



Operator Manual

Generator Set

with PowerCommand[®] 3201 Controller

DQGAA (Spec A–C)

DQGAB (Spec A–C)

California

Proposition 65 Warning

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

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IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

FUEL AND FUMES ARE FLAMMABLE

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

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use zinc coated or copper fuel lines with diesel fuel.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.
- Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

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

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

MEDIUM VOLTAGE GENERATOR SETS (601V to 15kV)

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

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat ex-

changer 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 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 breathe or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator system, turbo charger system and exhaust system.


KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

GENERAL

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

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

 *Improper operation and maintenance can lead to severe personal injury or loss of life and property by fire, electrocution, mechanical breakdown or exhaust gas asphyxiation. Read Important Safety Instructions pages and carefully observe all instructions and precautions in this manual.*

HOW TO OBTAIN SERVICE

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

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

GENERATORS-ELECTRIC or
ELECTRICAL PRODUCTS

For outside U.S. and Canada call Cummins Inc., 1-800-CUMMINS™ (1-800-286-6467).

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

WARNING

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

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2. Specifications

MODEL	DQGAA, DQGAB
Cummins Diesel Series	QSK50 (50/60 Hz)
Generator kW Rating	See Genset Nameplate for rating information.
Electrical System Starting Voltage Battery Charging Current Battery Group Number CCA (minimum) Cold Soak @ 0°F (-18° C)	24 Volts DC 35 Amps Four, 12 Volt 8D 1400
Cooling System Capacity with Standard Radiator	143 Gal (541 L)
Lubricating System Oil Capacity with Filters Oil Type*	61.0 Gal (231 L)
* Refer to Cummins engine Operation and Maintenance Manual for lubricating oil recommendations/specifications.	

FUEL CONSUMPTION (STANDBY/FULL LOAD/60HZ)

MODEL	DQGAA	DQGAB
US gph (L/hr)	92.7 (350.9)	109.4 (414.1)

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3. Operation

GENERAL

The following describes the function and operation of the PowerCommand® Control 3201 (PCC). All indicators, control switches/buttons and graphical display are located on the face of the control panel as illustrated in Figure 3-1.

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

PRESTART CHECKS

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

Lubrication

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

Coolant

Check the engine coolant level. Refer to Section 5.

Fuel

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

Ventilation

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

Remove all loose debris from surrounding area of generator set. Air flow from the radiator fan can blow loose items around and into ventilation openings.

Exhaust

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

EXHAUST GAS IS DEADLY!

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

- ***Dizziness***
- ***Nausea***
- ***Headache***
- ***Weakness and Sleepiness***
- ***Throbbing in Temples***
- ***Muscular Twitching***
- ***Vomiting***
- ***Inability to Think Coherently***

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

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

CONTROL PANEL POWER ON/OFF MODES

The power on/off modes of the control panel and operating software are Power On, Screen 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/graphical display will remain active until the Screen Saver mode is activated.

Screen Saver Mode: Power to the graphical display will be removed after 10 minutes (generator set not running or running). The 10 minute timer resets and begins after each control panel action (any button or switch selection) or signal received by the operating software. The bottom LEDs of the Analog AC Metering Panel (bar graphs) may remain on 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 will display the warning message. The control will remain active until the Fault Acknowledge button is pressed to clear the warning message and start the 10 minute timer.

Sleep/Awake Mode: In the Sleep mode, the control's operating software is inactive and the LEDs and the graphical display on the control panel are all

off. Sleep mode is a feature that is used to reduce battery power consumption when the control is in the Auto mode and is not being used.

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

The operating software is initialized and the control panel LEDs and graphical display is turned on in response to one of the following:

- moving/pressing any control panel switch/button.
- a remote start input signal (generator set in Auto mode), or
- customer fault 2 or 3 only (shutdown or warning indicator is on).

To activate the control and view the menu display without starting the generator set, press any button on the control panel.

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) when the control is in Auto mode.

