condition with the Reset input.

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

Remote Reset: When the O/Manual/ Auto switch is in the Auto position and the remote start switch is open, grounding this input resets any warning and shutdown fault (except Emergency Stop, which must be reset at the genset front panel.)

Customer Fault Inputs 1 through 4: Grounding any one of these inputs activates the corresponding warning or shutdown sequence.

External sensing equipment must be connected to the designated digital input.

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

Each of the four fault functions can be programmed (using InPower), as follows:

- Enable/disable input. Default setting:

  Enable **1** through **4**
- Status, Warning or Shutdown. Default setting:

  1 – None
  2 thru **4** – Warning
- Active closed or open. Default setting:

  Closed [ground] **1** through **4**
- Change display name using up to 19 characters. Default setting:

  1 – Customer Fault 1
  2 – Ground Fault
  3 – Low Fuel
  4 – Rupture Basin Fault

TB1 Customer Outputs

Refer to Page 8-7 for typical connections to TB1.

Customer Outputs 1 through 4: One set of normally open (NO) contacts, rated for 2 amps at 30 VDC for each of the four output signals. The relays can be used to control small devices and indicator lamps.

The nature of the customer output signal (contacts closed) is an optional customer selection. Example outputs: Genset running, common warning, common fault, load shed, ready to load, etc.

Each relay can be independently programmed (using InPower) to energize as follows.

- Enable/disable output. Default setting:

  Enable **1** through **4**
- Status, Warning or Shutdown. Default setting:

  1 – Common warning
  2 – Common shutdown
  3 – Not in Auto
  4 – Ready to Load

The customer outputs can also be connected to three control relays (optional) to operate larger equipment, such as, fans, pumps and motorized air dampers. Refer to *Control Relays* in this section for additional information.

B+: This is a fused 10 amp, 12/24 volt output. (Fuse F1 is located on Base board.) Two terminals (TB1-17 and -18) are connected to this 10 amp circuit.

B+ Switched: This is a fused 5 amp, 12/24 volt switched output. This output is activated when the control receives a run command. (Fuse F2 is located on Base board.)

Control Relays (K10, K11, K12) (Optional)

⚠ CAUTION ***Damage to the Base board can occur if the voltage suppressors (Figure 5-8) are not installed across relay coil terminals A1/A2, before connecting genset battery cables.***

The three optional control relays are rail mounted inside the control panel box.

These relays (Figure 5-8) are used to control auxiliary equipment, such as fans, pumps and motorized air dampers. Energizing of the relays is user definable (refer to *TB1 Customer Outputs* in this section for customizing information.)

The contacts are rated at 10 amps at 600 VAC.

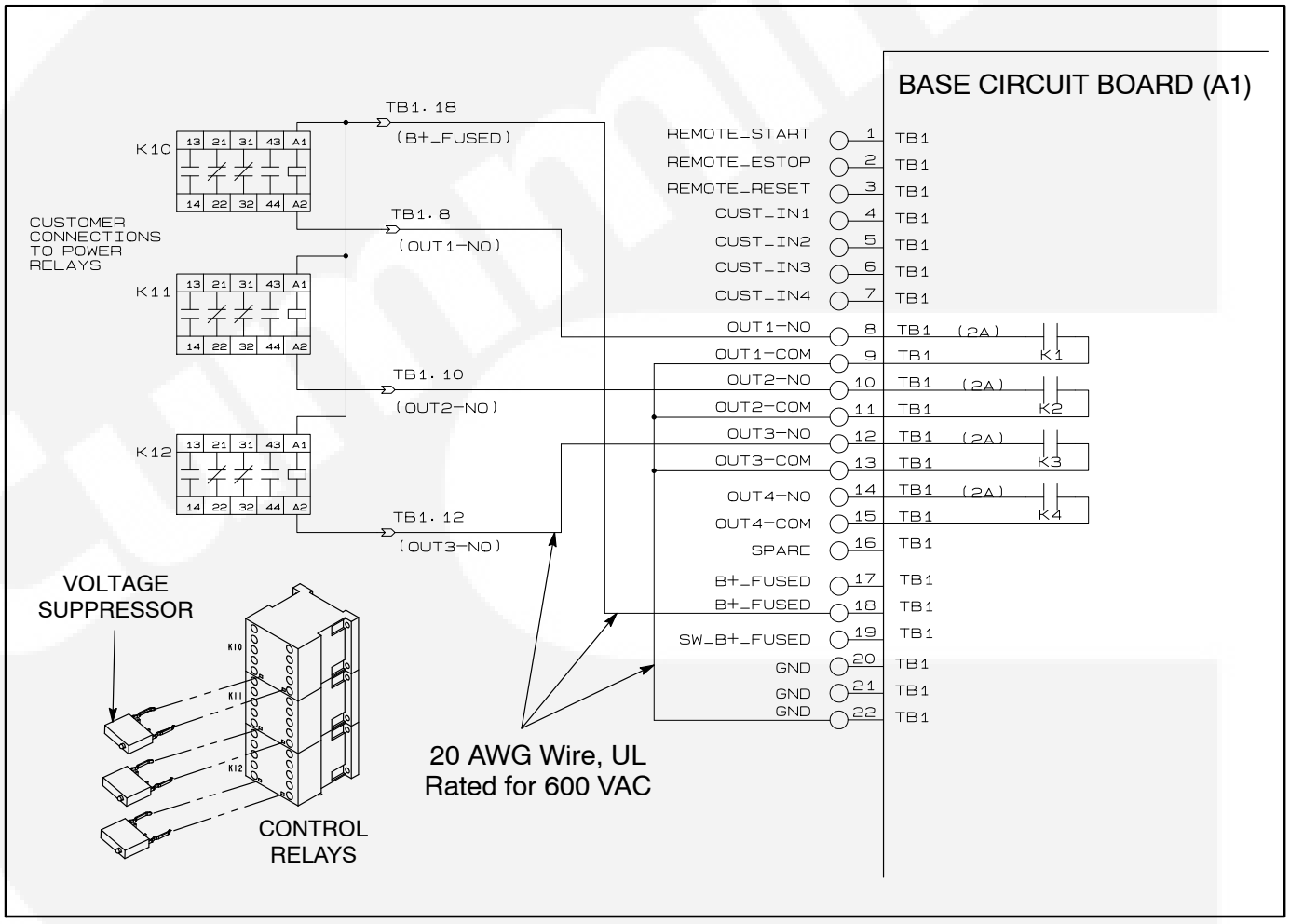

FIGURE 5-8. OPTIONAL CONTROL RELAYS (K10, K11, K12)

CURRENT TRANSFORMER (CT) INSTALLATION

Current transformers (CT's) are required on gensets for AC metering. The CT's must be installed as noted in the following *CT Installation Requirements*. Improper installation of CT's will cause a "1459 Reverse Power" shutdown error.

Refer to the Reconnection Diagram to identify the output leads/phase that must be routed through each CT, and also appropriate transformer post selection for meter sensing leads. The transformers are labeled CT1, CT2 and CT3 on the reconnection wiring diagram. (The Reconnection Diagram is located on the upper side cover of the control housing.)

CT Installation Requirements

A. The CT has a dot on one side. This dot must be facing toward the generator. A dot is also used to indicate pin 1 of the CT.

B. CT1 – U load leads (A phase)
CT2 – V load leads (B phase)
CT3 – W load leads (C phase)

C. Route the appropriate leads through each CT.
   - 6 lead generator sets – generator output leads are routed through the CT's.
   - 12 lead generator sets – load wires are routed through the CT's.

D. The CT's have dual secondaries (3 pins marked X1, X2 & X3). (Refer to Reconnection Diagram.)
   - X1 & X2 for above 300 volts L–L
   - X1 & X3 for below 300 volts L–L

   Non-reconnectable gensets (6 leads) have single secondary CT's (2 pins).
   - The lead from CT terminal #1 connects to the metering circuitry.
   - The lead from CT terminal #2/3 connects to ground.

6. Servicing the Generator

GENERAL

This section describes how to isolate a voltage fault to the Base board or generator, test the generator windings, and disassemble and reassemble the generator (Figure 6-1).

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service.***

⚠WARNING ***HAZARDOUS VOLTAGE. The PCC control box must be opened only by technically qualified personnel. Voltages of up to 600 VAC are present in the PCC box. These voltages can cause electrical shock, resulting in personal injury.***

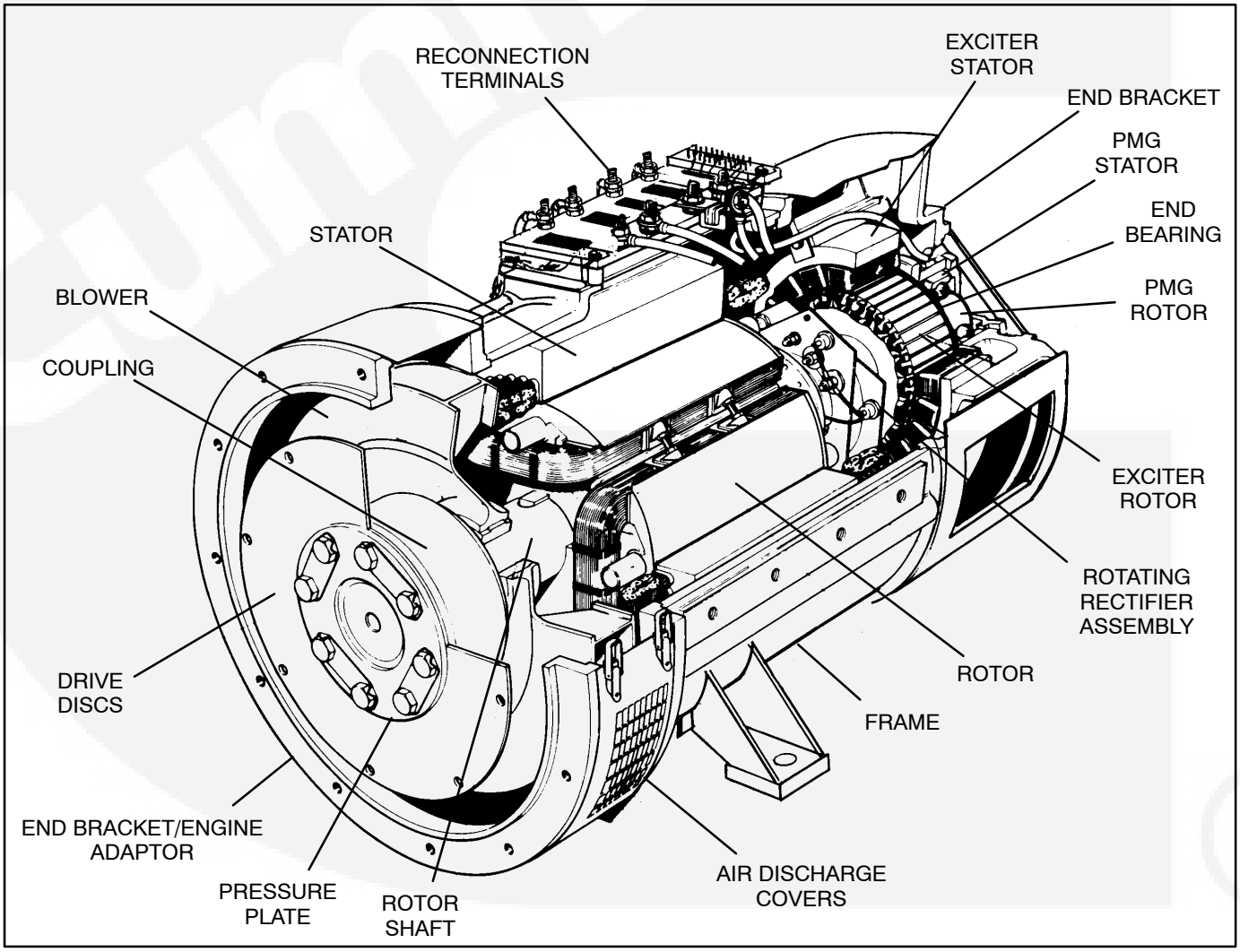

FIGURE 6-1. TYPICAL GENERATOR

GENERATOR/BASE BOARD ISOLATION PROCEDURE

The following procedure is used to determine if the generator or the control Base board is causing a high/low AC voltage shutdown fault.

1. Throw the line circuit breaker **OFF** and shut down the set.

   ⚠ CAUTION ***This test involves unregulated excitation of the generator. To prevent damage to the generator due to overcurrent, make sure that all loads have been disconnected and that all faults have been cleared from the power output terminals of the generator.***

   ⚠ WARNING ***HAZARDOUS VOLTAGE. Touching uninsulated parts inside the control housing and power output boxes can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.***

   Stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and use tools with insulated handles.

2. Remove the side access cover of the control housing to access the exciter stator leads (**X** and **XX**). Disconnect the **X** and **XX** leads from the AC harness (quick connect type connectors).
3. Prepare to measure output voltage across the generator terminals while the set is running.
4. Bring two jumpers from a 12 volt battery for connection to the excitor stator **X** (Field +) and **XX** (Field –) leads.

   Connect the jumper from the positive (**+**) post of the battery to the **X** lead. Be prepared to connect the jumper from the negative (**–**) post of the battery to the **XX** lead.
5. Check polarity again. Polarity must be correct or this test will be inconclusive because the induced and residual magnetic polarities in the exciter stator will be opposed.

   Genset may shut down on a fault condition within 5 to 15 seconds due to the excitor stator leads being disconnected from the Base board. Clear fault and start genset to check next phase.
6. Start the set and connect the jumper from the battery negative (–) terminal to the **XX** lead.
7. The generator circuitry is probably okay if rated output voltage or higher is obtained and the voltages for all phases are balanced when the exciter is powered by a 12 volt battery. Refer to *Section 4* to troubleshoot the PCC control circuitry. (Normal excitation voltage ranges from approximately 10 VDC at no-load to approximately 40 VDC at full–load.)
8. If the voltages are unbalanced, troubleshoot the main stator first. If the voltages are uniformly low, troubleshoot the exciter and field circuits first. Perform the *Winding Resistance Test* procedure for the desired windings as noted in this section.

TESTING THE GENERATOR

These tests can be performed without disassembling the generator. Before starting tests, disconnect the negative (–) cable from the battery to make sure the engine will not start while performing these tests.

⚠ CAUTION ***Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Fault code 1117 may display and engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. See fault code 1117 in Section 4 to reset ECM.***

⚠ 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 starting, disconnect the negative (–) cable from the battery to make sure the set will not start while working on it.

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. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (–) battery cable from the generator set starting battery.

Insulation Resistance Testing

The insulation resistance test should be performed when low winding insulation is suspected, e.g. damp or wet windings.

A 500 VAC megger is recommended for insulation testing. A test consists of applying the test potential between the winding and ground (winding laminations).

Resistance values of at least 5 megohms should be obtained for a new generator with dry windings. For a generator that has been in service, the resistance reading should not be less than 1 megohm.

If low readings are obtained, the cause should be investigated and corrected before the generator set is returned to service.

If moisture is determined to be the cause of low test readings, a winding drying process will be required.

Megger Testing:

1. Disconnect plug **P8** from the Base board.
2. Disconnect the AC control input leads from the generator output terminals. The AC control leads are marked 5, 6, 7 and 8. Refer to the appropriate *Reconnection Diagram* in *Section 8*.
3. If the RTD (resistive thermal device) option is installed, ground all six RTD temperature leads. Each RTD has three leads, one red and two white leads. Total of 18 leads must be grounded. Refer to *Customer Connections Diagram* in *Section 8*.
4. Perform the *Insulation Resistance Test* procedure for the desired windings as noted in this section.

Drying the Windings: If low readings are obtained or the set has been in standby for a long time in high humidity conditions, the windings should be dried out and the test repeated. Use the generator heaters (if so equipped) or blow warm air through the generator from front (exciter end) to back with a fan.

Exciter Stator

Testing Winding Resistance: Measure winding resistance with a Wheatstone bridge or digital ohmmeter. Replace the stator if winding resistance is not as specified by Table 6-1.

Testing Winding Insulation Resistance: Disconnect exciter stator leads **F1** and **F2** from their connectors in the AC wiring harness and isolate them from ground. Connect either one to the megger and conduct the test as instructed under *Insulation Resistance Testing.*

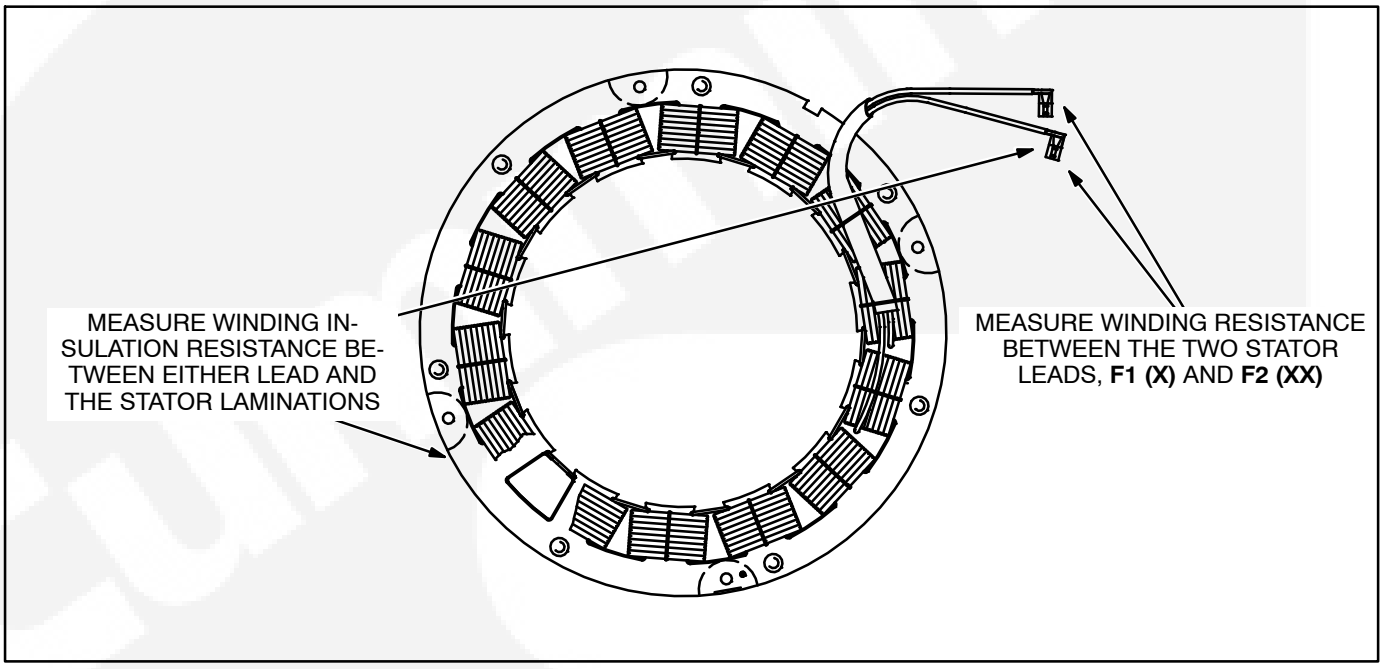

FIGURE 6-2. TESTING THE EXCITER STATOR

Exciter Rectifier Bridge (Rotating Rectifier Assembly)

The exciter rectifier bridge is mounted on the exciter rotor, inboard, facing the main rotor. It consists of a positive plate and a negative plate, split diametrically. Each carries three diodes, three terminal posts for connecting exciter rotor leads to the diode pigtails and a terminal for the main rotor (generator field) lead. A surge suppresser is connected across the two plates to prevent transient voltages that could damage the diodes.

Testing Diodes: Disconnect the diode pigtails from the terminal posts. Using an ohmmeter, measure electrical resistance between each diode pigtail and the plate on which the diode is mounted. Reverse the meter test probes and repeat the tests. The electrical resistance across each diode should be high in one direction and low in the other. If the resistance is high or low in both directions, replace the diode.

Replacing Diodes: Make sure the replacement diode is of the correct polarity. Disconnect the pigtail from the terminal post and unscrew the old diode. Apply heat-sink compound under the head of the diode. Make sure the compound does not get on the threads. Torque the diodes to 36 to 42 in-lbs (4 to 4.8 Nm) and the pigtail terminals to 24 in-lbs (2.7 Nm) when reassembling.

Surge Suppresser Testing and Replacement: Remove the suppresser. Replace the suppresser if it appears to have overheated or if ohmmeter readings indicate less than infinite resistance (end of scale) in both directions. Torque the terminals to 24 in-lbs (2.7 Nm) when reassembling.

⚠ CAUTION ***Layers of dust can cause diodes to overheat and fail. Inspect diodes during generator maintenance and clean if necessary, using a brush or dust remover spray.***

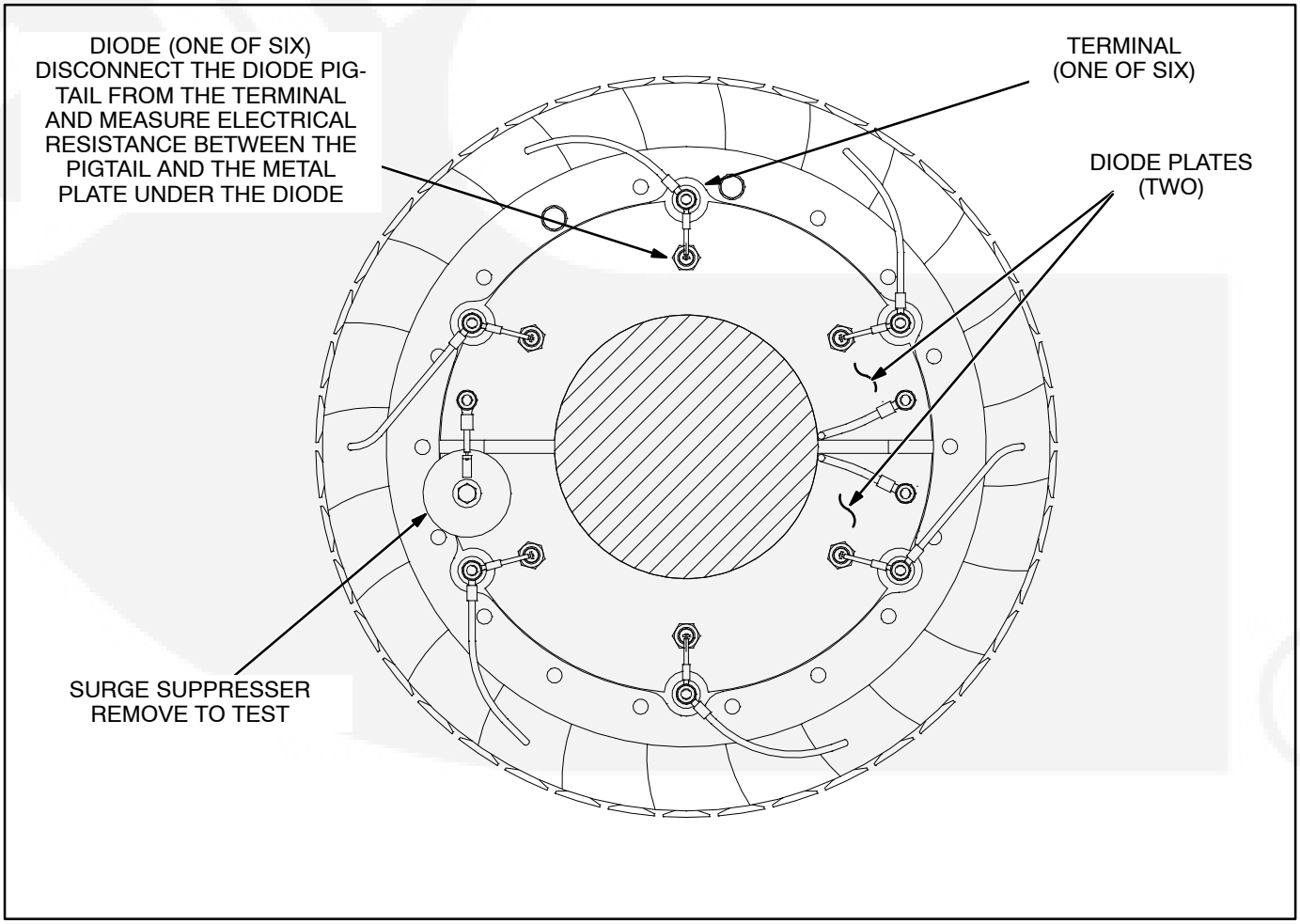

FIGURE 6-3. TESTING THE ROTATING RECTIFIER ASSEMBLY

Exciter Rotor

Testing Winding Resistance: Disconnect the six rotor winding leads from the terminal posts on the rectifier assembly. With a Wheatstone bridge, measure electrical resistance across each pair of rotor windings: **U** (CR1 or CR4) and **V** (CR2 or CR5), **V** (CR2 or CR5) and **W** (CR3 or CR6), **W** (CR3 or CR6) and **U** (CR1 or CR4). See the winding schematic. Replace the whole rotor shaft assembly if the resistance of any winding is not approximately 0.136 ohms.