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

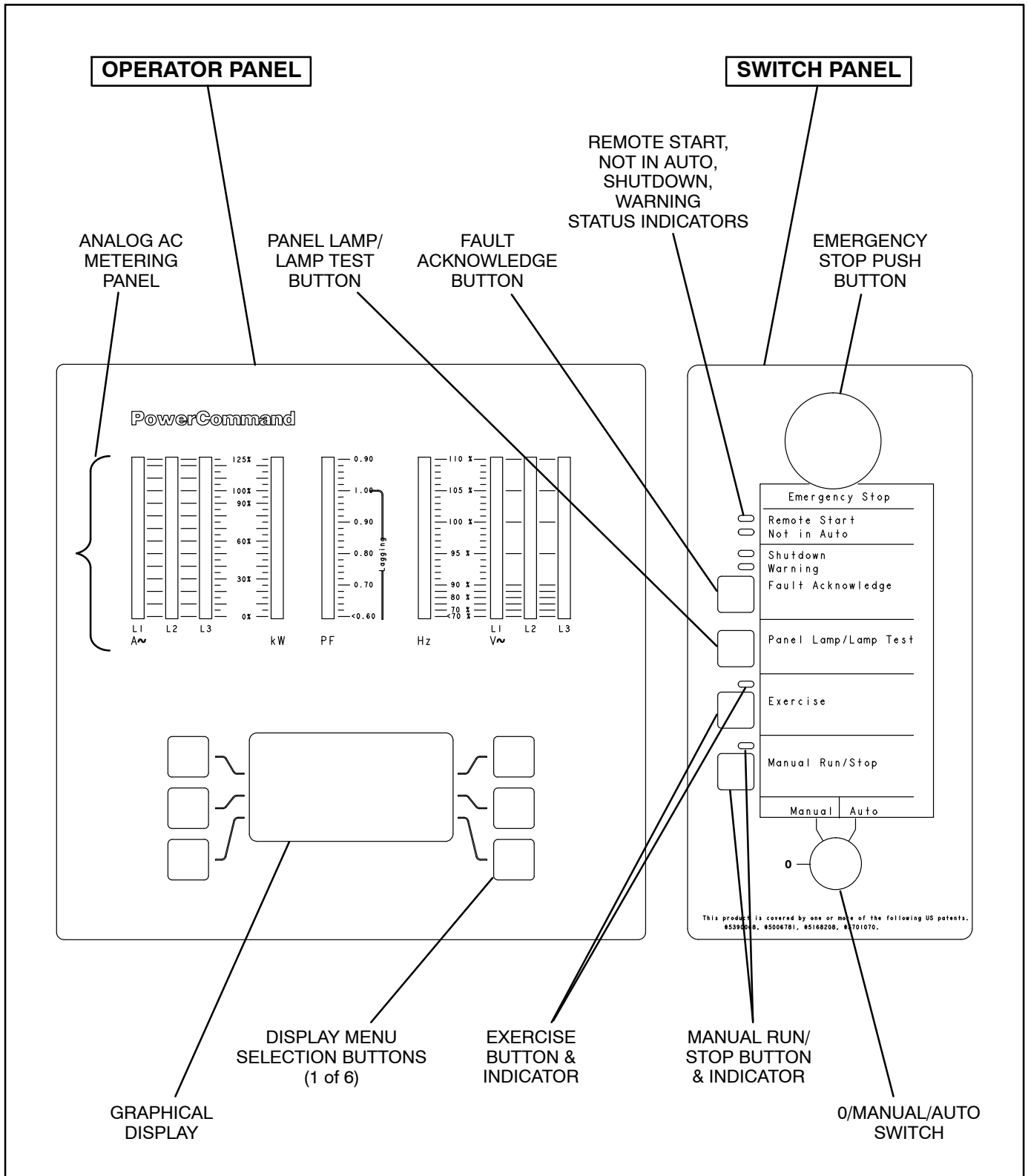


FIGURE 3-1. CONTROL PANEL ASSEMBLY (FULL-FEATURED)

CONTROL PANEL ASSEMBLY

The control panel assembly (Figure 3-1) consist of two panels, the *Operator Panel* and the *Switch Panel*. The control panel assembly can be mounted on the genset or in a freestanding cabinet located near the genset. In either location, the function of the control panel assembly switches and indicators remain the same.

Dependent on site requirements, the *Operator Panel* is either mounted on the control panel assembly (full-featured) as shown in Figure 3-1 or is contained in a separate enclosure and mounted remotely of the control panel assembly.

The function of several buttons on the operator panel will vary dependent on the location of the operator panel (remote or local of the control panel assembly). If the function differs, it is noted as either “remote” or “local operator panel” in the button description.

Operator Panel

The operator panel contains the following components:

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

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

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

Graphical Display: The graphical display is capable of displaying up to 9-lines of data with approximately 27 characters per line. The 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 warning and shutdown messages/error codes, modes of operation (Figure 3-3) and system actions, such as Warning, Derate, Shutdown, etc.

Display Menu Selection Buttons: Six momentary buttons—three on each side of the graphical display window—are used to navigate through the system control menus and to adjust generator set parameters. The button is active when the message adjacent to the button is highlighted (displayed in inverse video).

Switch Panel

The switch panel contains the following components:

Emergency Stop Button: Push the button in for emergency shutdown of the engine. If the engine is not running, pushing the button in will prevent the starting of the engine, regardless of the start signal source (local or remote).

To reset:

1. Pull the button out.
2. Move the 0/Manual/Auto switch to 0.
3. Press the front panel Fault Acknowledge button, and hold until the fault is cleared.
4. Select Manual or Auto, as required.

Remote Start Indicator: This green lamp is lit whenever the control is receiving a remote run signal. When flashing, indicates a load demand stop mode.

Not in Auto Indicator: This red lamp flashes continuously when the 0/Manual/Auto switch is not in the Auto position. (If in Auto position and lamp is flashing, service is required.)

Shutdown Status Indicator: This red lamp is lit whenever the control detects a shutdown condition. The generator set can not be started when this lamp is on. After the condition is corrected, shutdown indicators can be reset by turning the 0/Manual/Auto switch to the 0 position, and pressing the Fault Acknowledge button.

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

Warning Status Indicator: This yellow lamp is lit whenever the control detects a warning condition. After the condition is corrected, warning indicators can be reset by pressing the Fault Acknowledge button. (It is **not** necessary to stop the generator set if the fault becomes inactive during genset operation.)

Fault Acknowledge: Press this button to acknowledge warning and shutdown messages after the fault has been corrected.

To acknowledge a Warning message, the 0/Manual/Auto switch can be in any position. (It is **not** necessary to stop the generator set to acknowledge an inactive Warning condition.) To acknowledge a shutdown message with this button, the 0/Manual/Auto switch must be in the 0 (off) position.

This button is also used to blink a fault code if the Shutdown or Warning Status Indicator is lit. (This function is used when the control does not contain a graphical display.) Refer to *Reading Fault Codes* in this section, which describes how to use this button for interpreting fault codes.

Panel Lamp/Lamp Test Button: Press this button to turn on or off the panel lamp. Press and hold down this button for three seconds or more to turn all control panel LEDs on to make sure all lamps illu-

minate. The illumination will shut off after releasing button.

Exercise Button: Press this button to initiate a pre-programmed exercise sequence. The 0/Manual/Auto switch is used in conjunction with this button to enable this function (refer to Exercise Start in this section).

Manual Run/Stop Button: This button starts and stops the set locally and will bypass Time Delay to Start and Stop sequences. The 0/Manual/Auto switch must be in the Manual position to enable this button.

0/Manual/Auto Switch: Manual position enables the use of the switch panel Manual Run/Stop button.

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

0 (off) position prevents the starting of the set (local or remote). If moved to 0 during set operation, will cause an immediate engine shutdown (bypasses cool-down timers). This hot shutdown should be avoided, if possible, to help prolong the life of the engine. Hot shutdowns are logged by the system software.