Testing Winding Insulation Resistance: Connect any lead to the megger and conduct the test as instructed under *Insulation Resistance Testing.*

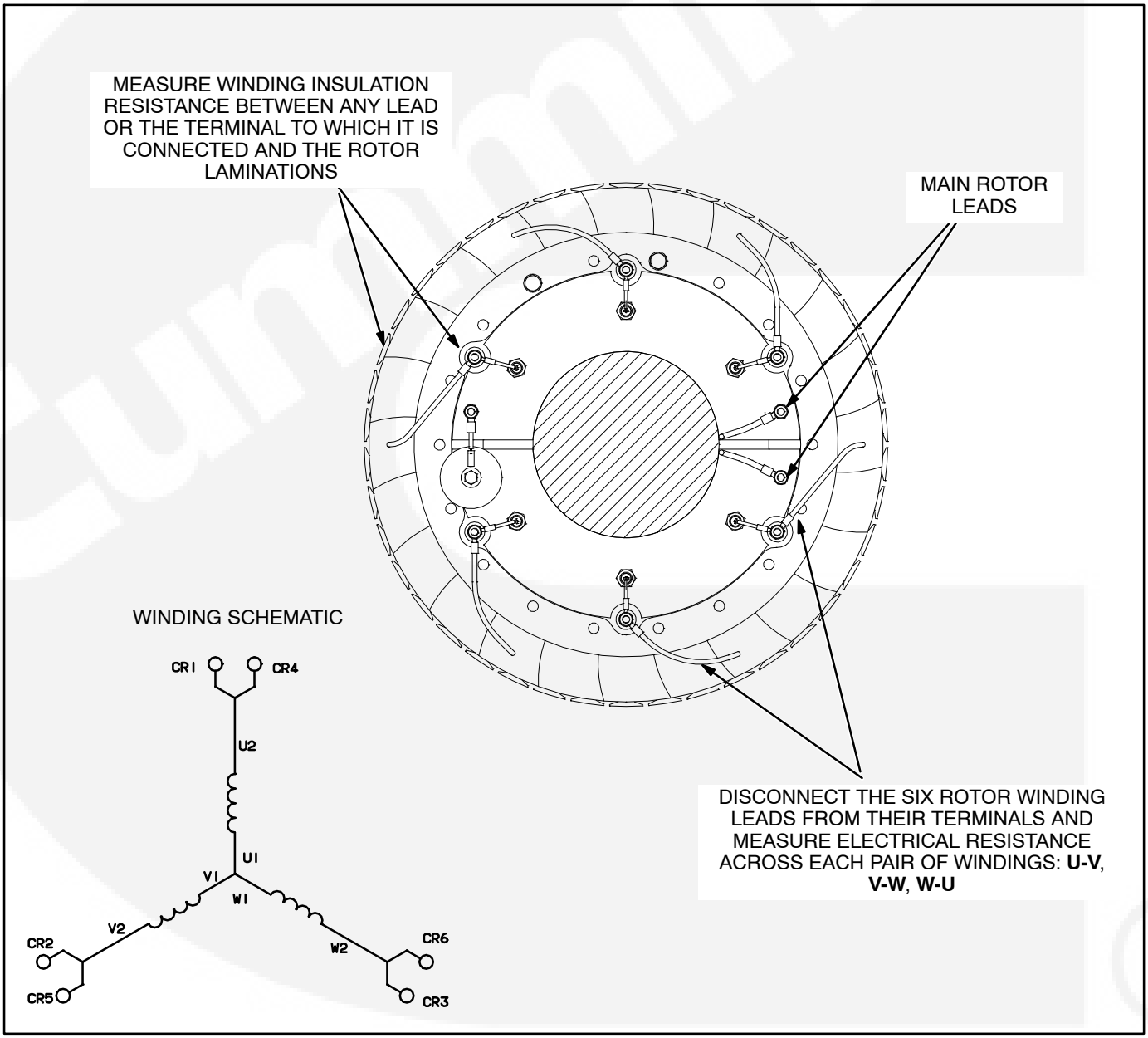

FIGURE 6-4. TESTING THE EXCITER ROTOR

Main Rotor (Generator Field)

Testing Winding Resistance: Disconnect the two leads of the main rotor from the terminals on the rotating rectifier assembly. See Figure 6-4. Measure electrical resistance between the two leads with a Wheatstone bridge or digital ohmmeter. Replace the rotor if the resistance is not as specified in Table 6-1. Connect the rotor leads and torque the terminals to 24 in-lbs (2.7 Nm) when reassembling.

Testing Winding Insulation Resistance: Connect either lead to the megger and conduct the test as instructed under *Insulation Resistance Testing.*

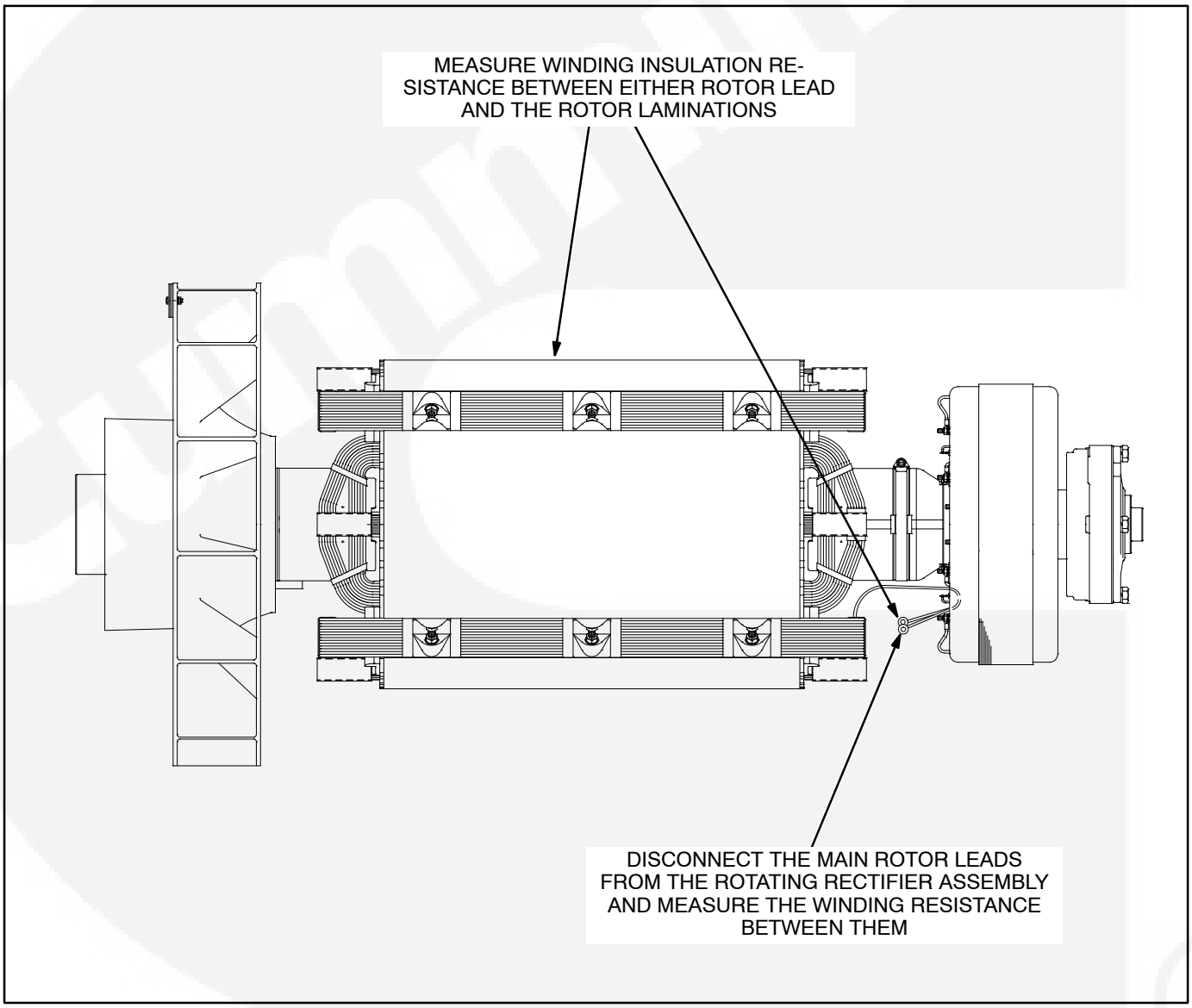

FIGURE 6-5. TESTING THE MAIN ROTOR

Main Stator

Winding Insulation Resistance: Test each winding separately. Disconnect the winding lead from its grounded neutral connection and isolate it (see reconnection drawing). Leave the other windings grounded. Connect either or both winding leads to the megger and conduct the test as instructed under *Insulation Resistance Testing*.

Winding Resistance: Disconnect all main stator leads from the terminals to which they are connected. Using a Wheatstone bridge having at least 0.001 ohm precision, measure electrical resistance across each pair of stator leads (see reconnection drawing). Replace the stator if the resistance of any winding is not as specified in Table 6-1.

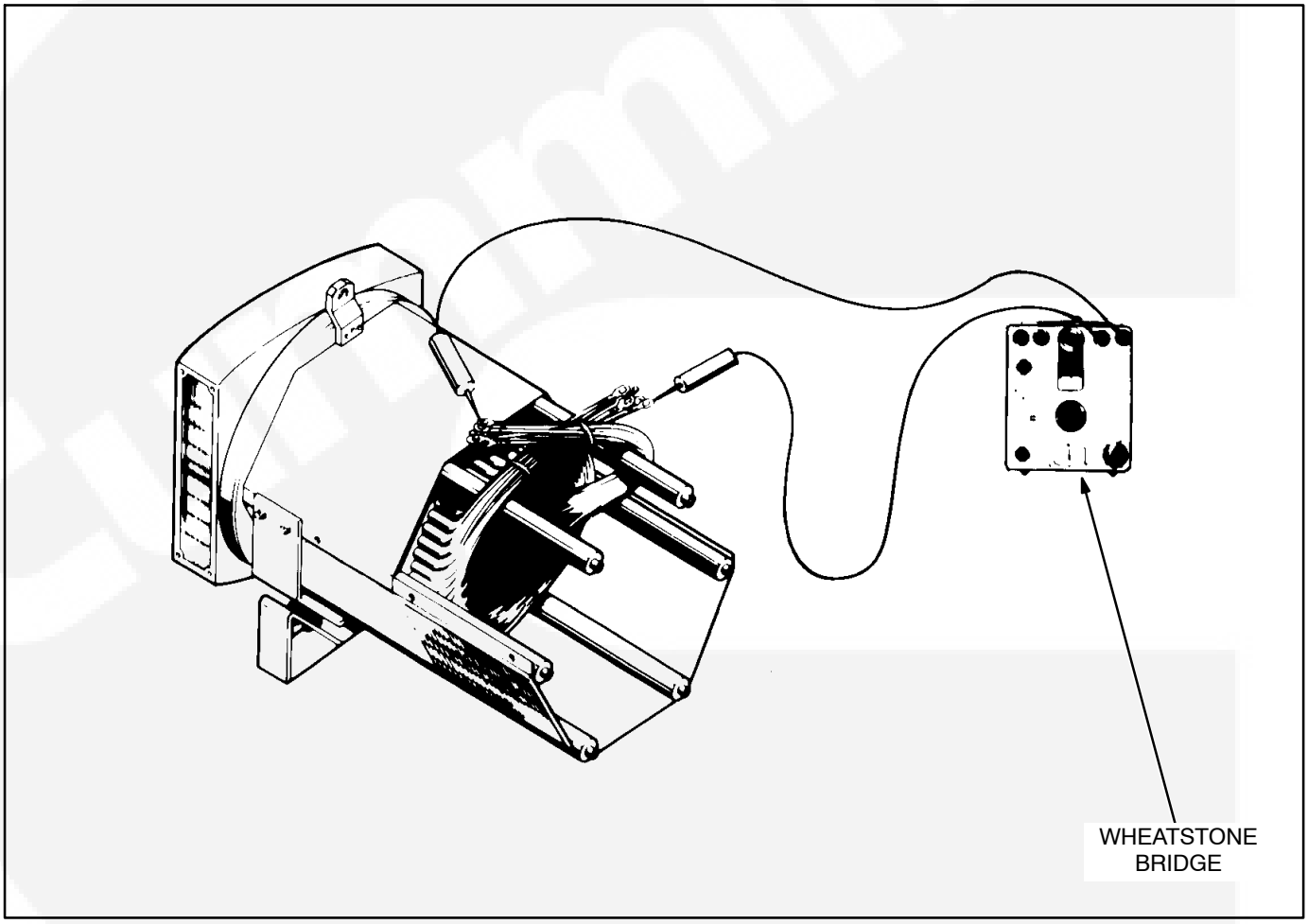

FIGURE 6-6. TESTING THE GENERATOR STATOR

TABLE 6-1. WINDING RESISTANCE VALUES*

FRAME SIZE	EXCITER STATOR	EXCITER ROTOR	MAIN ROTOR	MAIN STATOR			
				WINDING 11	WINDING 12	WINDING 17	WINDING 07
4C	18	0.136	0.91	0.0085	N/A	0.0115	N/A
4D	18	0.136	1.04	0.007	N/A	0.01	N/A
4E	18	0.136	1.17	0.0055	N/A	0.0075	N/A
4F	18	0.136	1.35	0.005	N/A	0.0052	N/A

***** Resistance figures are approximate, at 68° F (20°C) ± 10%.

TESTING THE PMG

1. Disconnect PMG leads **PMG 2**, **PMG 3** and **PMG 4** from their connectors in the AC harness. (AC harness quick connect terminals are located inside control housing.)
2. Start the generator set and let the speed stabilize.

   ⚠WARNING ***HAZARDOUS VOLTAGE. Touching uninsulated parts inside the control housing and power output boxes can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.***

   Stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and use tools with insulated handles.

3. Measure voltage across lead pairs **PMG 2 & PMG 3**, **PMG 3 & PMG 4** and **PMG 4 & PMG 2**. Voltage should be at least 150 VAC for 50 Hz sets and at least 180 VAC for 60 Hz sets, and should be approximately the same for each set of leads. If the voltages are low or uneven, check all the leads and connections between the voltage regulator and the PMG and repair as necessary before disassembling the PMG.
4. Stop the set and measure electrical resistance across lead pairs **PMG 2 & PMG 3**, **PMG 3 & PMG 4** and **PMG 4 & PMG 2** with a Wheatstone bridge or digital ohmmeter. Each winding should have a resistance of approximately 4.6 ohms.

BEARING INSPECTION/REMOVAL/REPLACEMENT

The end bearing is enclosed in a pre-packed machined cartridge.

Bearing Inspection: If a situation occurs which allows an opportunity to visually inspect the end bearing with it installed, check the color of the grease. The color of the grease is the only indication that can be used to determine if the bearing is defective.

New grease is a whitish-beige color but some mild discoloration will occur with use. If the grease shows signs of gross discoloration, the bearing should be replaced.

Bearing Removal: The bearing is press fitted onto the shaft and can be removed with standard workshop tools (i.e., two or three legged manual or hydraulic bearing pullers). The bearing should only be removed for replacement (bearing is destroyed during removal and must be replaced).

The end bearing is enclosed in a pre-packed cartridge housing and must only be dismantled as necessary for relubrication, replacement, or when a major overhaul is carried out on the generator set.

Bearing Removal

1. Remove the generator endbracket.
2. Remove the four screws holding bearing cap
3. Remove cap.
4. Remove circlip.
5. Remove bearing cartridge housing complete with bearing.

Bearing Replacement

When replacing bearing onto rotor shaft, be sure to apply pressing force to the inner face of the bearing only.

Bearing Lubrication

When re-lubricating or replacing the bearing, review the following.

- Recommended Lubricant: Lithium based grease, Mobilux No. 2 or Shell Alvania R3.
- Temperature Range: -22°F to +248°F (-30°C to +120°C).
- Quantity: 2.74 oz. (81 ml). The grease should be equally divided between the bearing, the bearing cap cavity, and the bearing cartridge cavity.

GENERATOR DISASSEMBLY

The following procedures provide information for removal and reassembly of the generator PMG exciter, control housing, and stator/rotor assemblies. Be sure to read through this section first, before performing procedures listed, to determine the steps most appropriate for the service attention required.

Permanent Magnet (PMG) Removal

⚠ CAUTION ***Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Fault code 1117 may display and engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. See fault code 1117 in Section 4 to reset ECM.***

⚠ 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.***

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. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (–) battery cable from the generator set starting battery.
5. Remove the PMG cover and disconnect the leads at the connector (Figure 6-7).
6. Remove the bolts and clamps that secure the PMG stator to the generator frame and carefully pull away the stator.

   The rotor is magnetic and will attract the stator. Hold the stator firmly so that the windings are not damaged by striking the stator support lugs.
7. Remove the rotor center bolt and pull away the rotor. The rotor is magnetic and will attract iron fillings. Put in a clean plastic bag until it is remounted. Do not take it apart or it will lose its magnetism. Also, if the dowel pin in the end of the shaft is loose, stow it in a safe place until it is time to reassemble the PMG.

   ⚠ CAUTION ***The rotor assembly must not be dismantled, or the magnetic properties will be destroyed.***

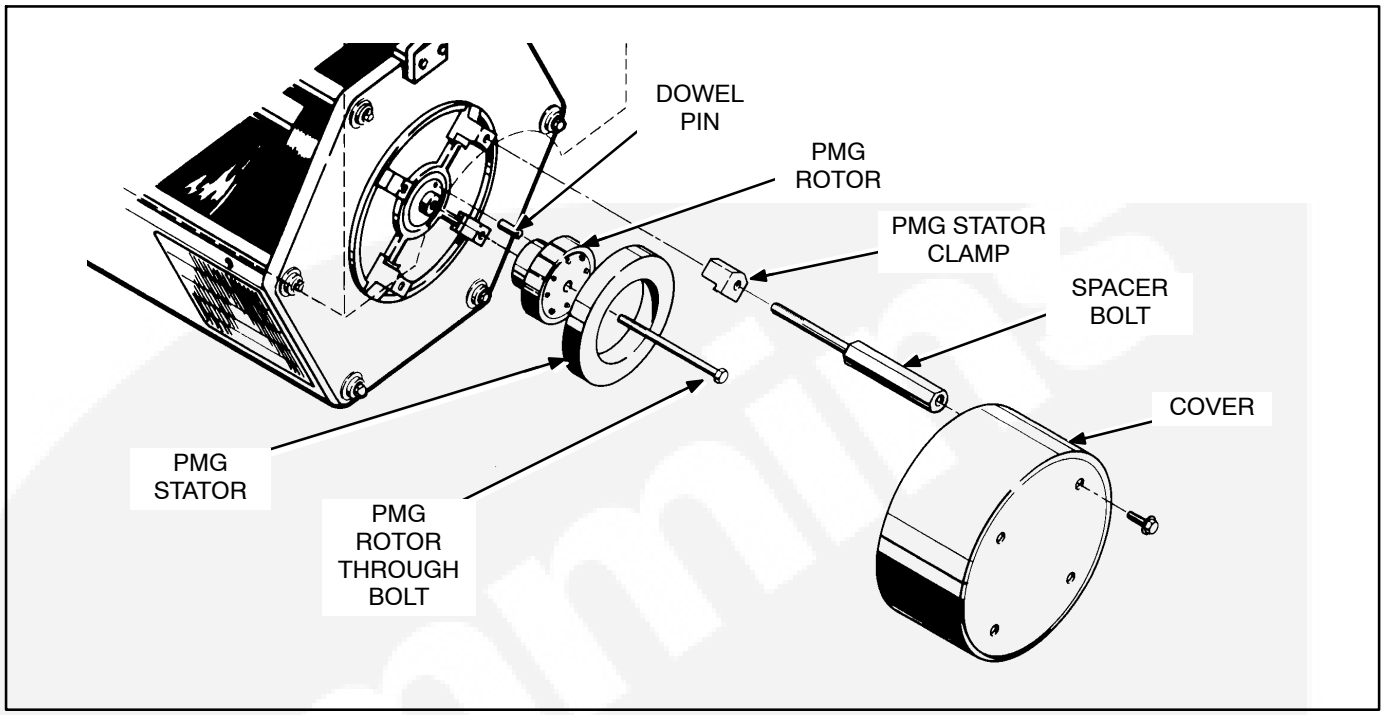

FIGURE 6-7. PMG ASSEMBLY

Permanent Magnet (PMG) Installation

1. Install the complete rotor assembly to the end of the main rotor shaft using the hex head through-bolt. Keep the rotor clean by avoiding contact with metal dust or particles.
2. Carefully locate the stator housing to position on the generator endbracket. Fasten in place using the 4 bolts and clamps, and tighten securely.

   The highly magnetic rotor will attract the stator core, care must be taken to avoid any contact which may damage the windings.
3. Connect the PMG wiring harness connector.
4. Install the PMG assembly cover using the three M5x12mm capscrews and lockwashers, and tighten securely.

Main Stator and Rotor Removal

1. Remove the PMG, refer to *Permanent Magnet PMG Removal,* earlier this section.
2. Remove the access covers from control housing and generator (see Figure 6-8).
3. Disconnect all load wires from the reconnection terminal block assembly. If equipped with the circuit breaker option, disconnect load wires from circuit breaker. Check that all leads are labeled to ease reassembly.
4. Disconnect the remote control wiring and conduit. For reconnections later, make sure each wire is clearly marked to indicate the correct terminal.
5. Disconnect all engine wiring harness connections in the generator control and output boxes. For reconnections later, make sure each wire is clearly marked to indicate the correct terminal.