STARTING

The following headings cover the systems used to start the generator set. Figure 3-2 provides a flow chart for each of the three start/run/stop sequences.

With the optional Power Transfer Control (PTC) feature installed, the function and sequence of operation for the Start command differs due to the transfer and retransfer of load. Refer to “Optional Power Transfer Control (PTC) Operation” in this section for the start/run/stop PTC sequences.

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

Starting at Switch Panel (Manual Mode)

Move the 0/Manual/Auto switch to the Manual position and press the Manual Run/Stop button. This will activate the engine control system and the starting system. The starter will begin cranking, and after a few seconds the engine will start and the starter will disconnect.

In the Manual position, the control will not complete the time delay to start or time delay to stop (Figure 3-2), but will complete the Warm-up At Idle and Cool-down At Rated/Idle. (See Table 3-4 for PTC sequence of operation.)

When the coolant reaches operating temperature or the Warm-up At Idle time delay is reached (0 to 300 seconds), whichever occurs first, the generator set will ramp to rated speed and voltage.

PTC – To manually transfer load between the utility and the genset during genset operation, refer to Transfer Control (PWR TRAN) Submenu in this section.

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

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

The InPower service tool is required to change the number of crank cycles, and the crank and rest times. Contact an authorized service center for assistance.

To clear a Fail To Start shutdown, place the 0/Manual/Auto switch in the 0 position and press the Fault Acknowledge button. Before attempting to restart, wait two or more minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to the *Troubleshooting* section.

Starting at Remote Operator Panel (Auto Mode)

When the operator panel is mounted remotely of the control panel assembly, the Start button of the Control submenu can also be used to start the generator set. The function of this Start button is identical to the following *Starting from Remote Location* description. Refer to page 3-21 for Control Submenu description.

The 0/Manual/Auto switch must be in the Auto position to activate the Remote Menu Buttons of the Control submenu.

Starting from Remote Location (Switch or Device) (Auto Mode)

Place the 0/Manual/Auto switch in the Auto position. This allows the generator set to be started from a remote switch or device (e.g., transfer switch or the optional Power Transfer Control feature).

With the PTC feature installed, the Remote Start input (TB8-4/5) will function as a Test mode switch for the PTC. The PTC Test sequence is shown in Table 3-3 (Exercise). The *Installation* manual describes how to enable test “with load” or “without load”.

There are two start modes that are selectable for the remote start input, one for non-emergency start and the other for emergency start. In the non-emergency mode, the control will complete the Warm-up At Idle. In the Emergency mode, the genset will skip the warm-up and go directly to rated speed and voltage.

Emergency start feature is controlled by connecting a remote contact between TB8-3 and TB8-5. Open

the contact for emergency start and close the contact for non-emergency start.

In response to the remote run signal or the control detects the loss of utility voltage detected through the PTC, the control lights the Remote Start indicator and initiates the starting sequence described in the previous heading (*Starting at Switch Panel*), except for the following:

In the Auto position, the control will complete the Time Delay To Start (0 to 300 seconds) and the Time Delay To Stop (0 to 600 seconds).

Refer to Adjust submenu in this section to change the time delay settings.

When the generator set is operating in the Remote Start mode, removing the Remote Start command does not shut off the engine if the load is more than 10 per cent, the cooldown timer is set to zero, and the control is configured for a single unit (not in parallel). The generator set continues to operate until it runs out of fuel, the E-stop button is used, or the load is removed.

Exercise Start

Move the 0/Manual/Auto switch to the Auto position and press and hold the Exercise button. Move the control switch from Auto to Manual and back to Auto.

This will activate the engine control system to complete a pre-programmed exercise sequence. The sequence (Figure 3-2) will vary accordingly to the settings/selections of the system control parameters.

PTC – The *Installation* manual describes how to enable exercise “with load” or “without load”. (See Table 3-3 for PTC Exercise sequence.)

The InPower service tool is required to modify the following exercise parameters. Contact an authorized service center for assistance.