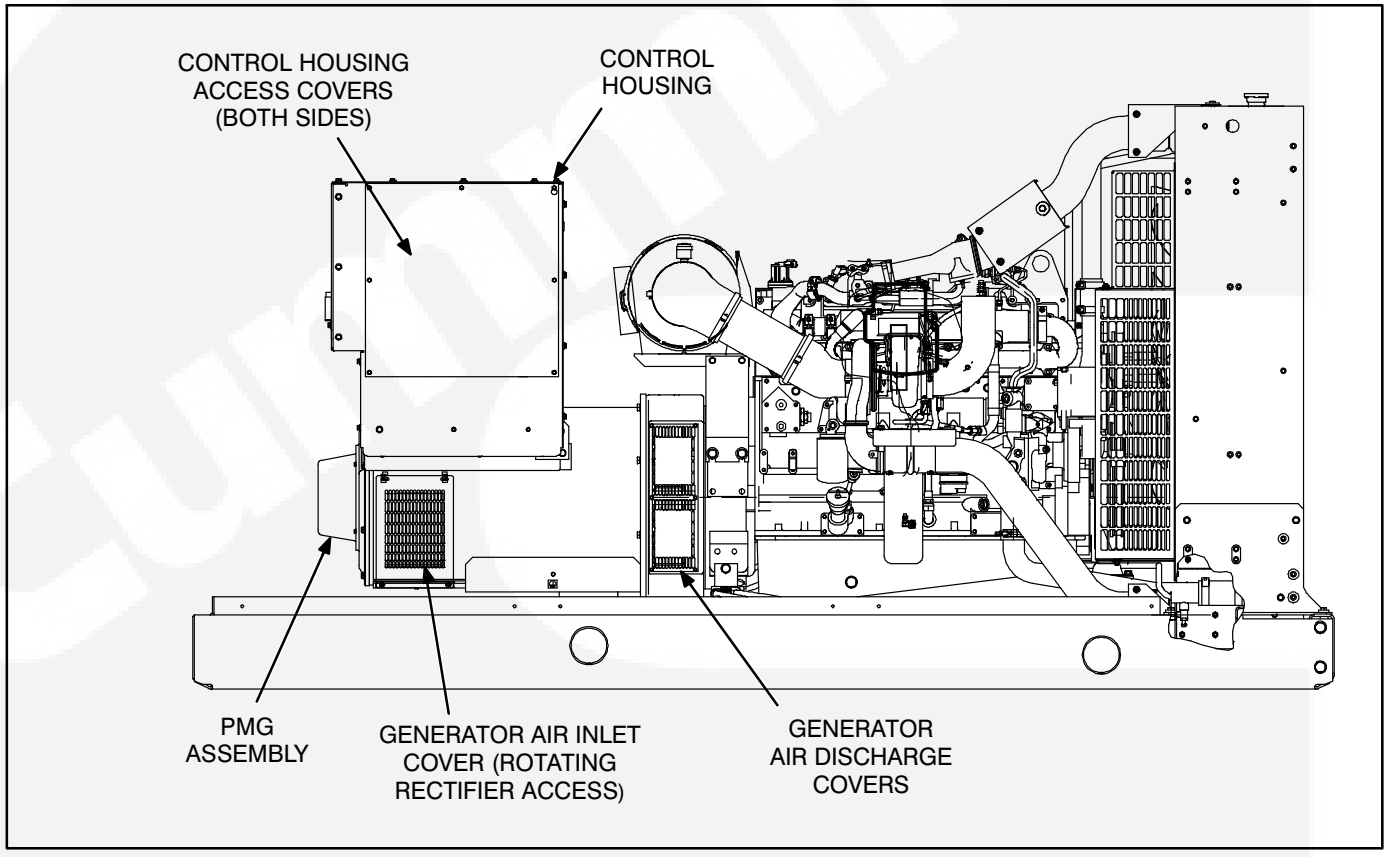

FIGURE 6-8. GENERATOR AND CONTROL HOUSING ASSEMBLY

6. Use a hoist or similar lifting device to support the control housing assembly (see Figure 6-9).

   ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

7. Loosen the fasteners that secure the control housing side and bottom panels to generator. Make sure that hoisting device is controlling weight of control housing assembly.
8. Remove control housing fasteners, and remove the control housing assembly from the generator. Replace panel fasteners to their respectable positions for safe keeping, and tighten finger-tight.
9. Remove control housing mounting brackets from both sides of generator, and assemble lifting eyes to generator.
10. Remove as necessary, air intake components to engine that may interfere with disassembly and reassembly of generator. Cover intake opening to prevent debris from entering engine induction system.

    ⚠ CAUTION ***Do not use fan blade to bar over engine. That can damage blades and cause property damage and personal injury.***

11. Crank or bar the engine/generator to position the rotor such that a full pole face is at the bottom of the main stator core. Proper positioning can be viewed through the generator access openings. Refer to engine service manual for proper cranking or barring procedure.

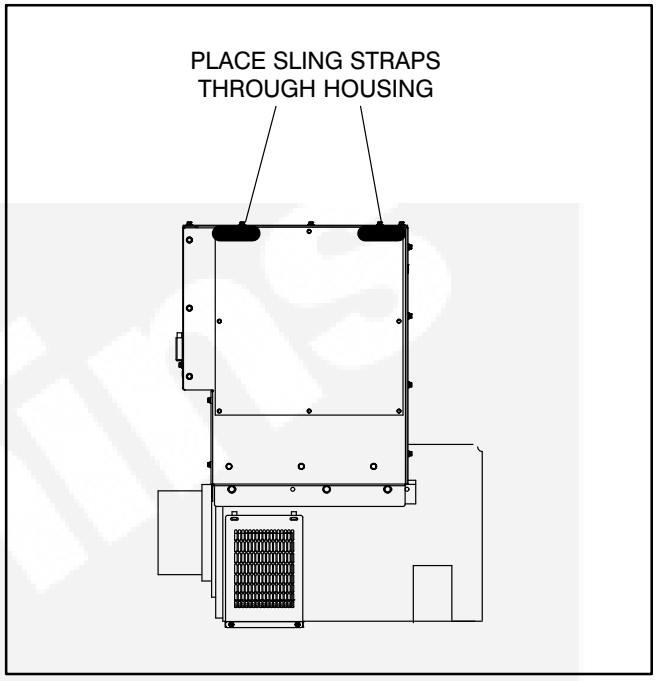

FIGURE 6-9. REMOVING CONTROL HOUSING

To remove the stator and rotor at the same time, skip to step 29. To remove the stator and rotor individually, continue with step 12.

12. Remove the four bolts retaining the bearing cartridge housing in the endbracket (outer four bolts).
13. Remove the eight bolts holding the endbracket to the generator housing.
14. Insert two bolts (M10) in the two holes provided for “jacking” purposes, on the endbracket center line. Screw bolts in until endbracket spigot is clear of locating recess.
15. Carefully tap the whole assembly off the bearing cartridge housing, ensuring the endbracket is supported to prevent the exciter stator from damaging the windings on the exciter rotor.

⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

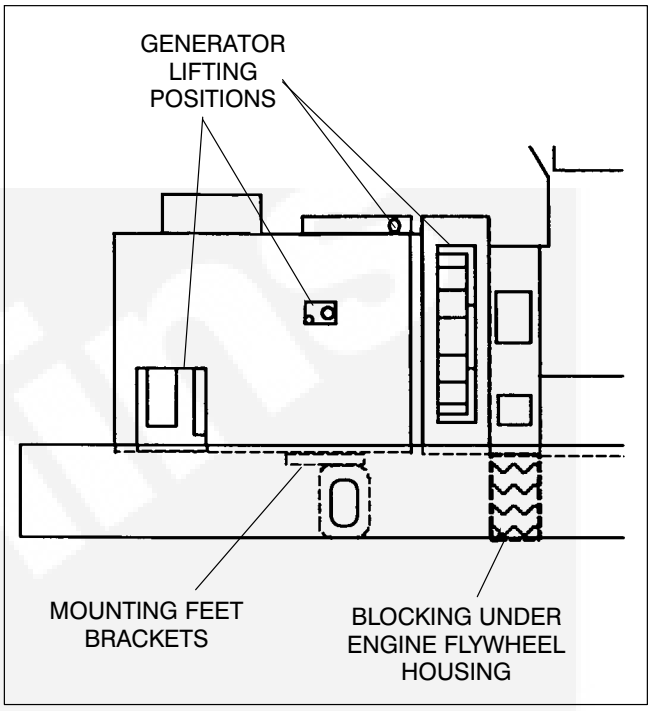

FIGURE 6-10. GENERATOR LIFTING POSITIONS

16. The exciter stator is now accessible for inspection and removal from endbracket/engine adaptor.
17. The end bearing can now be removed if required. Refer to Bearing Removal in this section.
18. Remove the fasteners from the two generator mounting feet brackets.
19. Using an adequate lifting device, lift the generator (at lifting eyes provided, and main stator housing) until the mounting feet brackets are clear of the frame member (see Figures 6-10 and 6-11).

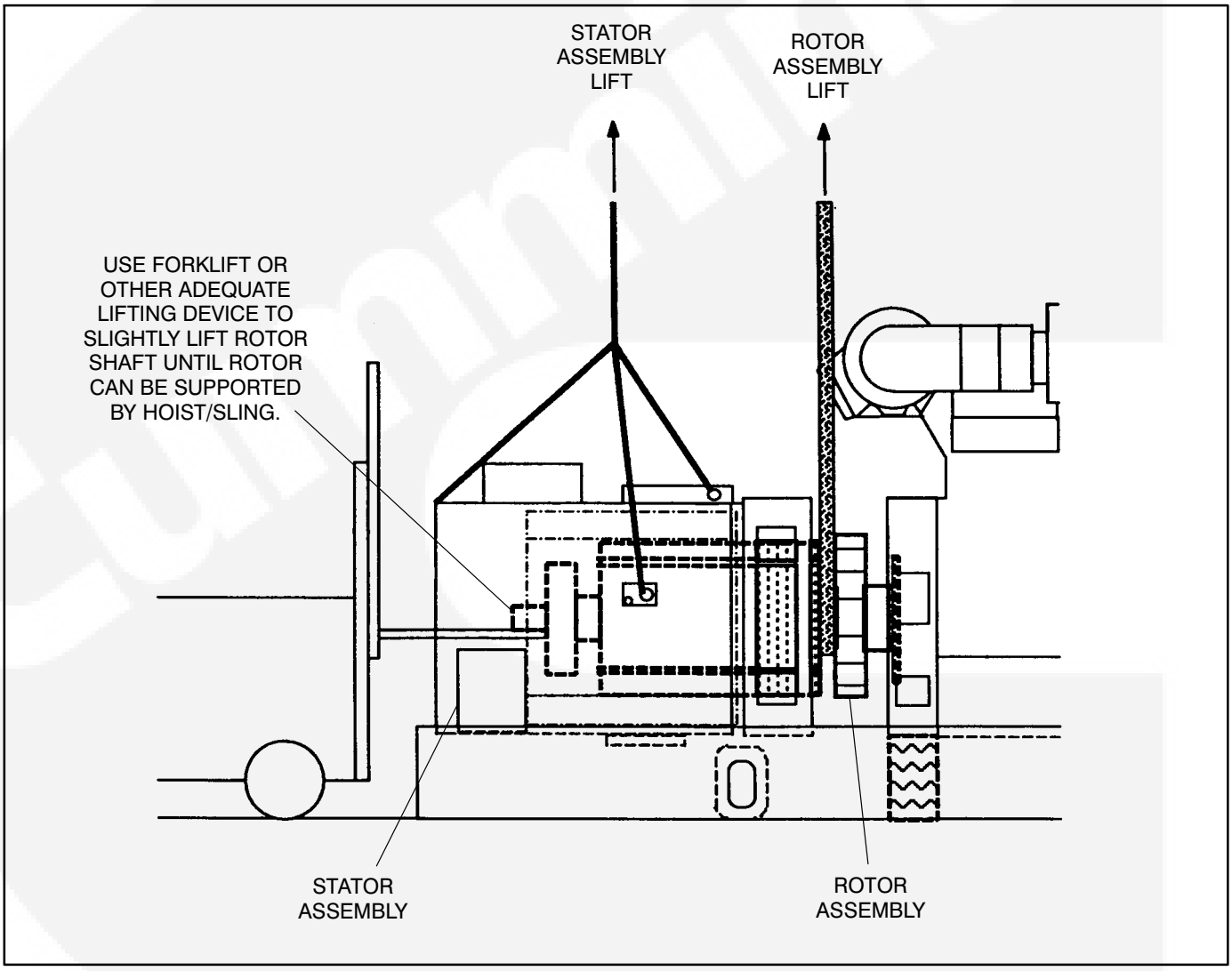

FIGURE 6-11. REMOVING STATOR ASSEMBLY

⚠WARNING ***Improper support of engine when generator is removed, will allow the engine to fall (tip), causing personal injury and/or damage to generator set. The generator provides structure to hold the engine in the upright position. Removing the generator compromises the ability of the engine to stay upright. To avoid this hazard, make sure support blocks are properly positioned under engine flywheel housing and support engine with adequate lifting device.***

20. If the engine does not have chassis mounts at generator end, block the rear of the engine in place by supporting the flywheel housing. A length of steel channel and wooden blocking is required to support the rear of the engine. Place the channel and blocking under the flywheel housing. Lower the generator until most of the genset weight is supported by the blocking (see Figure 6-10). Use additional hoist to support top of engine.
21. Disconnect the grounding strap from the flywheel housing.
22. Using a forklift, position a lifting bar of the forklift (inside and inline with the generator) under the rotor shaft. Lift the rotor shaft slightly so that rotor is not resting on inside of stator assembly. See Figure 6-12.
23. Verify that the stator is adequately supported and then carefully remove the capscrews from the stator attachment ring.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

    ⚠CAUTION ***Improper stator assembly rigging and handling can result in damage to stator and rotor assemblies. Lifting eyes may not be at center-of-gravity position of stator assembly. Therefore, lifting and moving the stator assembly alone, by hoisting at lifting eyes only, presents the hazard of load imbalance; allowing one end to drop and other end to rise. Make sure the stator is adequately hooked/strapped to maintain level control of stator assembly while lifting and moving.***
24. Being careful not to drag the windings on the rotor, move the stator assembly sufficiently away from engine to sling and support the rotor assembly. Do not allow rotor assembly to hang on engine flywheel.

    ⚠CAUTION ***Drive disc damage can be caused by allowing the rotor assembly to hang on flywheel. Use adequate hoist and sling to support the rotor assembly.***
25. Reposition or add hoist and sling support for the main rotor, and remove the forklift. See Figure 6-12, Rotor Lift detail.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***
26. Remove the stator assembly, being careful not to drag the windings on the rotor. Place stator assembly away from the chassis in the horizontal position.
27. Using the hoist and sling to support the rotor, carefully remove the capscrews and flat washers that secure the drive discs to the engine flywheel.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***
28. Remove the rotor assembly and place it on wood blocks in the horizontal position. To avoid possible distortion, do not allow the drive discs or fan to rest on anything.

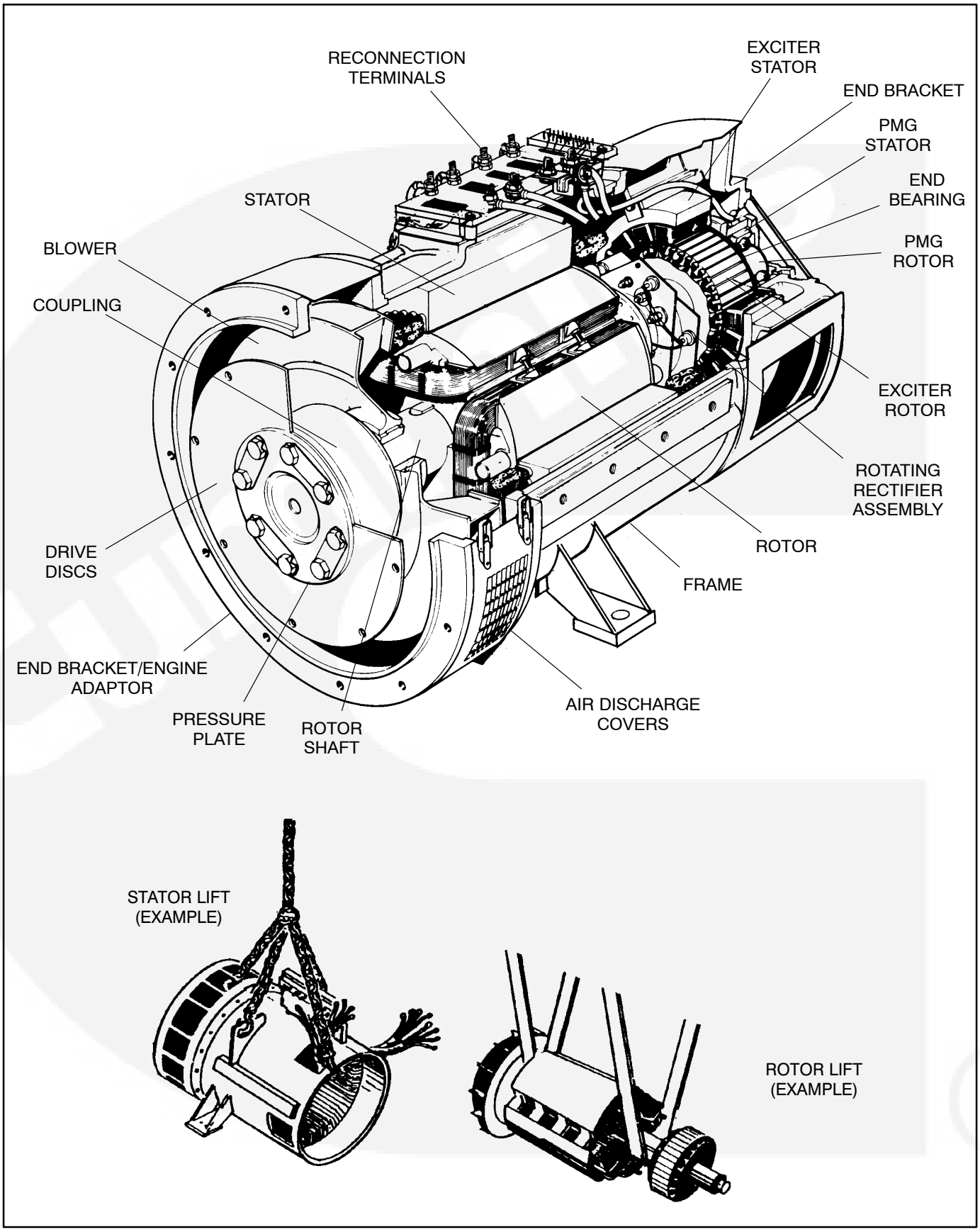

FIGURE 6-12. TYPICAL GENERATOR ASSEMBLY

Generator Assembly Removal

29. Remove the fasteners from the two generator mounting feet brackets.

30. Using an adequate lifting device, lift the generator (at lifting eyes provided, and main stator housing) until the mounting feet brackets are clear of the frame member (see Figure 6-10).

    ⚠WARNING ***Improper support of engine when generator is removed, will allow the engine to fall (tip), causing personal injury and/or damage to generator set. The generator provides structure to hold the engine in the upright position. Removing the generator compromises the ability of the engine to stay upright. To avoid this hazard, make sure support blocks are properly positioned under engine flywheel housing and support engine with adequate lifting device.***

31. If the engine does not have chassis mounts at generator end, block the rear of the engine in place by supporting the flywheel housing. A length of steel channel and wooden blocking is required to support the rear of the engine. Place the channel and blocking under the flywheel housing. Lower the generator until most of the set weight is supported by the blocking (see Figure 6-10). Use additional hoist to support top of engine.

32. Disconnect the grounding strap from the flywheel housing.

33. Carefully remove the capscrews and flat washers that secure the drive discs to the engine flywheel.

34. Verify that the generator assembly is adequately supported. Carefully remove the capscrews securing the engine adaptor endbracket to the engine flywheel housing.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

    ⚠CAUTION ***Improper generator assembly rigging and handling can result in damage to stator and rotor assemblies. Lifting eyes may not be at center-of-gravity position of stator assembly. Therefore, lifting and moving the generator by hoisting at lifting eyes only, presents the hazard of load imbalance; allowing one end to drop and other end to rise. Make sure the generator is adequately hooked/strapped to maintain level control of assembly while lifting and moving.***

35. Remove the generator assembly away from engine. Place generator assembly on floor with a piece of wood beneath the stator housing (toward PMG end) to allow for endbracket removal, if desired.

GENERATOR REASSEMBLY

Generator reassembly is the reverse of disassembly procedure.

To assemble the stator and rotor at the same time, continue with step 1. To assemble the stator and rotor individually, skip to step 17.

1. Using an adequate lifting device, locate the generator assembly into position near the engine flywheel housing. Align the holes of the rotor drive discs with the holes of the engine flywheel. Install the capscrews and flat washers that secure the drive discs to the engine flywheel, hand tighten.

   ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

   ⚠ CAUTION ***Improper generator assembly rigging and handling can result in damage to stator and rotor assemblies. Lifting eyes may not be at center-of-gravity position of stator assembly. Therefore, lifting and moving the generator by hoisting at lifting eyes only, presents the hazard of load imbalance; allowing one end to drop and other end to rise. Make sure the generator is adequately hooked/strapped to maintain level control of assembly while lifting and moving.***

2. Align the holes of the engine adaptor endbracket with the holes in the flywheel housing and install the capscrews and lock washers. Tighten fasteners to 35–38 ft-lbs. (48–52 N•m).

3. Secure the rotor assembly to the flywheel. Tighten fasteners to 85 ft-lbs. (115 N•m).

4. Lift the generator slightly and remove any blocking from under the flywheel housing. Lower the generator (see Figure 6-10).

5. Connect the grounding strap to the flywheel housing using a capscrew and EIT locking washer; and tighten securely.

6. Install the mounting feet bracket fasteners; and tighten securely.

   If endbracket has been removed, continue with step 7, otherwise skip to step 16.

7. Lift slightly on end of rotor shaft and install wooden shims to hold rotor on center with stator.

8. If removed, refer to B*earing Removal/Replacement* procedure in this section to install end bearing.

9. Install two threaded studs into end bearing cartridge to aid subsequent procedures. Position the end bearing cartridge assembly close to proper position for hole alignment with endbracket.

10. Assemble exciter stator, if removed, to inside of endbracket. Tighten fasteners to 4.5 ft-lbs. (6 N•m) torque.

11. Install endbracket to the stator frame using the proper capscrews and lock washers, but do not tighten securely as yet.

12. Insert and start the threads of the bearing cartridge fasteners, and remove threaded alignment studs, through the endbracket into the cartridge housing.

13. Lift slightly on endbracket and remove wooden shims holding rotor on center with stator.

14. Securely tighten the endbracket fasteners.

15. Tighten the bearing cartridge fasteners to 4.5 ft-lbs. (6 N•m) torque.

16. Install the PMG assembly, if removed. Refer to *Permanent Magnet (PMG) Installation.*

    Perform the 'Aligning Generator with Engine' procedures, later in this section, then return to the following steps.

    To assemble the control housing, skip to step 37.

    To assemble the stator and rotor individually begin here.

17. If removed, replace exciter rotor and rotating rectifier assembly to main rotor shaft. Reconnect main rotor wire leads to positive and negative terminals of rectifier assembly.

18. If removed, install the drive disk spacer, drive disc and pressure plate on the rotor shaft. Install the cap screws and flat washers and tighten to 352 ft-lbs. (476 N•m).

19. Using a hoist and sling to support the rotor, align the holes in the drive disc with the corresponding holes in the flywheel.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

20. Secure the rotor assembly drive disc to the flywheel using appropriate capscrews and flat washers. Tighten fasteners to 85 ft-lbs. (115 N•m) Do not allow rotor assembly to hang on engine flywheel.

    ⚠ CAUTION ***Drive disc damage can be caused by allowing the rotor assembly to hang on flywheel. Use adequate hoist and sling to support the rotor assembly.***

21. Reassemble engine adaptor endbracket to stator frame if removed. Using an adequate lifting device, carefully move the stator into position over the rotor assembly, being careful not to drag the windings on the rotor.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

    ⚠ CAUTION ***Improper stator assembly rigging and handling can result in damage to stator and rotor assemblies. Lifting eyes may not be at center-of-gravity position of stator assembly. Therefore, lifting and moving the stator assembly alone, by hoisting at lifting eyes only, presents the hazard of load imbalance; allowing one end to drop and other end to rise. Make sure the stator is adequately hooked/strapped to maintain level control of stator assembly while lifting and moving.***

22. Using a forklift, position a lifting bar of the forklift (inside and inline with the generator) under the rotor shaft. Lift the rotor shaft slightly so that rotor is not resting on inside of stator assembly.

23. Remove the hoist/sling support of the rotor assembly. Align the holes of the engine adaptor endbracket with the holes in the flywheel housing and install the capscrews and lock washers. Tighten fasteners to 35–38 ft-lbs. (48–52 N•m).

24. Using an adequate lifting device, slightly raise the generator so that the wooden blocking and steel channel can be removed from under the flywheel housing; then lower the generator so the full weight is resting on the generator mounting feet brackets.

25. Connect the grounding strap to the flywheel housing using a capscrew and EIT locking washer; and tighten securely.
26. Install the mounting feet bracket fasteners; and tighten securely.
27. Lift slightly on end of rotor shaft and install wooden shims to hold rotor on center with stator.
28. If removed, refer to B*earing Removal/Replacement* procedure in this section to install end bearing.
29. Install two threaded studs into end bearing cartridge to aid subsequent procedures. Position the end bearing cartridge assembly close to proper position for hole alignment with endbracket.
30. Assemble exciter stator, if removed, to inside of endbracket. Tighten fasteners to 4.5 ft-lbs. (6 N•m) torque.
31. Install endbracket to the stator frame using the proper capscrews and lock washers, but do not tighten securely as yet.
32. Insert and start the threads of the bearing cartridge fasteners, and remove threaded alignment studs, through the endbracket into the cartridge housing.
33. Lift slightly on endbracket and remove wooden shims holding rotor on center with stator.
34. Securely tighten the endbracket fasteners.
35. Tighten the bearing cartridge fasteners to 4.5 ft-lbs. (6 N•m) torque.
36. Install the PMG assembly, if removed. Refer to *Permanent Magnet (PMG) Installation*.
37. Reassemble control housing mounting brackets to sides of generator and fasten securely.

⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

38. Use an adequate lifting device to lift the control housing in position for mounting to the stator frame. Replace the capscrews and lock washers and tighten to 20 ft-lbs. (27 N•m) torque.
39. Connect all control wires and generator leads using the proper generator set AC and DC wiring diagram/schematic.
40. Reassemble any engine air intake components removed during generator disassembly.
41. Reassemble the covers over the generator air discharge openings and fasten securely.
42. Refer to *Permanent Magnet (PMG) Installation*.
43. If equipped with the circuit breaker option, reconnect load wires to circuit breaker. Reconnect all lead wires to the terminal block assembly using proper reconnection diagram in *Section 8*.
44. Verify that all connections are proper and secure and then install the air inlet panel and access covers to control housing.
45. Connect the negative (-) battery cable and test the generator set for operation. If objectionable vibration is present, refer to *Aligning Generator with Engine* procedure later this section.

ALIGNING GENERATOR WITH ENGINE

Proper alignment of the generator and engine assemblies is necessary to avoid premature wear and improper operation of the genset.

Axial Misalignment: Is the result of the generator shaft axis not aligning with engine crankshaft axis. The tolerances in the bolted flywheel and drive disc connection may add up to displace the generator axially relative to the crankshaft axis.

Axial misalignment needs to be checked only when an objectionable vibration is present.

Axial Alignment Procedure

Fasten dial indicator holding device to skid base, engine block, or generator shell with a magnetic base or clamp and position so the sensor point of indicator rests on the generator shaft hub, see Figure 6-13. Bar the engine over in a clockwise rotation as viewed from engine flywheel, through a couple of rotations. Record indicator readings in eight equally spaced points around the shaft diameter. This will provide a T.I.R. for Axial shaft misalignment.

The maximum allowable T.I.R. runout is subjective, the optimal T.I.R. for runout would be .000", however, that may not be attainable. The recommendation of this procedure will be to reduce the measured T.I.R. runout by one half. Specific out-of-tolerance runout levels are difficult to establish due to the varying surface quality of the generator shaft's drive disc mountain hub.

The goal of the Axial realignment is to reduce the vibration level of the genset while it is operating. A small improvement in the T.I.R. runout may have dramatic effects in the mechanically measured or physically observed vibration levels.

To correct for an out of tolerance T.I.R. indication, remove the capscrews connecting drive discs and flywheel. Mark the drive discs and flywheel with respect to each other. Rotate either the engine or generator so that drive discs holes are repositioned 180 degrees from their original location. Put the drive discs capscrews back in and retorque. Recheck shaft alignment as before. If shaft T.I.R. runout remains unchanged then the discs should be rotated to either 30, 60, or 90 degrees from original location to correct the out of tolerance condition. If the T.I.R. does not improve after repositioning, a closer inspection of the flywheel pilot and drive disc runouts is required. This will help determine the cause of the Axial misalignment.

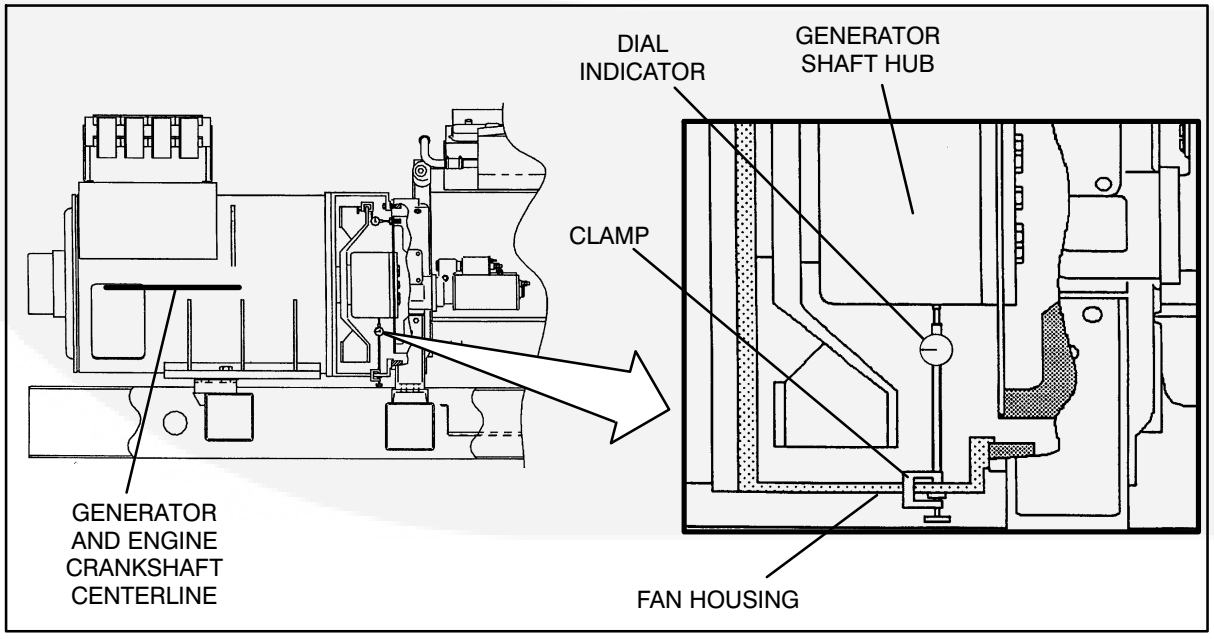

FIGURE 6-13. AXIAL ALIGNMENT MEASUREMENT

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7. Optional Enclosure Fuel Tank System

GENERAL

This section describes the operation and testing of the optional components of the fuel tank system shown in Figure 7-1.

When a sub-base fuel tank is provided, a fuel transfer pump with control, an external fuel alarm panel and external fuel fill box are available as an option.

WIRING CONNECTIONS

Fuel Transfer Control Customer Outputs

See *Enclosure/Options Wiring Diagrams* in Section 8 for customer connections to remote annunciators.

PCC Customer Inputs

PCC Customer Fault Inputs 3 (Low Fuel) and 4 (Rupture Basin) are prewired to the sub-base fuel tank when shipped from the factory.

The “Low Fuel” warning message, when displayed by the PCC, indicates that the fuel level has dropped below the low fuel level (approximately 62%).

The “Rupture Basin” warning message is used to indicate that fuel is detected in the fuel tank basin.

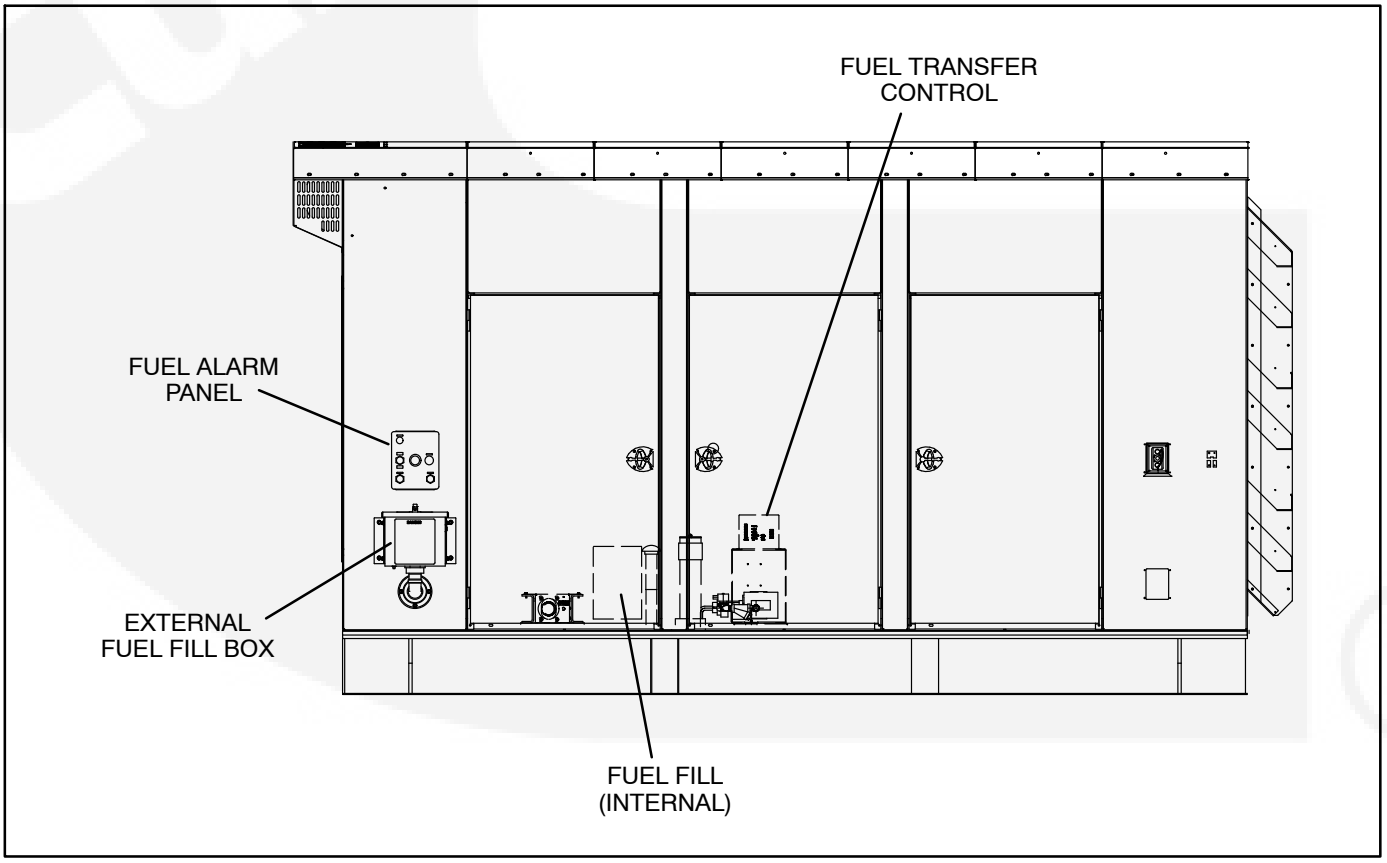


FIGURE 7-1. FUEL TANK SYSTEM OPTIONAL COMPONENTS

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/testing 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. 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.

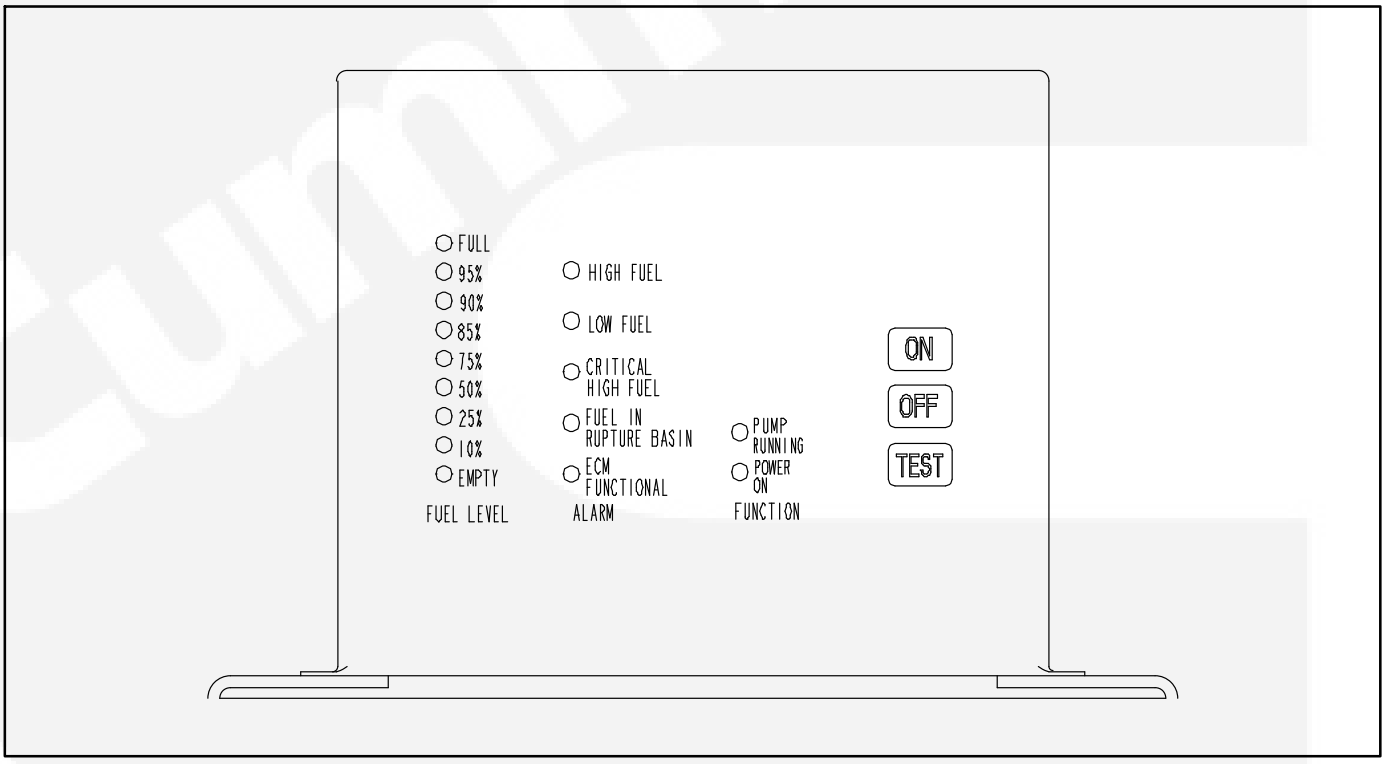


FIGURE 7-2. TRANSFER PUMP CONTROL FRONT PANEL

- **LOW FUEL** (red): indicates that the fuel level has dropped below the low fuel level. 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 FUEL FILL BOX

The external fuel fill box plumping 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.

If the valve remains closed after correcting the critical high fuel condition, check the following possible causes before replacing the valve.

- Defective Critical High switch mounted on fuel tank. (Critical High switch remains closed with fuel gauge indicating less than 95% full.)
- Defective External Alarm panel (refer to *Enclosure/Options Wiring Diagrams* in Section 8).

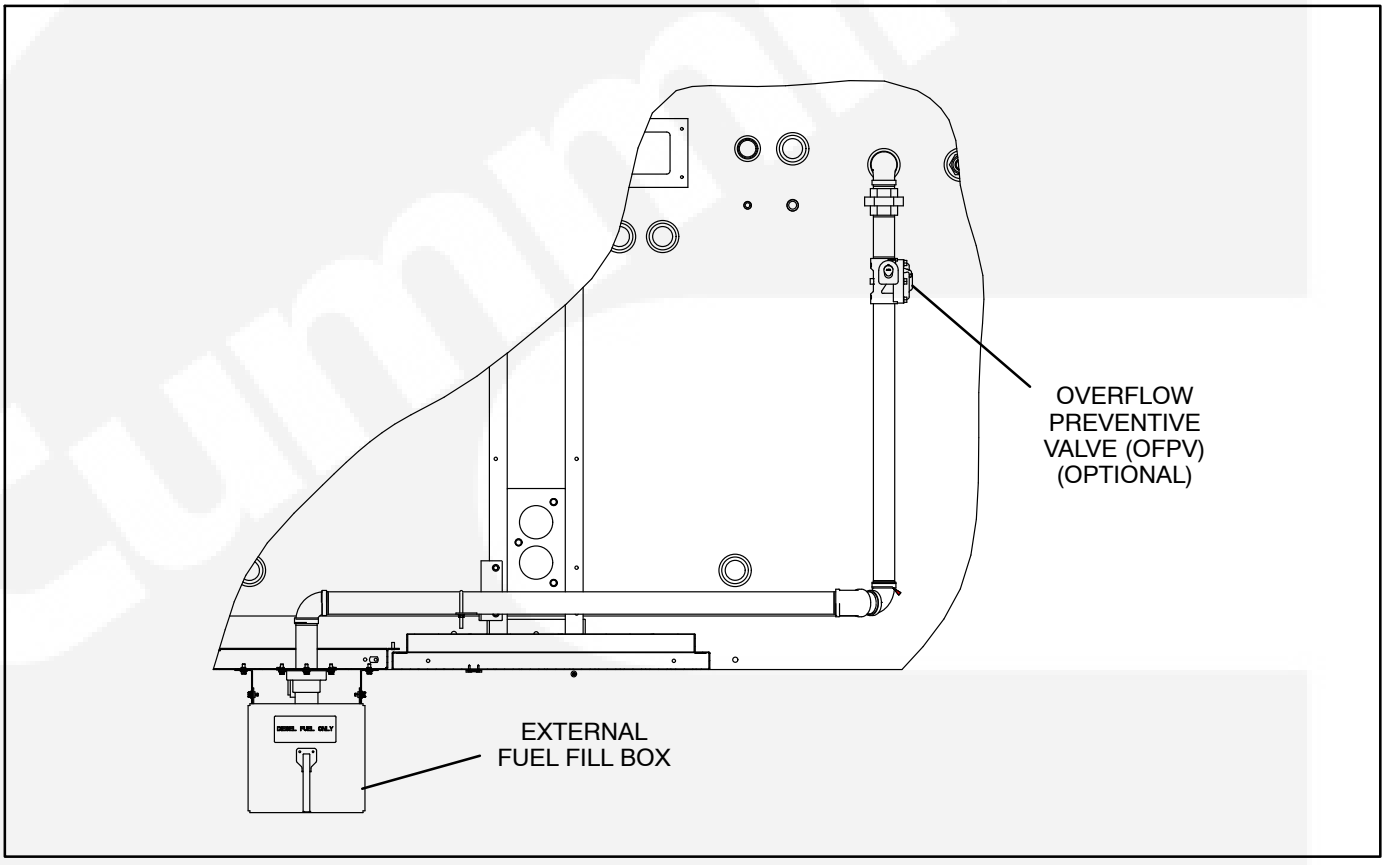


FIGURE 7-3. OPTIONAL FUEL (SPILL) FILL BOX

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 7-3) 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.

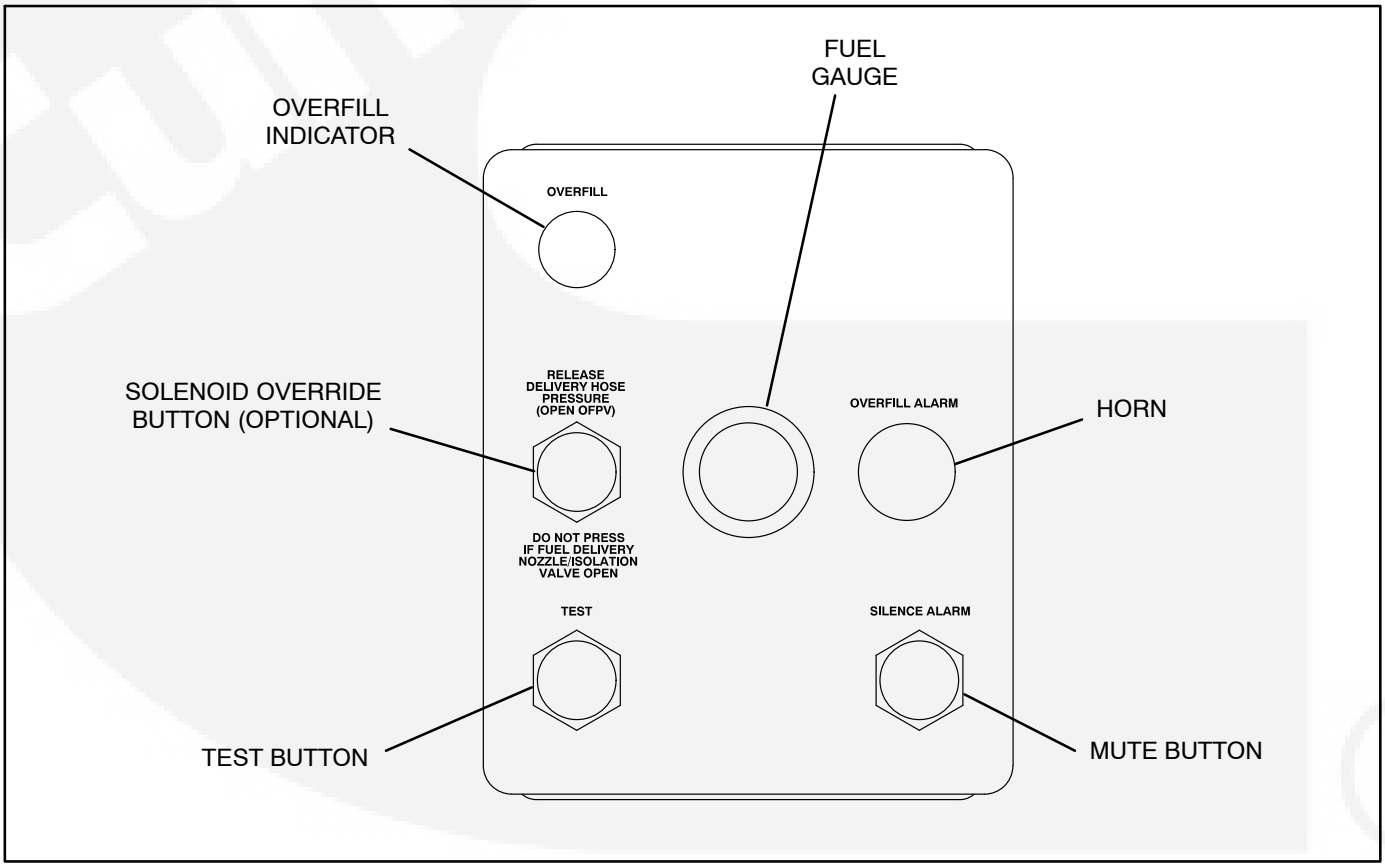


FIGURE 7-4. EXTERNAL ALARM PANEL

RUPTURE BASIN LEAK DETECT SWITCH TEST

The rupture basin leak detect switch (Figure 7-5) is provided with sub-base fuel tanks used with the optional enclosure. This switch should be checked once a year to make sure switch is properly operating. In some areas, weekly inspections may be required by safety code regulations.

To test the leak detect switch:

1. Remove the pipe fitting/switch assembly from the rupture basin tank.
2. Move the O/Manual/Auto switch to the MANUAL position.
3. Activate leak detect switch (move float upward).
4. Check control display for Rupture Basin fault message. If no indication of fault, repair defective circuit. Refer to *Enclosure/Options Wiring Diagrams* in Section 8.
5. Apply thread sealant to pipe fitting and install switch assembly.

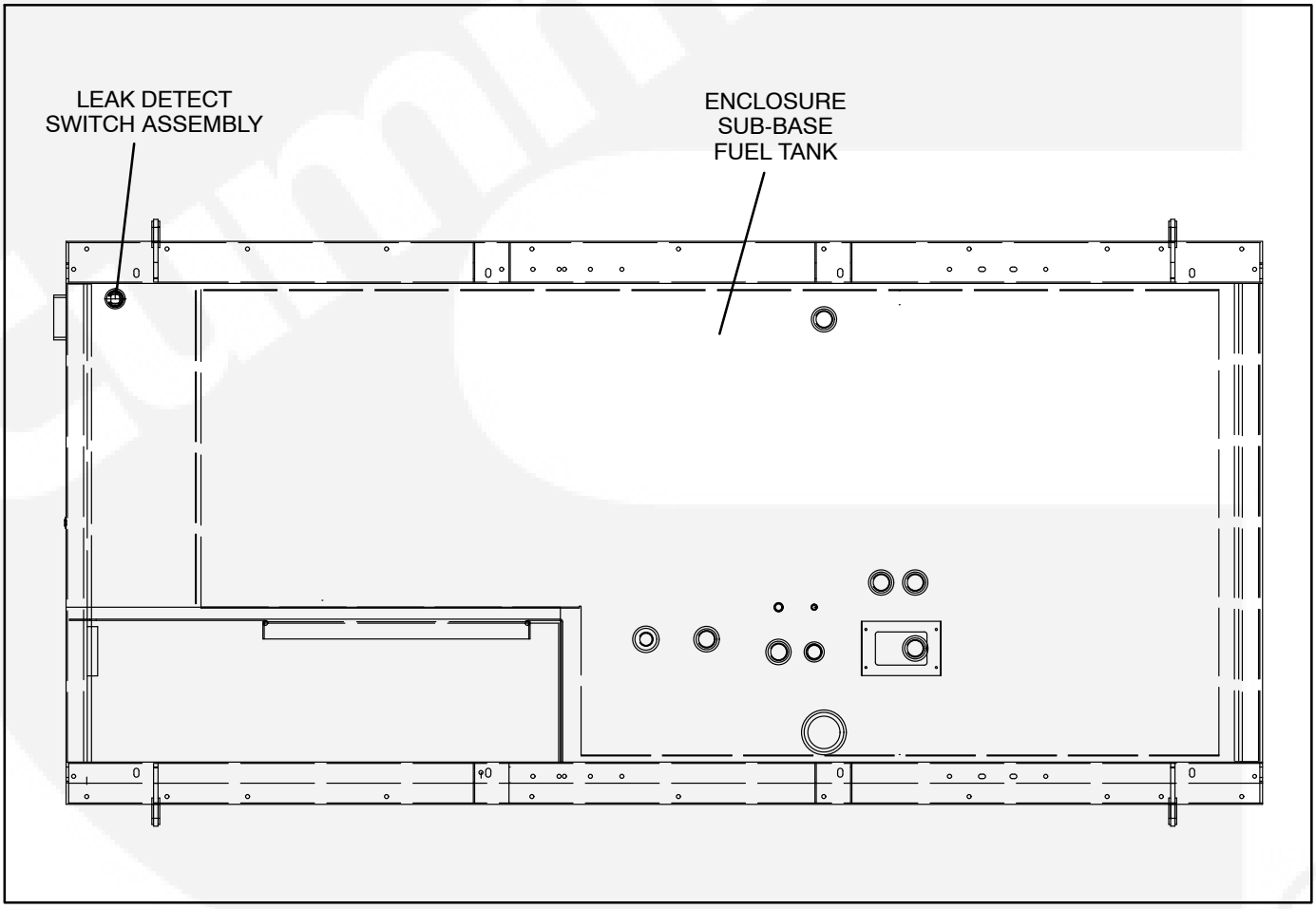


FIGURE 7-5. RUPTURE BASIN LEAK DETECT SWITCH

8. Wiring Diagrams

GENERAL

This section consists of the schematic and connection wiring diagrams referenced in the text. The following drawings are included.

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

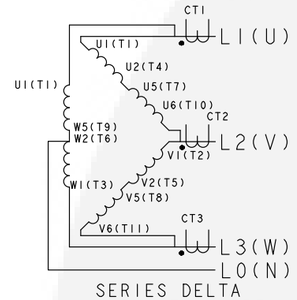
3 PHASE RECONNECTABLE, 12 LEAD

CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X3

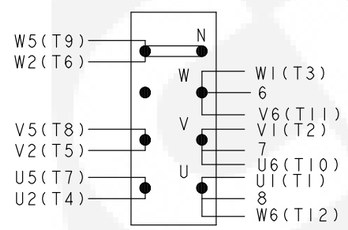
110/220V, (R028)
115/230V, (R071)
120/240, (R106)

* RANGE *
110 - 120/220 - 240V

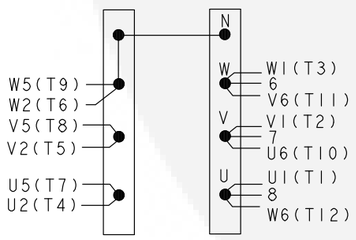


SERIES DELTA
3 PHASE 4 WIRE
OUTPUT TERMINALS
U.V.W.N.

FRAME 4



FRAME 5,6, & 7



5 NO NEUTRAL SENSE (LEAD 5)

-01

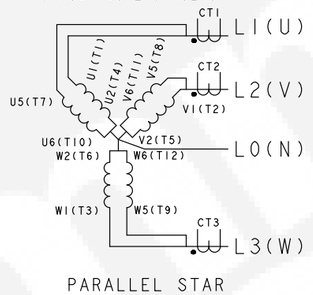
CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X3

110/190V, (R004)
120/208V, (R098)
127/220V, (R020)

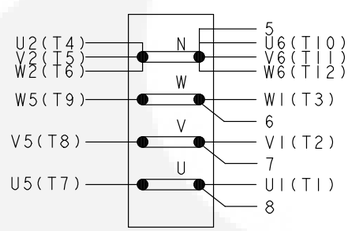
115/200V, (RO50)
139/240V, (R067)

* RANGE *
110-139/190-240 VOLTS

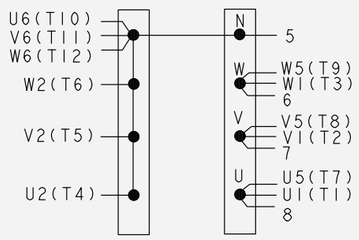


PARALLEL STAR
3 PHASE 4 WIRE
OUTPUT TERMINALS
U,V,W,N

FRAME 4



FRAME 5,6, & 7



-02

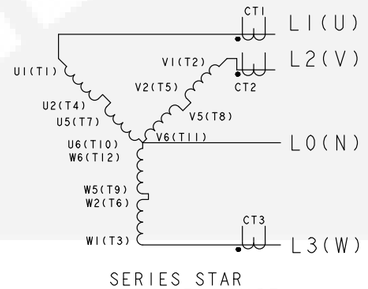
CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X2

220/380V, (R099)
230/400V, (R029)
240/416V, (R003)
255/440V, (R023)

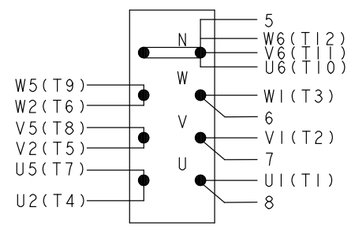
277/480V, (R002)

* RANGE *
220-277/380-480 VOLTS

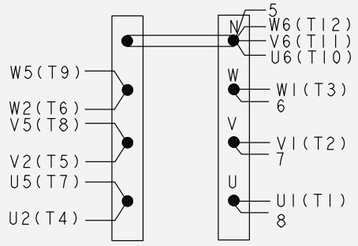


SERIES STAR
3 PHASE 4 WIRE
OUTPUT TERMINALS
U,V,W,N

FRAME 4



FRAME 5,6, & 7



-03

NOTES:

1. UVW PHASE SEQUENCE WITH C.W. ROTATION FACING DRIVE END.
2. TIE BACK UNUSED LEADS.
3. WHEN RECONNECTING GENERATOR LEADS, BOLTS SHOULD BE TORQUED AT 68 ±6 FT-LBS. FOR FRAMES 5,6 AND 7.
4. WHEN RECONNECTING GENERATOR LEADS, BOLTS SHOULD BE TORQUED AT 22 ±2 FT-LBS. FOR FRAMES 4.
5. NEUTRAL SENSE FLOATED FOR DELTA CONFIGURATION. TIE LEAD 5 BACK INTO HARNESS.

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AC RECONNECT WIRING DIAGRAM (SHEET 1 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

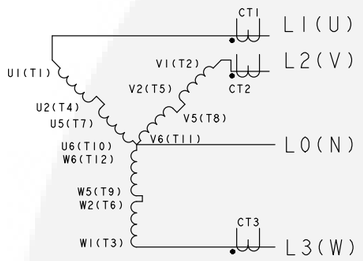
3 PHASE NON-RECONNECTABLE

CURRENT TRANSFORMER SECONDARY CONNECTION

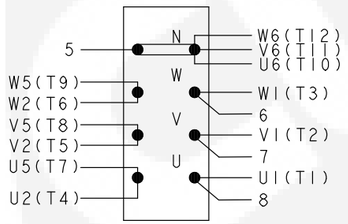
X1 X2

346/600V, 60HZ (R114)

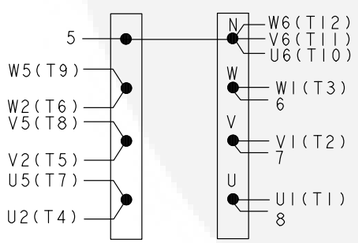
* RANGE *
220-277/380-480 VOLTS



FRAME 4



FRAME 5 & 6



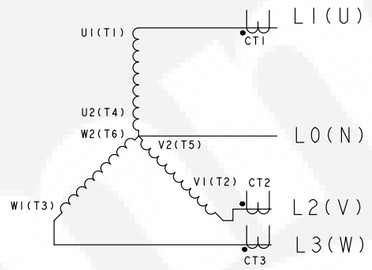
-04

CURRENT TRANSFORMER SECONDARY CONNECTION

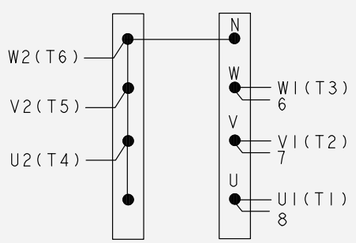
X1 X2

220/380V, (RO99)
240/416V, (RO03)
277/480V, (RO02)
347/600V, (R114)
120/208V, (RO98)
127/220V, (RO20)

230/400V, (RO29)
254/440V, (RO23)



FRAME 5,6 & 7

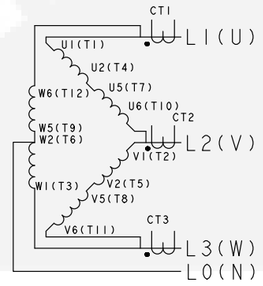


-05

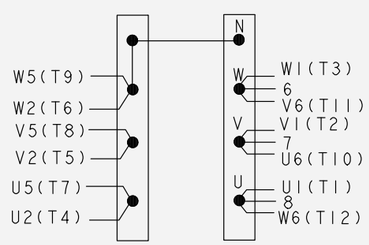
CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X2

220/440V, (RO19)
240/480V, (RII9)



FRAME 5,6 & 7



△5 NO NEUTRAL SENSE (LEAD 5)

-06

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AC RECONNECT WIRING DIAGRAM (SHEET 2 OF 2)

QSM11 WIRING DIAGRAM WITH PCC2100, CM876, AND CAN/J1939 DATA LINK

(REFER TO 0630-2601 FOR ADDITIONAL PCC 2100 WIRING DETAIL)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

PCC 2100 CONTROL BASEBOARD (0327-1379-02)

CUSTOMER CONNECTIONS TO OPTIONAL POWER RELAYS

TB1.18 (B+_FUSED)
TB1.8 (OUT1-NO)
TB1.10 (OUT2-NO)
TB1.12 (OUT3-NO)
TB1.9
TB1.11
TB1.13
TB1.22 (GND)
K10
K11
K12

J2 (RIBBON)

(300-5180)
(OPTIONAL)
(BARGRAPH ASSY)
(DISPLAY ASSY) (300-5467)
MEMBRANE PANEL
(E-STOP) S13
J5
J12
REMOTE START
NOT IN AUTO
SHUTDOWN
WARNING
RUN
(CONFIG1)
(CONFIG2)
(CONFIG3)
(CONFIG4)
(CONFIG5)
(LED/SWITCH ASSY)
S12
(AUTO/MAN/OFF)

MEMBRANE (0-9) J3 (RIBBON)
DISPLAY (0-13) J4 (RIBBON)

OPTIONAL LONWORKS MODULE
LONWORKS (0-25)
J6 (RIBBON)

TB1

CUSTOMER INPUTS
(APPLY GROUND TO ACTIVATE)
(*SEE PAGE 2 FOR REMOTE E-STOP WIRING DETAILING)
REMOTE_START
* REMOTE_ESTOP
REMOTE_RESET
CUST_IN1
CUST_IN2
CUST_IN3
CUST_IN4

XFR-16 (FUEL TRANSFER PUMP)

CUSTOMER OUTPUTS
(SEE RATINGS IN PARENTHESES)
OUT1-NO (2A) K1
OUT1-COM
OUT2-NO (2A) K2
OUT2-COM
OUT3-NO (2A) K3
OUT3-COM
OUT4-NO (2A) K4
OUT4-COM
SPARE
B+_FUSED
B+_FUSED
SW_B+_FUSED
GND
GND
GND

XFR-17 (FUEL TRANSFER PUMP)

B+_IN
F1 10A
(10A)
(5A)
K6 (RUN)
F2 5A
F3 2A
CR8

PTC MODULE (OPTIONAL)
TB2
RS485 +
RS485 -
PTC B+
GND
PTC STATUS
GND

BATTERY ALT FLASH OUTPUT

(CRANK) U8
(FSO) U7
RELAY DRIVERS
GND
(OPEN IF E-STOP IS ACTIVE)

GENERATOR
PMG
FIELD WINDING
RECONNECT TERMINAL BLOCK
TO CUSTOMER LOAD CONNECTIONS OR CIRCUIT BREAKER TERMINALS

J7 P7
CT1
CT1-COM
CT2
CT2-COM
CT3
CT3-COM

J8 P8
V1
V2
V3
VN
FIELD -
FIELD +
AC1
AC2
AC3

J9
DCD
RXD
TXD
DTR
GND
DSR
RTS
CTS
RI
RS232 INPOWER/ SERVICE TOOL CONNECTOR

J10 P10
R2 (120Ω)
SAE J1939 DATALINK (+)
SAE J1939 DATALINK (-)
K11 KEYSWITCH PILOT RELAY
CR3

J1 P1
ESTOP-NC1-2
ESTOP-NC1-1
ESTOP-NO1
ESTOP-NO2
AUTO
MANUAL
OFF
GND
S13 E-STOP
S12
AUTO/MANUAL/STOP

S13 (E-STOP)
NC2-2
NC2-1
K10 FSO PILOT RELAY
CR2

K11 KEY SWITCH PILOT RELAY
F2 5 AMP

P3 HEATER
(REFER TO HEATER OUTLINE FOR ADDED DETAIL)
GND

J7 P7
B+
B+
B+
B+
GND
GND
GND
GND
SP5
SP6
GND

SW B+
SIGNAL
GND
SW B+
SW GND
S7
COOLANT LEVEL SENSOR

SP3
SP2
SP1
F1 30 AMP

G1
BATTERY CHARGING ALTERNATOR
STARTER #2
BATTERIES (24 VDC)
GND

CRANK RELAY
NO
SOLENOID
K4
S1
S2

CONNECTOR C-06
3 PIN DATALINK
SAE J1939 DATALINK (-)
SAE J1939 DATALINK (+)

CONNECTOR C-05
9 PIN DATALINK
DATALINK COMMON
DATALINK POWER
SAE J1939 DATALINK (+)
SAE J1939 DATALINK (-)
SP7
SP8
SP9

R1 (120Ω)
R3 (165Ω)
KEY SWITCH

50 PIN OEM CONNECTOR
46
47
32
28
39

ECM POWER
SP10
SP11
B+ 04
B+ 03
GND 02
GND 01
SP4

CM876 ENGINE CONTROL MODULE

60 PIN ECM CONNECTOR

29 ENGINE SPEED/POSITION SIGNAL #1
18 ENGINE SPEED/POSITION RETURN #1
26 SENSOR SUPPLY #3 — ENGINE SPEED/POSITION +5 VOLT SUPPY
ENGINE SPEED/POSITION SENSOR #1

23 ENGINE SPEED/POSITION SIGNAL #2
ENGINE SPEED/POSITION RETURN #2
ENGINE SPEED/POSITION +5 VOLT SUPPLY
ENGINE SPEED/POSITION SENSOR #2

44 INTAKE MANIFOLD PRESSURE SIGNAL
INTAKE MANIFOLD TEMPERATURE/PRESSURE +5 VOLT SUPPLY
43 INTAKE MANIFOLD TEMPERATURE SIGNAL
INTAKE MANIFOLD TEMPERATURE/PRESSURE RETURN
INTAKE MANIFOLD TEMPERATURE/ PRESSURE SENSOR

16 SENSOR SUPPLY #2 — CRANKCASE PRESSURE +5 VOLT SUPPLY
12 SENSOR RETURN #2 — CRANKCASE PRESSURE RETURN
39 CRANKCASE PRESSURE SIGNAL
CRANKCASE PRESSURE SENSOR

14 WATER IN FUEL SIGNAL
WATER IN FUEL RETURN
WATER IN FUEL SENSOR

47 EGR TEMPERATURE SIGNAL
EGR TEMPERATURE RETURN
EGR TEMPERATURE SENSOR

15 ENGINE COOLANT TEMPERATURE SIGNAL
ENGINE COOLANT TEMPERATURE RETURN
COOLANT TEMPERATURE SENSOR

13 ENGINE OIL TEMPERATURE SIGNAL
35 SENSOR RETURN — ENGINE OIL TEMPERATURE RETURN
ENGINE OIL TEMPERATURE SENSOR

54 BAROMETRIC PRESSURE SIGNAL
BAROMETRIC PRESSURE RETURN
BAROMETRIC PRESSURE +5 VOLT SUPPLY
BAROMETRIC AIR PRESSURE SENSOR

46 ENGINE OIL PRESSURE SIGNA;
ENGINE OIL PRESSURE RETURN
ENGINE OIL PRESSURE +5 SUPPLY
ENGINE OIL PRESSURE SENSOR

53 EGR DIFFERENTIAL PRESSURE SIGNAL
19 SENSOR RETURN #1 — EGR DIFFERENTIAL PRESSURE SIGNAL
17 SENSOR SUPPLY #1 — EGR DIFFERENTIAL PRESSURE +5 VOLT SUPPLY
EGR DIFFERENTIAL PRESSURE SENSOR

50 SAE J1939 (+)
40 SAE J1939 (-)
SAE J1939 DATALINK TERMINATOR

EGR VALVE J1939 (-)
EGR VALVE J1939 (+)
56 EGR VALVE RETURN
EGR VALVE +12 VOLT SUPPLY
EGR VALVE MOTOR

SAE J1939 (+)
SAE J1939 (-)
SAI J1939 DATALINK SERVICE TOOL CONNECTOR

SENSOR RETURN
ENGINE BLOCK GROUND TERMINAL

32 ENGINE BRAKE SOLENOID NUMBER 1 SIGNAL
51 ENGINE BRAKE SOLENOID NUMBER 2 SIGNAL
CYLINDER NUMBERS 1, 2, 3 SOLENOID 4, 5, 6 SOLENOID

INJECTOR SOLENOID DRIVER CYLINDER 1 SIGNAL
INJECTOR SOLENOID DRIVER CYLINDER 1 RETURN — INJECTOR #1
INJECTOR SOLENOID DRIVER CYLINDER 2 SIGNAL
INJECTOR SOLENOID DRIVER CYLINDER 2 RETURN — INJECTOR #2
INJECTOR SOLENOID DRIVER CYLINDER 3 SIGNAL
INJECTOR SOLENOID DRIVER CYLINDER 3 RETURN — INJECTOR #3
INJECTOR SOLENOID DRIVER CYLINDER 4 SIGNAL
INJECTOR SOLENOID DRIVER CYLINDER 4 RETURN — INJECTOR #4
INJECTOR SOLENOID DRIVER CYLINDER 5 SIGNAL
INJECTOR SOLENOID DRIVER CYLINDER 5 RETURN — INJECTOR #5
INJECTOR SOLENOID DRIVER CYLINDER 6 SIGNAL
INJECTOR SOLENOID DRIVER CYLINDER 6 RETURN — INJECTOR #6
FUEL SHUTOFF ACTUATOR — FUEL SHUTOFF ACTUATOR TERMINAL

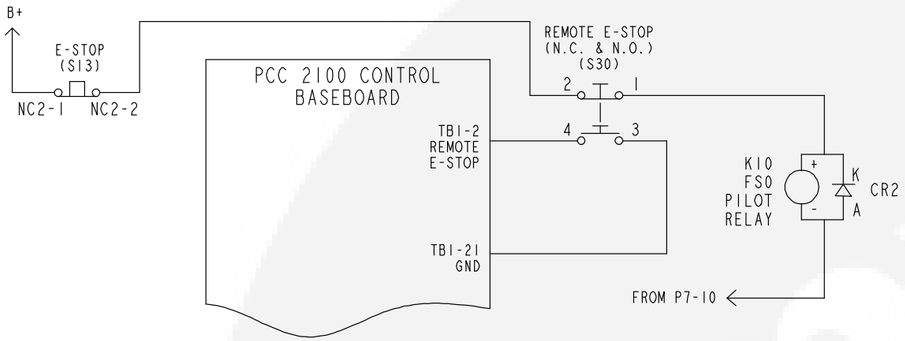
K10 FSO PILOT RELAY
(B1)

No. 630-3445 sh 1 of 2
Rev. B
Modified 11-06

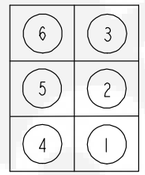
GENSET WIRING DIAGRAM (SHEET 1 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

PCC 2100 REMOTE, NORMALLY CLOSED, E-STOP SCHEMATIC

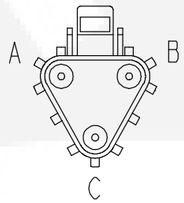


P10 (PCC 2100)
CONNECTOR MATING FACE

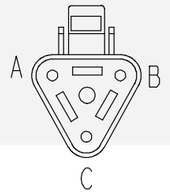


S7 (LOW COOLANT
LEVEL SWITCH)
CONNECTOR MATING SWITCH

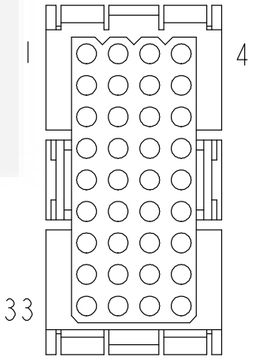
P3 (COOLANT HEATER)
CONNECTOR MATING FACE



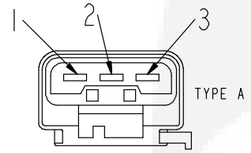
SAE J1939 ENGINE
DATALINK SERVICE
CONNECTOR ENGINE
CONTROL MODULE SIDE



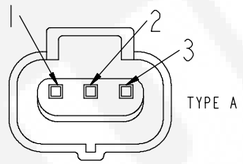
P7 (PCC 2100)
CONNECTOR MATING FACE



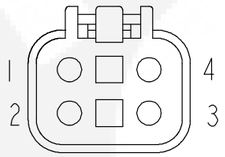
ENGINE OIL
PRESSURE SENSOR
CONNECTOR MATING FACE



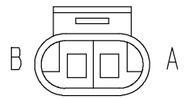
EGR DIFFERENTIAL PRESSURE SENSOR
AFTERTREATMENT DIESEL PARTICULAR
FILTER DIFFERENTIAL PRESSURE SENSOR



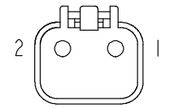
ECM POWER
CONNECTOR MATING FACE



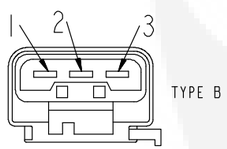
ENGINE COOLANT TEMPERATURE
& ENGINE OIL TEMPERATURE SENSOR
CONNECTOR MATING FACE



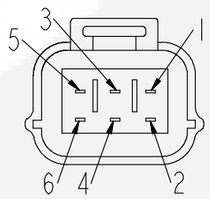
WATER-IN-FUEL SENSOR,
EGR VALVE MOTOR,
EXTENSION HARNESS
CONNECTOR MATING FACE



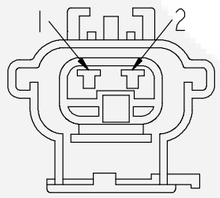
CRANKCASE PRESSURE,
BAROMETRIC AIR PRESSURE SENSOR
CONNECTOR MATING FACE



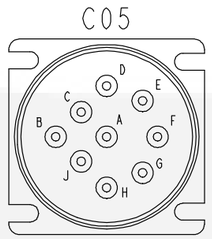
EXHAUST GAS RECIRCULATION
(EGR) VALVE MOTOR
CONNECTOR MATING FACE



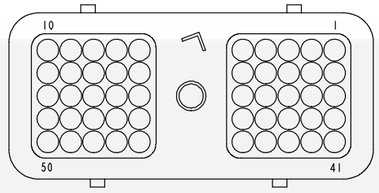
AFTERTREATMENT TEMPERATURE SENSORS
EGR TEMPERATURE SENSOR
CONNECTOR MATING FACE



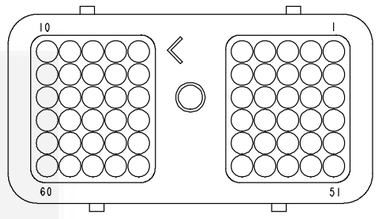
SERVICE CONNECTOR
C05



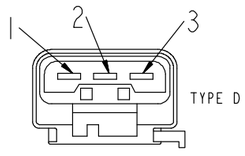
ELECTRONIC CONTROL MODULE (ECM)
50 PIN OEM HARNESS
CONNECTOR MATING FACE



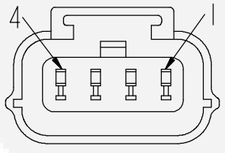
ELECTRONIC CONTROL MODULE (ECM)
60 PIN ENGINE HARNESS
CONNECTOR MATING FACE



ENGINE POSITION 1 & 2, SENSOR
CONNECTOR MATING FACE



INTAKE MANIFOLD
TEMPERATURE & PRESSURE SENSOR
CONNECTOR MATING FACE

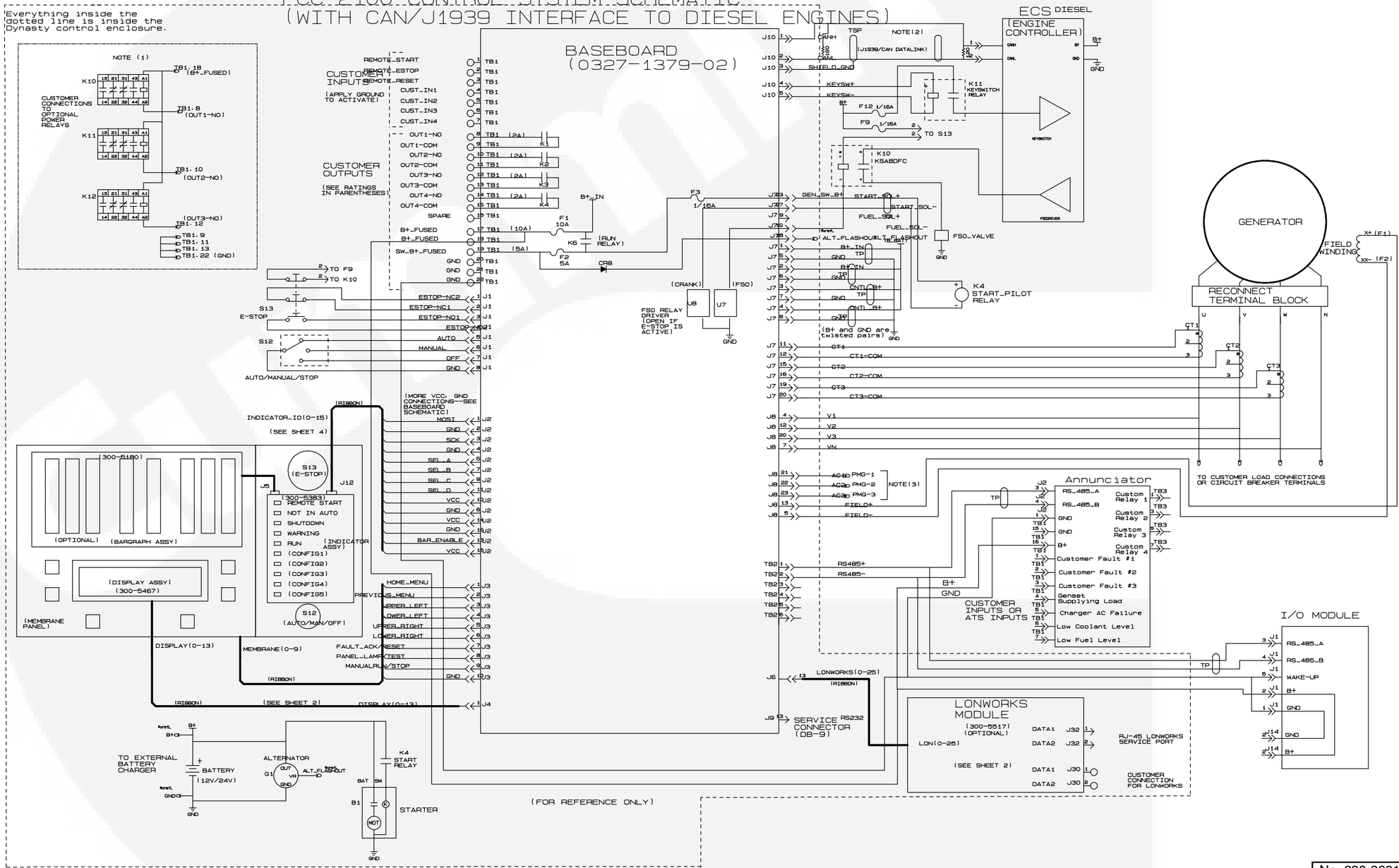


No. 630-3445 sh 2 of 2
Rev. B
Modified 11-06

GENSET WIRING DIAGRAM (SHEET 2 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

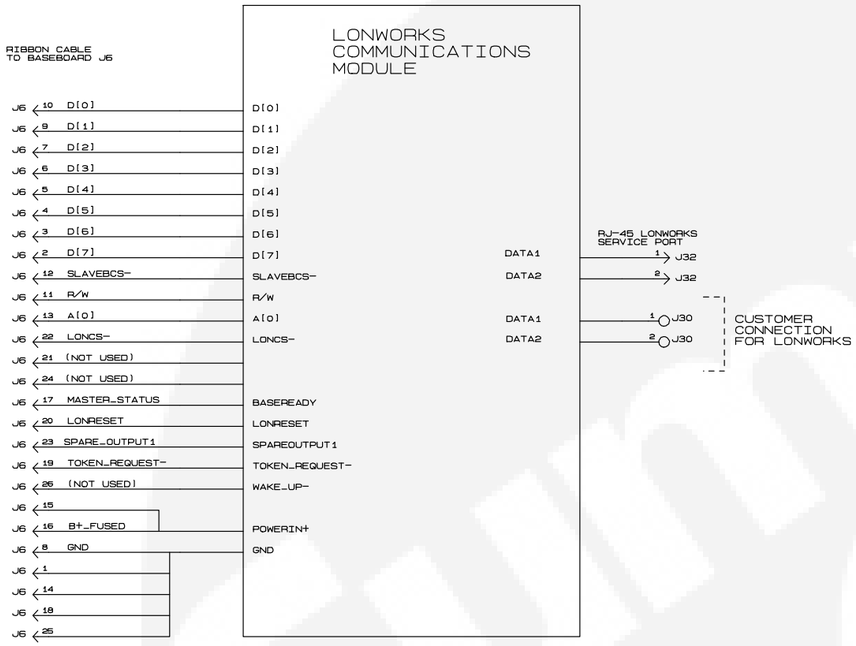
PCC 2100 CONTROL SYSTEM SCHEMATIC (WITH CAN/J1939 INTERFACE TO DIESEL ENGINES)

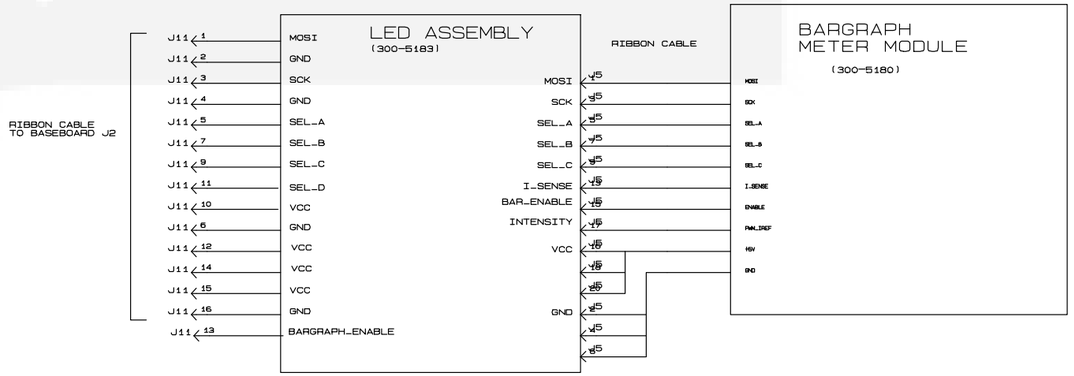


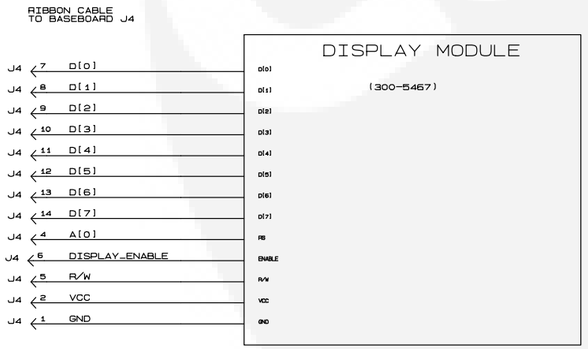
No. 630-2601 sh 1 of 2
Rev. E
Modified 04-07

CONTROL WIRING DIAGRAM (SHEET 1 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.







NOTES:

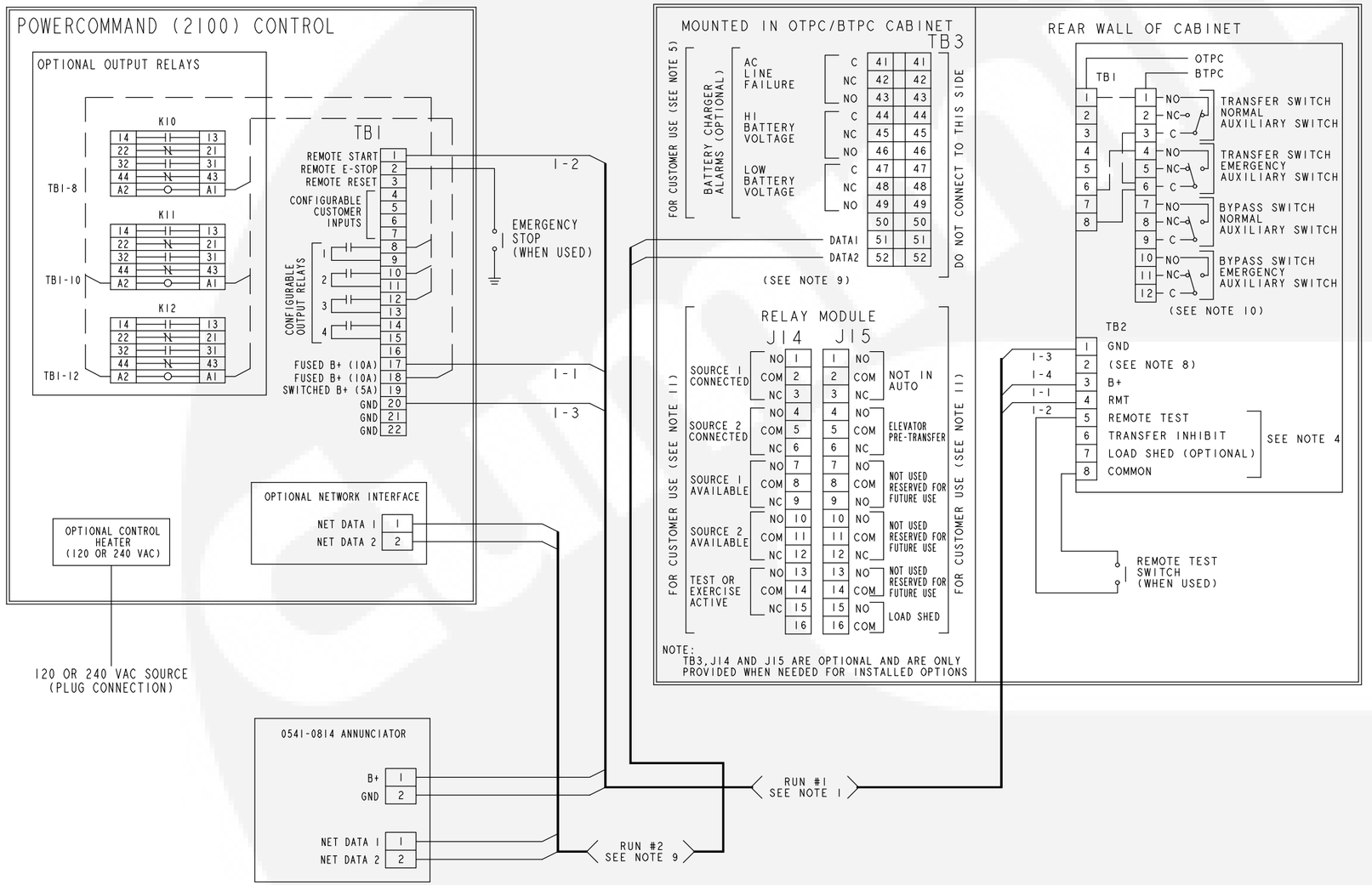
1. K10, K11, K12 ARE OPTIONAL DIN RAIL MOUNTED RELAYS.
2. NETWORK CONNECTIONS: USE BELDEN 9729 24 GAUGE TWISTED, STRANDED, SHEILDED CABLE. SHIELD SHOULD BE GROUNDED AT ONE END. TOTAL NETWORK LENGTH CAN NOT EXCEED 4000 FEET. UP TO 20 NODES CAN BE CONNECTED TO THE NETWORK. (NOTE ANY COMMUNICATIONS WIRE CONNECTED TO THE GENSET SHOULD BE STRANED CABLE.)
3. FOR SHUNT OPERATION, CONNECT AC1 AND AC2 TO GENERATOR OUTPUTS (250VAC MAX)
4. ECS IS SUPPLIED WITH ENGINE. ALL ENGINE SENSORS INTERFACE TO ECS WITH DATA COMMUNICATED BACK TO PCC2100 BASEBOARD.

No. 630-2601 sh 2 of 2
Rev. E
Modified 04-07

CONTROL WIRING DIAGRAM (SHEET 2 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

OTPC & BTPC
UTILITY TO GENSET



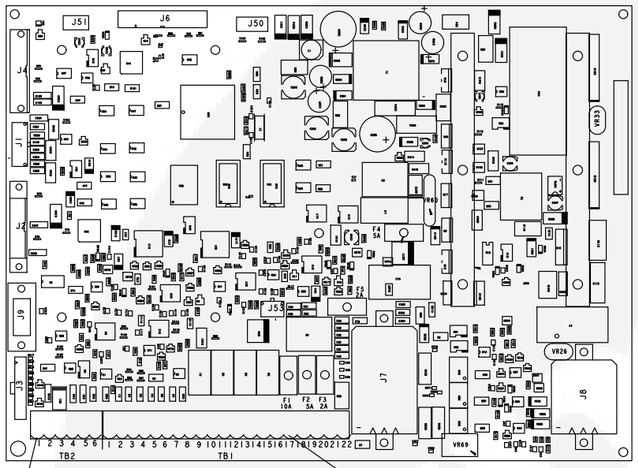
WIRE SIZE (AWG)	DISTANCE IN FEET. ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

NOTES:

1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-1, -2, -3, -4, -5 USE COL A.
   WITH 2 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. B
   WITH 10 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. C
2.
3. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
4. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
5. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
6. REFER TO ONAN 900-0529 POWERCOMMAND NETWORK INSTALLATION & OPERATION MANUAL FOR WIRING INSTRUCTIONS.
7. INPUTS FOR CUSTOMER FAULTS. GROUNDED SIGNAL REQUIRED TO ACTIVATE INPUT (MAX 50 MA.)
8. INSTALL JUMPER BETWEEN TB2-1 & TB2-2.
9. USE STRANDED TWISTED PAIR WIRES (PART# 334-1350 OR EQUAL) WHEN CONNECTING DATA1 AND DATA 2 TO THE NETWORK.
10. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN NEUTRAL POSITION.
11. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.
12. OPEN CONNECTION TO INITIATE EMERGENCY STOP. THESE TERMINALS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP OPTION NOT USED.
13. 120VAC OR 240VAC AT 50W.
14. CUSTOMER SUPPLIED EITHER 12 OR 240VDC RELAYS OUTPUT SIGNAL 20ma @ 24VDC MAX.

No. 630-1974 sh 7 of 7
Rev. G
Modified 12-02

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.



TERMINAL/WIRE SPECIFICATION

1) TORQUE TERMINALS TO 4.4 IN/LBS (0.5 Nm)
2) WIRE SIZE, 30-12 AWG (0.14-2.5MM) (TB1)
3) WIRE TYPE, USE 60°C RATED MINIMUM, COPPRER WIRE (TB1)
4) TERMINAL SCREWS ARE SLOTTED (0.6MM)
5. USE FLAT-BLADED SCREWDRIVER WITH 2.5MM BLADE
6) STRIP WIRE LENGTH TO 6.0MM

TB2 **NOT USED**

TB1

1	REMOTE START	APPLY GROUND TO ACTIVATE
2	REMOTE E-STOP	
3	REMOTE RESET	
4	CUSTOMER FAULT 1	
5	CUSTOMER FAULT 2	
6	CUSTOMER FAULT 3	
7	CUSTOMER FAULT 4	
8	CUSTOMER RELAY 1	RATED 2A @ 30VDC (MAX)
9	COM	
10	CUSTOMER RELAY 2	
11	COM	
12	CUSTOMER RELAY 3	
13	COM	
14	CUSTOMER RELAY 4	
15	COM	
16	(NOT USED)	
17	B+ FUSED OUT	10A FUSED
18	B+ FUSED OUT	
19	SWITCHED B+	5A FUSED
20	GND	
21	GND	
22	GND	

DEFAULT SETTING

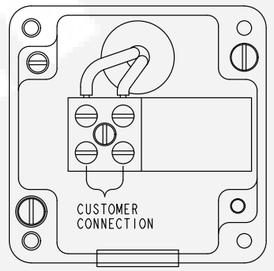
TB1-CUSTOMER FAULTS:
1 CUSTOMER FAULT 1
2 GROUND FAULT
3 LOW FUEL
4 RUPTURE BASIN FAULT

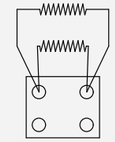
TB1-CUSTOMER RELAYS:
1 COMMON WARNING
2 COMMON SHUTDOWN
3 NOT IN AUTO
4 READY TO LOAD

TERMINAL SPECIFICATION

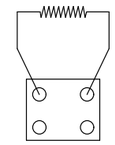
1) TORQUE TERMINALS TO 4.4 IN/LBS (0.5 Nm)
2) USE FLAT-BLADED SCREWDRIVER WITH 2.5MM BLADE

ALTERNATOR HEATER





DUAL HEATER



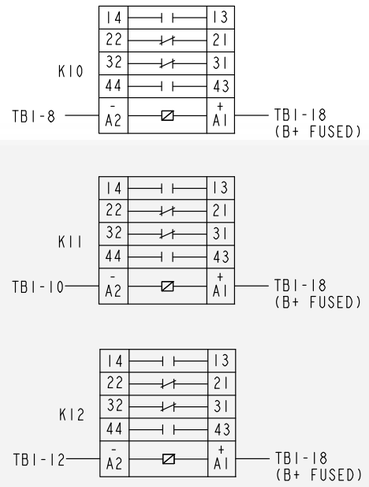
SINGLE HEATER

TERMINAL/WIRE SPECIFICATIONS

1. USE 60°C RATED MINIMUM COPPER WIRE.
2. WIRE SIZE: #12 - 18 AWG .
3. TORQUE TO 7.7 IN-Lb (0.9 Nm)
4. STRIP WIRE TO 0.32 INCHES (8.0 mm).
5. USE SLOTTED SCREWDRIVER WITH 3.0 mm BLADE
6. TERMINALS RATED AT 150V/20A AND 300V/10A.

HEATER RATING	
100 WATT	110 -125VAC 220 -260VAC
150 WATT	110 -125VAC 220 -260VAC
300 WATT	110 -125VAC 220 -260VAC

CUSTOMER RELAYS



TERMINAL/WIRE SPECIFICATIONS

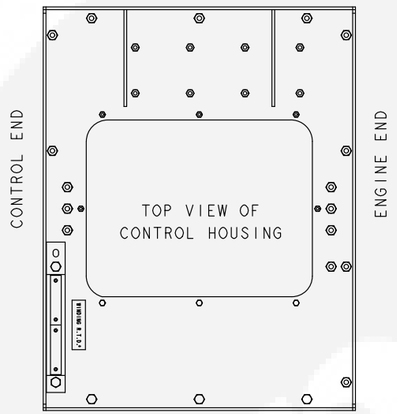
1) NORMALLY OPEN (NO) TERMINALS: 13,14 43,44
NORMALLY CLOSED (NC) TERMINALS: 21,22 31,32
2) TORQUE TERMINALS TO 7 INCH LBS (0.8Nm)
3) WIRE SIZE 1-18 AWG MIN (0.75MM²)
2-14 AWG MAX (2.5MM²)
1-12 AWG MAX (4.0MM²)
4) USE 60°C RATED MINUMUM, COPPER WIRE, 600VAC
5) TERMINAL SCREWS ARE PHIL SLOT
6) USE SLOTTED SCREWDRIVER WITH 5.0 MM BLADE OR NO. 2 PHILIPS
7) CONTACT RATINGS: 600VAC, 10 AMPS MAX
8) STRIP WIRE LENGTH TO 7.0 MM

No. 620-0247 sh 1 of 2
Rev. C
Modified 06-04

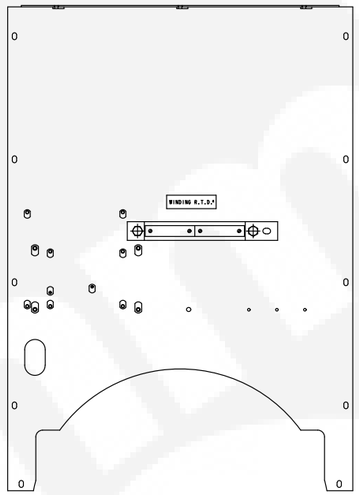
CUSTOMER CONNECTIONS (SHEET 1 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

RTD CUSTOMER CONNECTIONS



HC6 & 7 ONLY

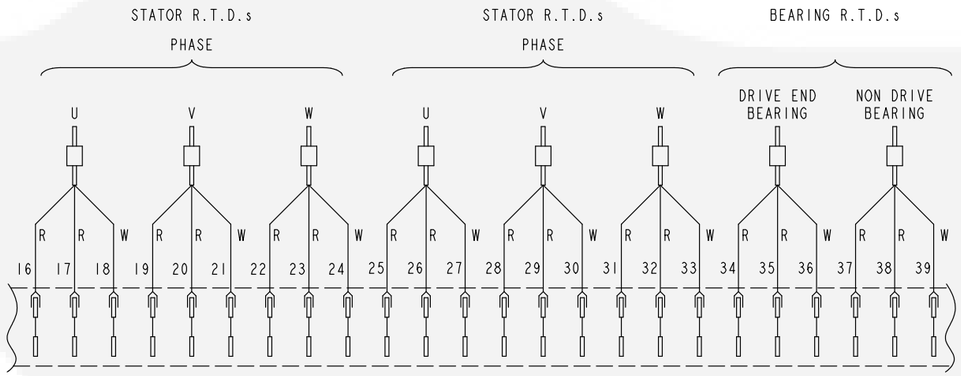


HC4 & 5 ONLY

RTD TERMINAL BLOCK CONNECTIONS:

1. USE 60°C RATED MINIMUM COPPER WIRE.
2. USE WIRE SIZES 22 TO 12 AWG.
3. TORQUE TO 7.7 LBS-IN (0.9 N-M)
4. STRIP WIRE TO 0.32 INCHES (8.0 MM).
5. USE SLOTTED SCREWDRIVER WITH A 3.0 MM BLADE.
6. TERMINALS RATED AT 150V/20A AND 300V/10A.

R.T.D. (Resistance Temperature Detector)



NOTES:

(1) R = RED W = WHITE

No. 620-0247 sh 2 of 2
Rev. C
Modified 06-04

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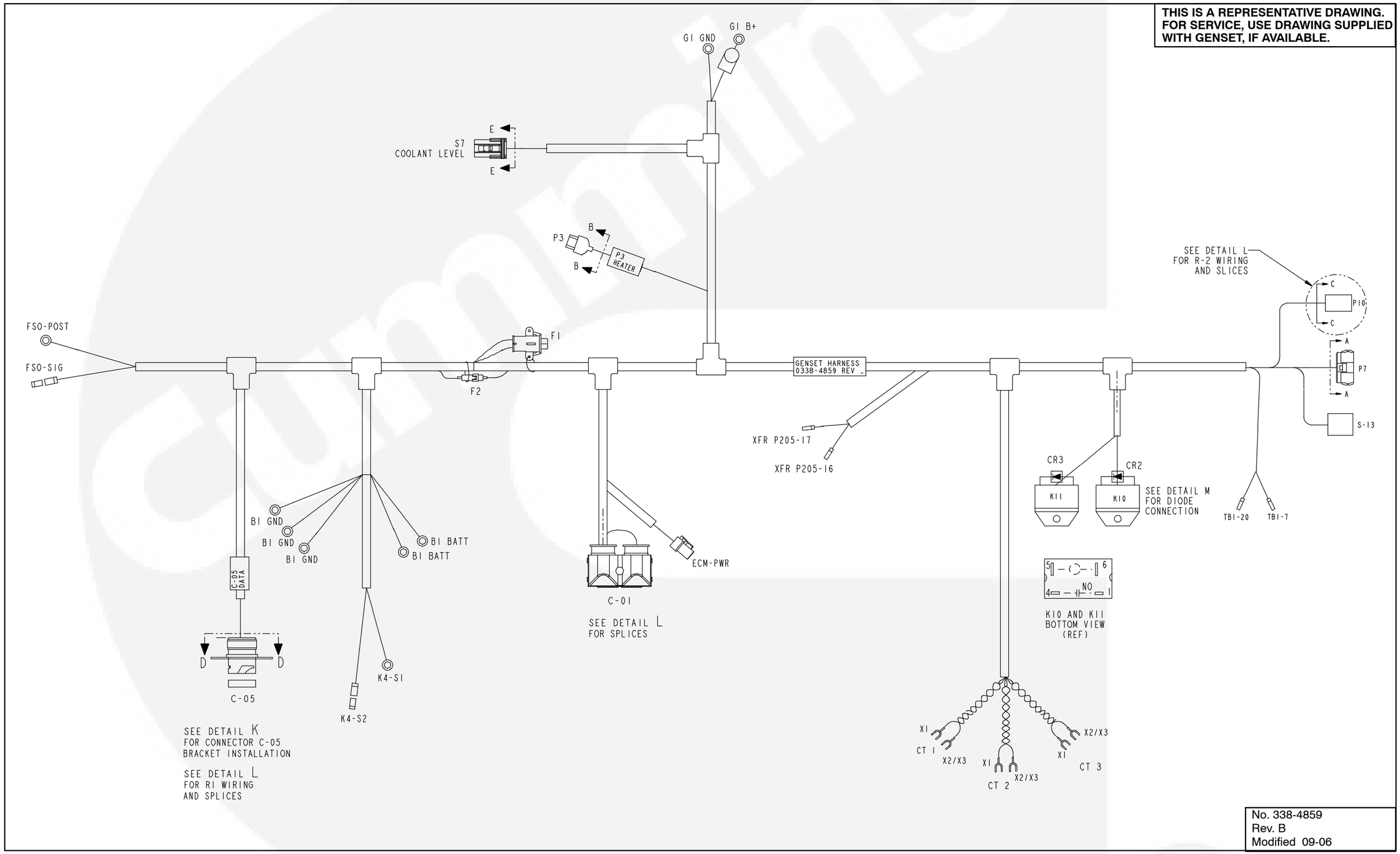
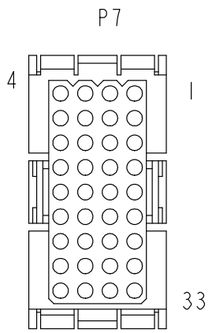
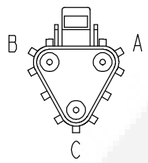


GENSET HARNESS DIAGRAM (SHEET 1 OF 2)

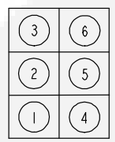
THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.



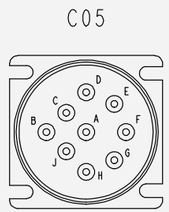
VIEW A-A



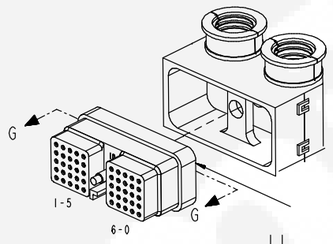
VIEW B-B



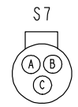
VIEW C-C



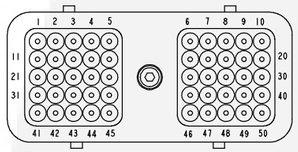
VIEW D-D



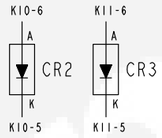
DETAIL H



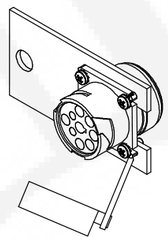
VIEW E-E



VIEW G-G

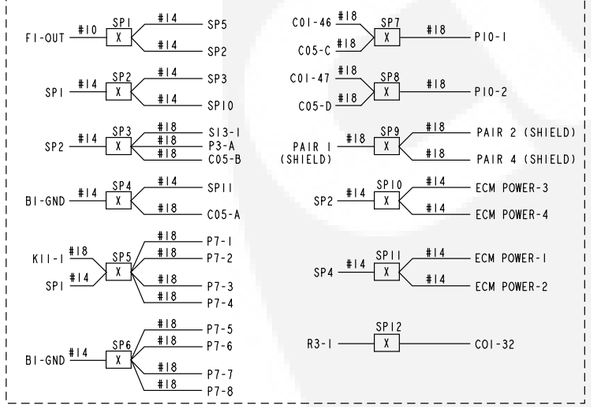


DETAIL M



DETAIL K

SPLICE DETAILS



DETAIL L

LEAD TABULATION			
NOTES COLOR SHIELD	FROM STATION	TO STATION	CIRCUIT FUNCTION
RED	BI-BATT	F1-IN	MAIN FUSE IN
RED	F1-OUT	SP1	MAIN FUSE OUT
RED	K11-1	SP5	FUSED B+ (KEYSWITCH RELAY IN)
RED	SP1		FUSED B+ (DATA-LINK)
RED		SP2	FUSED B+
RED	SP2	SP10	FUSED B+ (ECM POWER)
RED		SP3	FUSED B+
RED	SP3	P3-A	FUSED B+ (COOLANT HTR)
RED		C05-B	FUSED B+ (SERVICE DATA-LINK)
RED		S13-1	FUSED B+ (E-STOP RELAY)
BLACK	SP4	C05-A	RETURN (DATA-LINK)
BLACK		SP11	RETURN (ECM POWER)
BLACK	BI-GND	SP4	RETURN
BLACK		P3-C	COOLANT HEATER GND
RED	SP5	P7-1	FUSED B+ (PCC2100)
RED		P7-2	FUSED B+ (PCC2100)
RED		P7-3	FUSED B+ (PCC2100)
RED		P7-4	FUSED B+ (PCC2100)
BLACK	BI-GND	SP6	RETURN
BLACK	SP6	P7-5	RETURN (PCC2100)
BLACK		P7-6	RETURN (PCC2100)
BLACK		P7-7	RETURN (PCC2100)
BLACK		P7-8	RETURN (PCC2100)
RED	SP10	ECM PWR-4	FUSED B+ (ECM POWER)
RED		ECM PWR-3	FUSED B+ (ECM POWER)
BLACK	SP11	ECM PWR-1	RETURN (ECM POWER)
BLACK		ECM PWR-2	RETURN (ECM POWER)
RED	C01-39	F2-OUT	FUSED B+ (KEYSWITCH RELAY OUT)
RED	K11-4	F2-IN	FUSED B+ (KEYSWITCH RELAY OUT)
RED	S13-2	K10-5	FSO B+
RED	K10-5	CR2-K	DIODE
WHITE	P7-10	K10-6	FSO RELAY DRIVER
BLACK	K10-6	CR2-A	DIODE
RED	P7-23	K4-S1	STARTER PILOT RELAY B+
WHITE	P7-27	K4-S2	STARTER PILOT RELAY (START SIG)
WHITE	FSO-SIG	K10-1	FSO SIGNAL
WHITE	FSO-POST	K10-4	FSO SIGNAL
RED	BI-BATT	GI B+	BATT ALTERNATOR (+)
BLACK	BI-GND	GI GND	BATT ALTERNATOR (-)
WHITE	P10-4	K11-5	KEYSWITCH RELAY (+)
RED	K11-5	CR3-K	DIODE
WHITE	P10-5	K11-6	KEYSWITCH RELAY (-)
BLACK	K11-6	CR3-A	DIODE

LEAD TABULATION				
NOTES COLOR SHIELD	FROM STATION	TO STATION	CIRCUIT FUNCTION	SHIELD
BLACK	R1-1	C01-46	J1939 DATA-LINK (DETAIL L & NOTE 2)	
TWISTED SHIELDED PAIR 1-1 (BLACK)	SP7		J1939 DATA-LINK (DETAIL L)	
TWISTED SHIELDED PAIR 1-2 (WHITE)	SP8	C01-47	J1939 DATA-LINK (DETAIL L)	
WHITE	R1-2		J1939 DATA-LINK (DETAIL L & NOTE 2)	
--	R2-1	P10-1	J1939 DATA-LINK (DETAIL L)	
TWISTED SHIELDED PAIR 2-1 (BLACK)	SP7		J1939 DATA-LINK (DETAIL L & SP7)	
TWISTED SHIELDED PAIR 2-2 (WHITE)	SP8	P10-2	J1939 DATA-LINK (DETAIL L & SP8)	
--	R2-2		J1939 DATA-LINK (DETAIL L)	
TWISTED SHIELDED PAIR 2-SHIELD	P10-3	--	J1939 DATA-LINK (SHIELD) (DETAIL L)	
TWISTED SHIELDED PAIR 4-1 (BLACK)	SP7	C05-C	J1939 DATA-LINK (SEE SP7) (DETAIL L)	
TWISTED SHIELDED PAIR 4-2 (WHITE)	SP8	C05-D	J1939 DATA-LINK (SEE SP8) (DETAIL L)	
TWISTED SHIELDED PAIR 4- SHIELD	C05-E	--	J1939 DATA-LINK (DETAIL L)	
TWISTED SHIELDED PAIR 1- SHIELD	SP9	--	J1939 DATA-LINK (DETAIL L)	
TWISTED SHIELDED PAIR 2- SHIELD		--	J1939 DATA-LINK (DETAIL L)	
TWISTED SHIELDED PAIR 4- SHIELD		--	J1939 DATA-LINK (DETAIL L)	
TWISTED PAIR 6-1 (WHITE)	P7-11	CT1-X1	CURRENT TRANSFORMER 1	
TWISTED PAIR 6-2 (WHITE)	P7-12	CT1-X2/X3	CURRENT TRANSFORMER 1 RETURN	
TWISTED PAIR 7-1 (WHITE)	P7-15	CT2-X1	CURRENT TRANSFORMER 2	
TWISTED PAIR 7-2 (WHITE)	P7-16	CT2-X2/X3	CURRENT TRANSFORMER 2 RETURN	
TWISTED PAIR 8-1 (WHITE)	P7-19	CT3-X1	CURRENT TRANSFORMER 3	
TWISTED PAIR 8-2 (WHITE)	P7-20	CT3-X2/X3	CURRENT TRANSFORMER 3 RETURN	
RED/ORANGE STRIP	P7-9	P3-B	COOLANT HEATER SWB+	
WHITE	XFR P205-16	TB1-7	DAY TANK CONTROL	
WHITE	XFR P205-17	TB1-20	DAY TANK CONTROL	
WHITE	P7-31	S7-A	LOW COOLANT LEVEL SENSOR	
WHITE	P7-32	S7-B	LOW COOLANT LEVEL SENSOR	
WHITE	P7-35	S7-C	LOW COOLANT LEVEL SENSOR	
WHITE	C01-32	SP12	R3-SIM. LCL ENGINE (DETAIL J, NOTES 15 & 16)	
---	R3-1	SP12	R3-SIM. LCL ENGINE (DETAIL J, NOTES 16 & 17)	
---	R3-2	C01-28	R3-SIM. LCL ENGINE (DETAIL J, NOTES 16 & 17)	

No. 338-4859
Rev. B
Modified 09-06

GENSET WIRING DIAGRAM (SHEET 2 OF 2)

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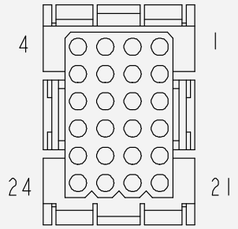
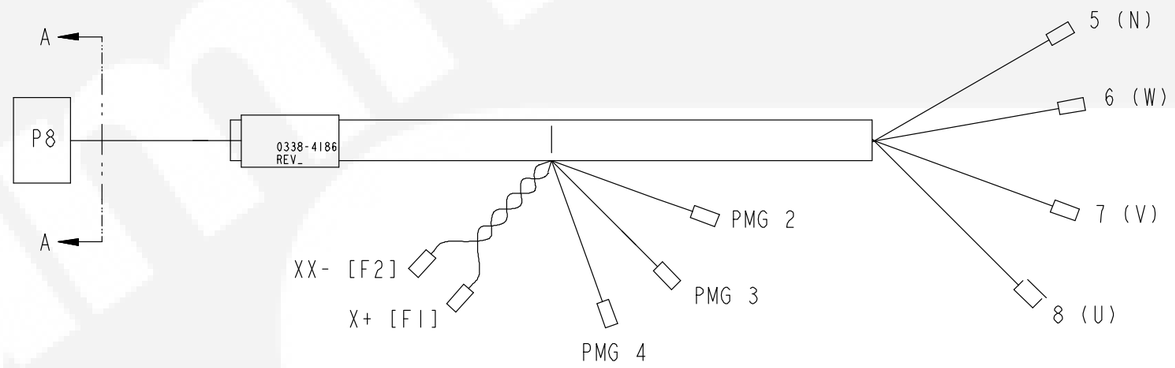


VIEW A-A



LEAD TABULATION			
FROM STATION	TO STATION	COMMENTS	WIRE COLOR
P8-4	8 (U)		BLACK
P8-12	7 (V)		RED
P8-20	6 (W)		LIGHT BLUE
P8-7	5 (N)		WHITE
P8-21	PMG 2		WHITE
P8-22	PMG 3		WHITE
P8-23	PMG 4		WHITE
P8-13	X+ (F1)	TWISTED PAIR	WHITE
P8-5	XX- (F2)		WHITE

No. 338-4186
Rev. E
Modified 01-05

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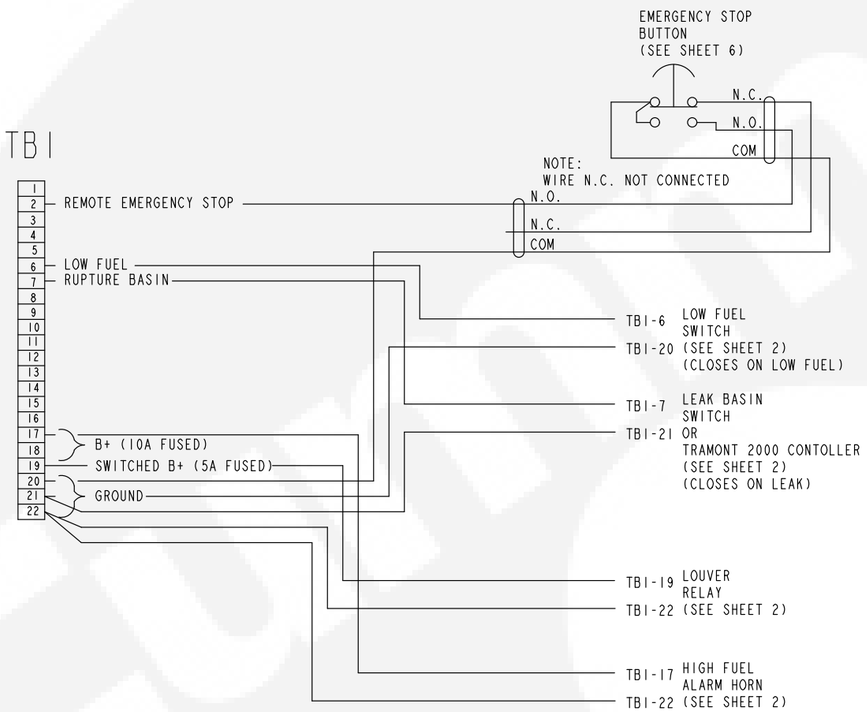
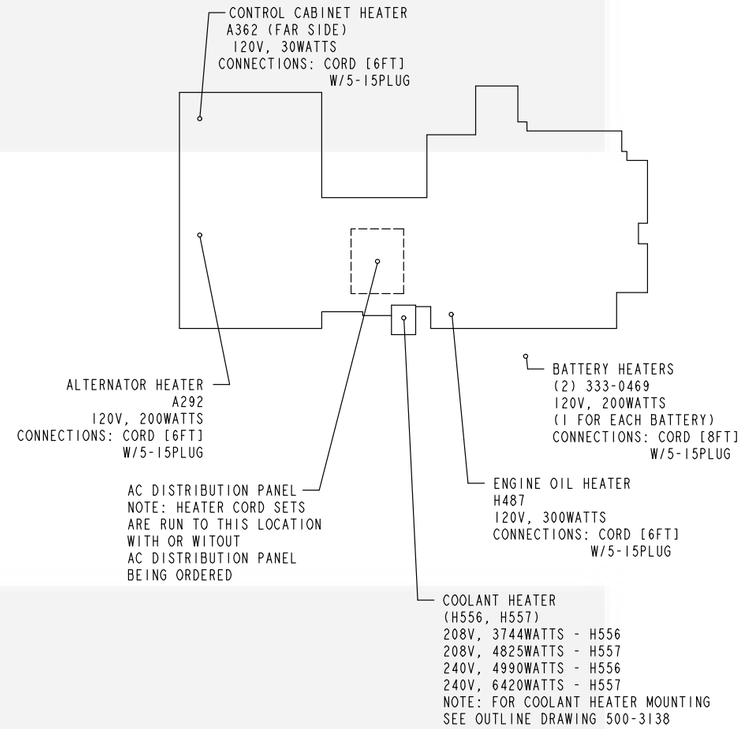
CUSTOMER CONNECTIONS TERMINAL STRIP

TB1



OPTIONAL GENSET HEATERS AND AC DISTRIBUTION PANEL LOCATIONS



No. 630-2672
Rev. B
Modified 10-03

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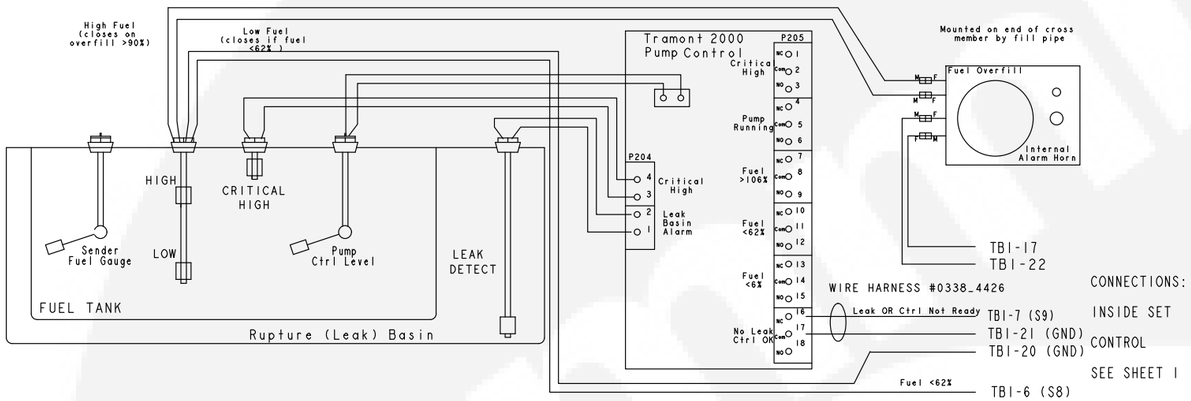
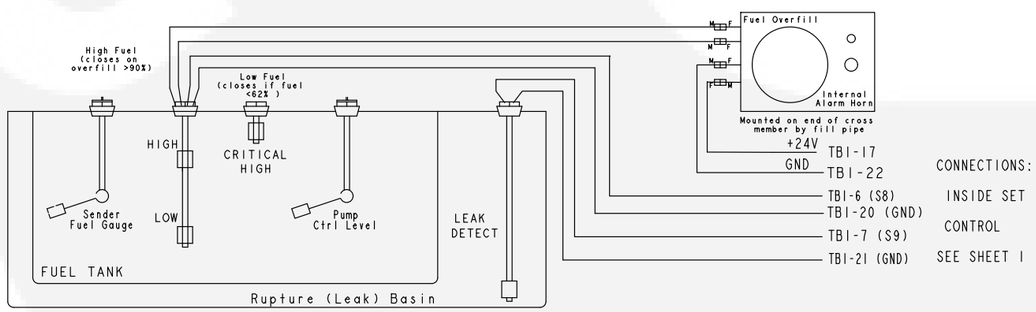
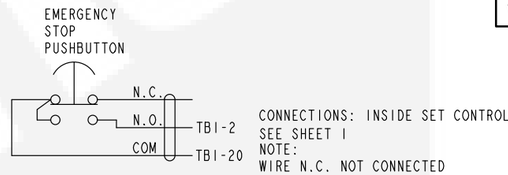
FUEL OVERFILL ALARM WITH TRANSFER PUMP CONTROLLER W/ CRITICAL ALARM AND LEAK BASIN ALARM

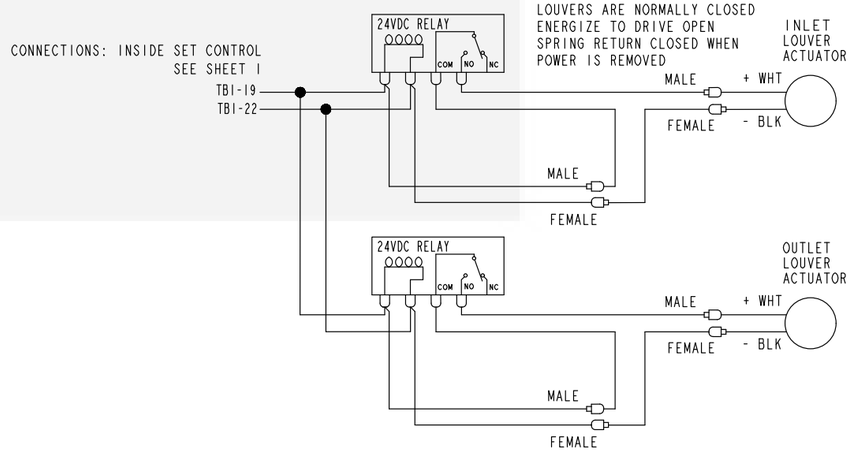


FUEL OVERFILL ALARM WITHOUT TRANSFER PUMP CONTROLLER

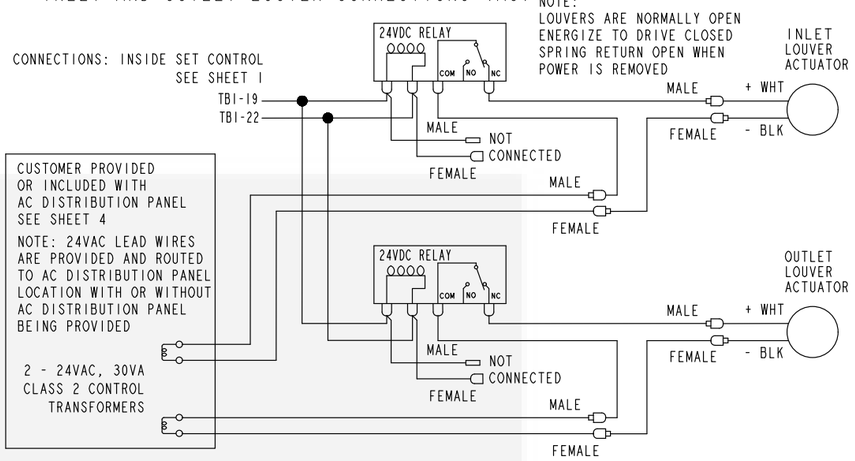




INLET AND OUTLET LOUVER CONNECTIONS (DC)



INLET AND OUTLET LOUVER CONNECTIONS (AC)



No. 630-2672
Rev. B
Modified 10-03

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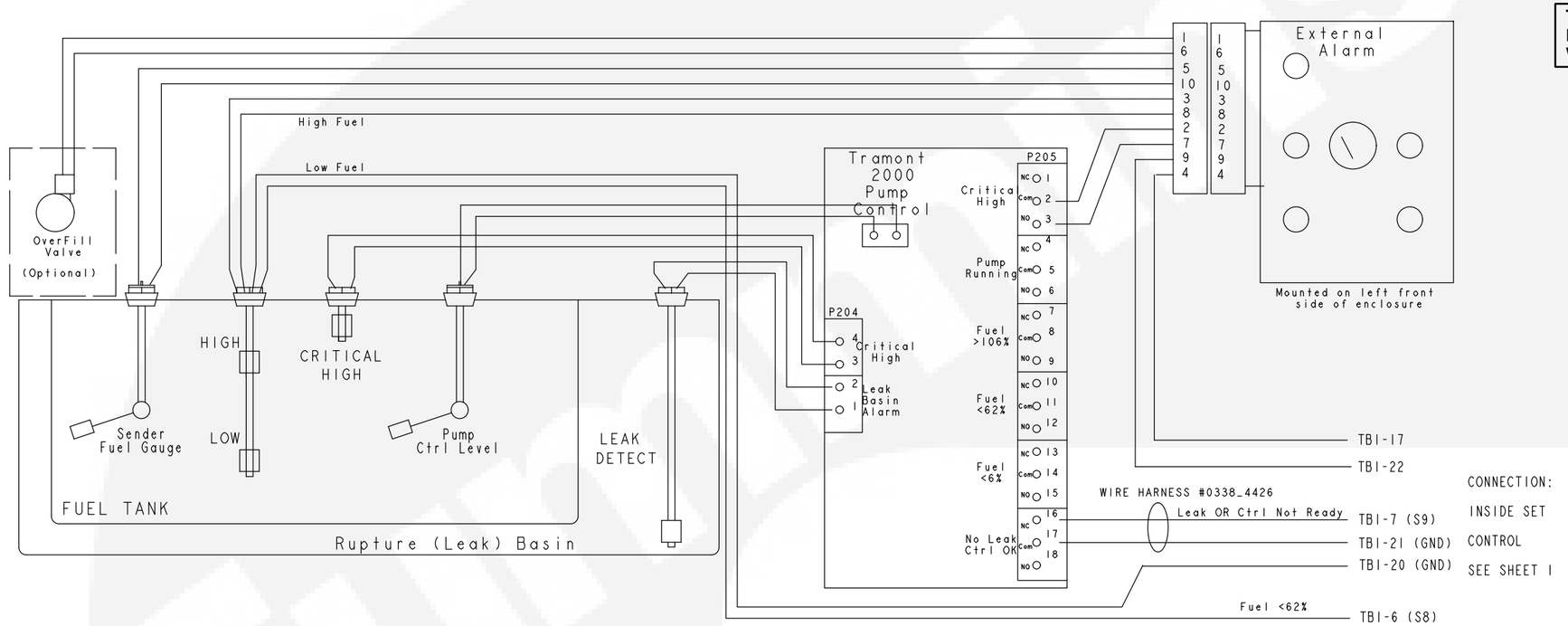

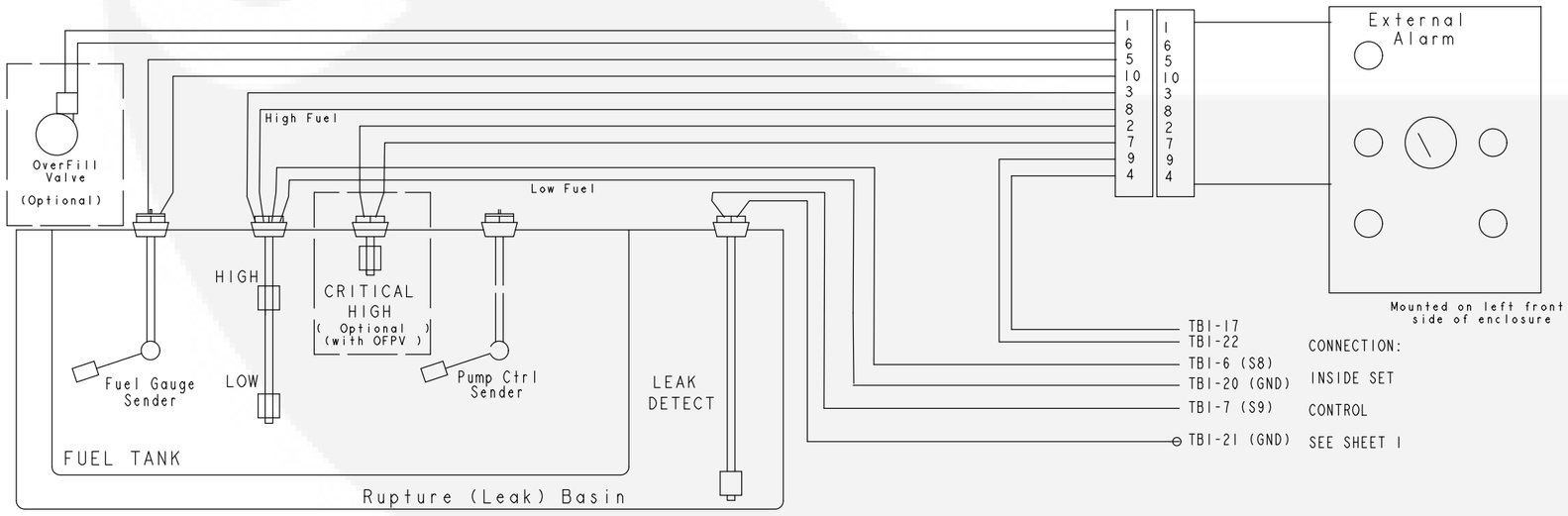

No. 630-2672
Rev. B
Modified 10-03

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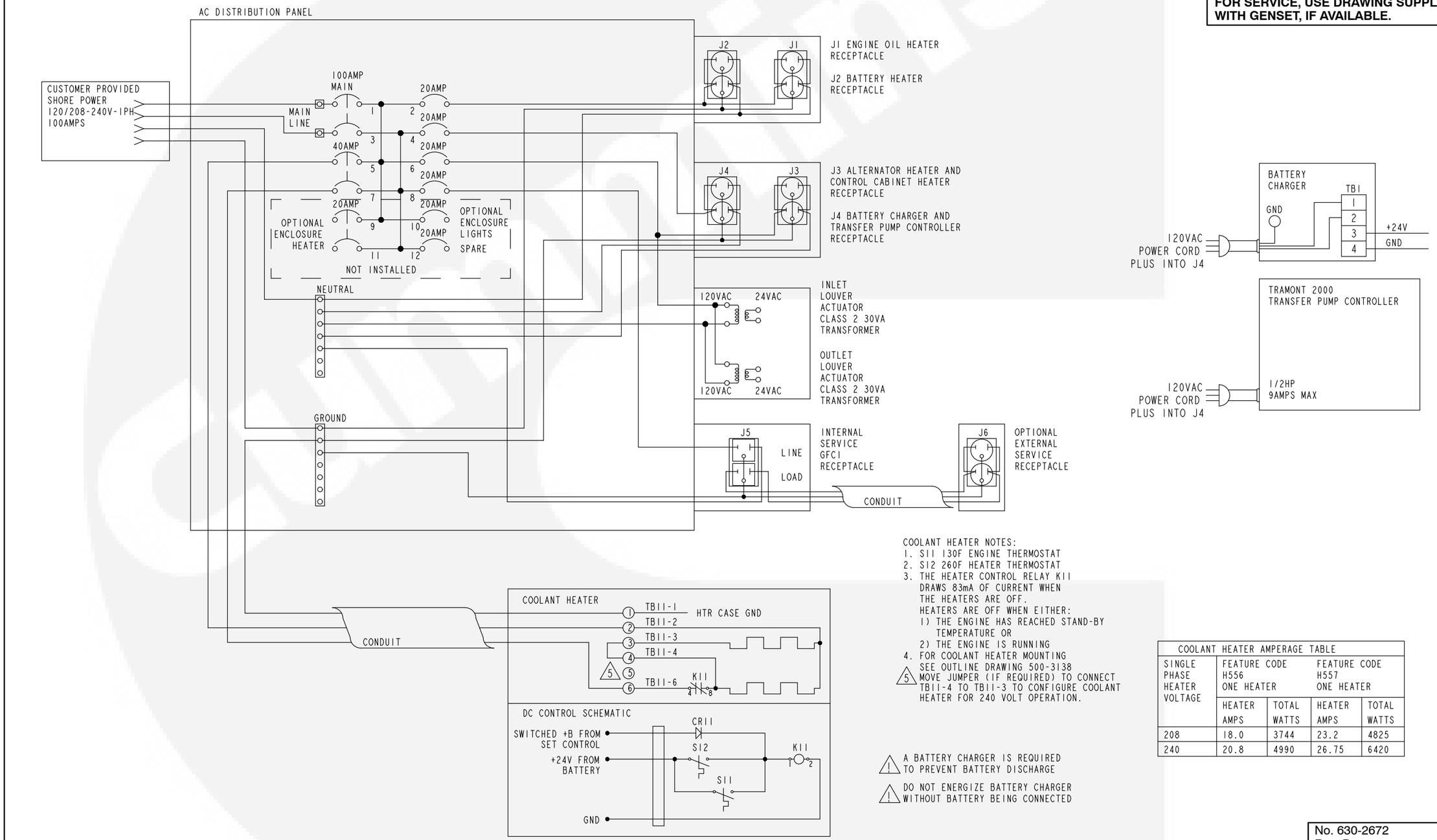

COOLANT HEATER NOTES:
1. S11 130F ENGINE THERMOSTAT
2. S12 260F HEATER THERMOSTAT
3. THE HEATER CONTROL RELAY K11 DRAWS 83mA OF CURRENT WHEN THE HEATERS ARE OFF.
   HEATERS ARE OFF WHEN EITHER:
   1) THE ENGINE HAS REACHED STAND-BY TEMPERATURE OR
   2) THE ENGINE IS RUNNING
4. FOR COOLANT HEATER MOUNTING SEE OUTLINE DRAWING 500-3138
5. MOVE JUMPER (IF REQUIRED) TO CONNECT TB11-4 TO TB11-3 TO CONFIGURE COOLANT HEATER FOR 240 VOLT OPERATION.

⚠ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE

⚠ DO NOT ENERGIZE BATTERY CHARGER WITHOUT BATTERY BEING CONNECTED

COOLANT HEATER AMPERAGE TABLE				
SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H556 ONE HEATER		FEATURE CODE H557 ONE HEATER	
	HEATER AMPS	TOTAL WATTS	HEATER AMPS	TOTAL WATTS
208	18.0	3744	23.2	4825
240	20.8	4990	26.75	6420

No. 630-2672
Rev. B
Modified 10-03

ENCLOSURE/OPTIONS WIRING DIAGRAMS (SHEET 4 OF 5)

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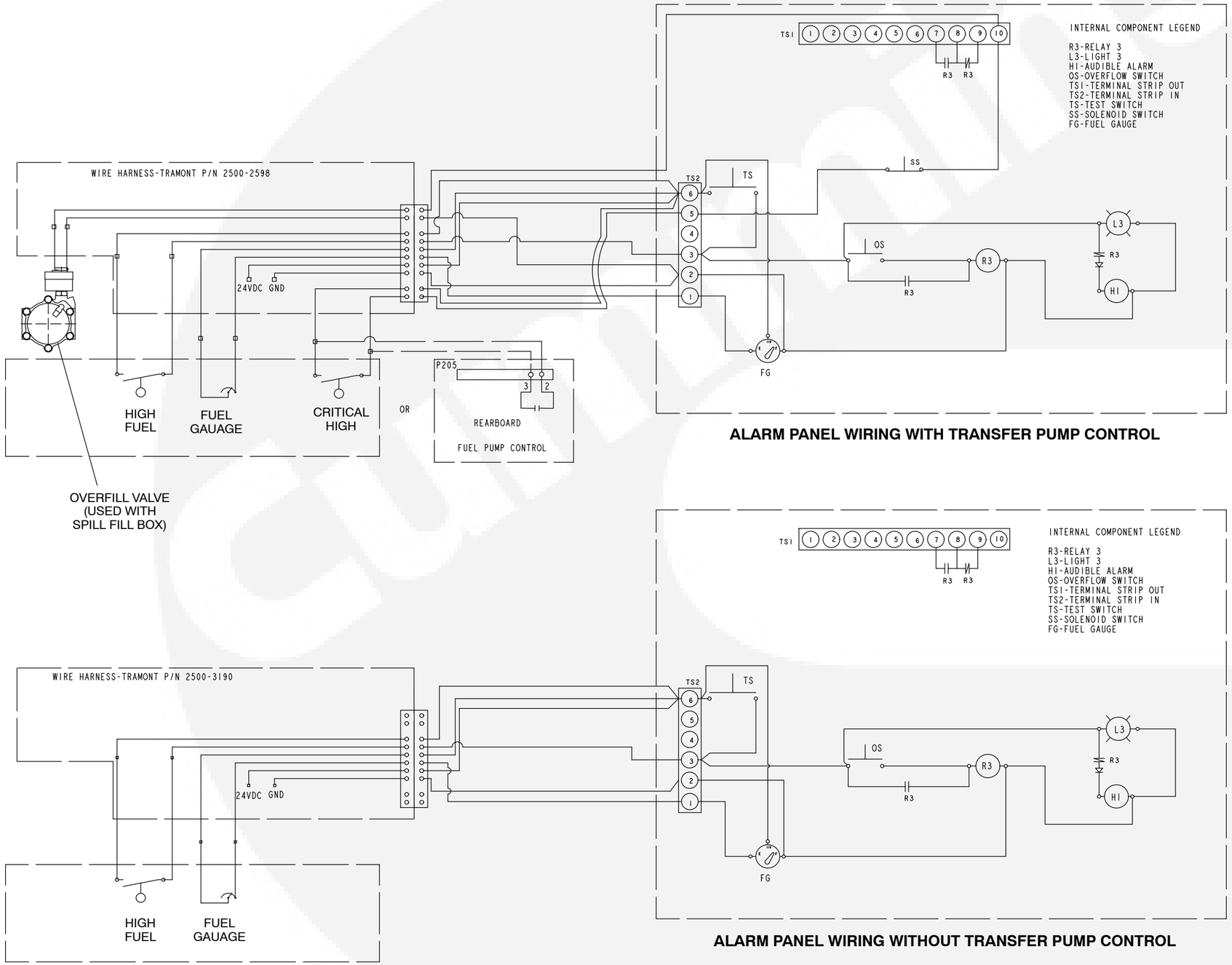

ALARM PANEL WIRING WITH TRANSFER PUMP CONTROL

ALARM PANEL WIRING WITHOUT TRANSFER PUMP CONTROL

No. 541-1066
Rev. B
Modified 12-03

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