The exercise sequence may include running at idle speed, ramping to rated speed, running for a predetermined period of time and timed shutdown. During the exercise operation, the LED lamp adjacent to the Exercise button will light. To manually stop the exercise operation before completion, press the Exercise button. The set will complete its normal cool-down sequence. The control will indicate that the set is in a cool-down mode by flashing the exercise LED.

PTC – If exercising with load, cool-down mode is activated after retransfer of load to utility. (See Table 3-3 for PTC Exercise sequence.)

All exercise functions are disabled when a remote start signal is received by the control.

Cold Starting with Loads

In accordance with NFPA 110, Cummins Power Generation recommends installing diesel standby generator sets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is above 40°F (4°C). NFPA also requires that the engine be heated as necessary to maintain the water jacket temperature determined by the manufacturer for cold start and load acceptance for the type of sys-

tem. Although most Cummins Power Generation generator sets will start in temperatures down to –25°F (–32°C) when equipped with engine jacket water coolant heaters, it might take more than 10 seconds to warm the engine before a load can be applied when ambient temperatures are below 40°F (4°C).

The **Low Coolant Temperature (Code 152)** message, is provided to meet the requirements of NFPA 110. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 70°F (21°C). In applications where the ambient temperature falls below 40°F (4°C), a cold engine may be indicated even though the coolant heaters are connected and operating correctly. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

RUNNING AT IDLE (MANUAL)

The Run At Idle mode is selectable only when the operator panel is mounted on the control panel assembly.

The run mode can be set to Rated or Idle with the set running or not running. To manually select the engine idle function, the 0/Manual/Auto switch must be in the Manual position. Once selected and the set is manually started, the control will limit the engine idle time to 10 minutes. When the 10 minute idle cycle is complete, the genset will ramp to rated speed.

To activate the idle function, refer to page 3-21.

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

STOPPING

When the generator set stops for any reason (pressing the local or remote Stop button, shutdown fault, etc.) the message “ECM DATA SAVE IN PROCESS” will be displayed. If a Run command is received during this process, the control will bypass the data save and start the generator set. The data save process will finish after the next stop command.

Emergency Stop (Code 1434)

The emergency stop button is located on the upper right side of control panel (Figure 3-1). Push the button in for emergency stop. The red Shutdown status LED will light, and the graphical display message will be: “EMERGENCY STOP
1434 – SHUTDOWN”

To reset:

1. Pull the button out.
2. Move the 0/Manual/Auto switch to 0.
3. Press the front panel Fault Acknowledge button, and hold until the fault is cleared.
4. Select Manual or Auto, as required.

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

Stopping at Switch Panel (Manual Mode)

If the set was started at the switch panel (0/Manual/Auto switch in the Manual position), pressing the Manual Run/Stop button will cause the set to complete its normal (Local Start) shutdown sequence (Figure 3-2). (See Table 3-4 for PTC sequence of operation.)

The preset cool-down time (at rated speed) can vary dependent on the kW output. That is, if prior to shutdown, the kW is 10% or less of rated, the control software considers this output as cool-down and will subtract this time from the preset cool-down timer.

The set will stop after the Cool-down At Idle Timer (0 to 10 minutes) has timed out. (If necessary, the set

will continue to run after time-out until coolant reaches normal operating temperature.)

Moving the 0/Manual/Auto switch to the 0 position will cause an immediate engine shutdown (bypass Cool-down At Idle) and display a Cool-down Interrupted Warning message. If possible, this hot shutdown should be avoided to help prolong the reliability of the generator set. Hot shutdowns are logged in the system software.

Stopping at Remote Operator Panel (Auto Mode)

When the operator panel is mounted remotely of the control panel assembly, the Stop button of the Control submenu can also be used to stop the generator set (0/Manual/Auto switch in the Auto position).

The function of this Stop button is identical to the Stopping from Remote Location (non-emergency sequence, Figure 3-2). Refer to page 3-21 for Control Submenu description.

The 0/Manual/Auto switch must be in the Auto position to activate the Remote Menu Buttons of the Control submenu.

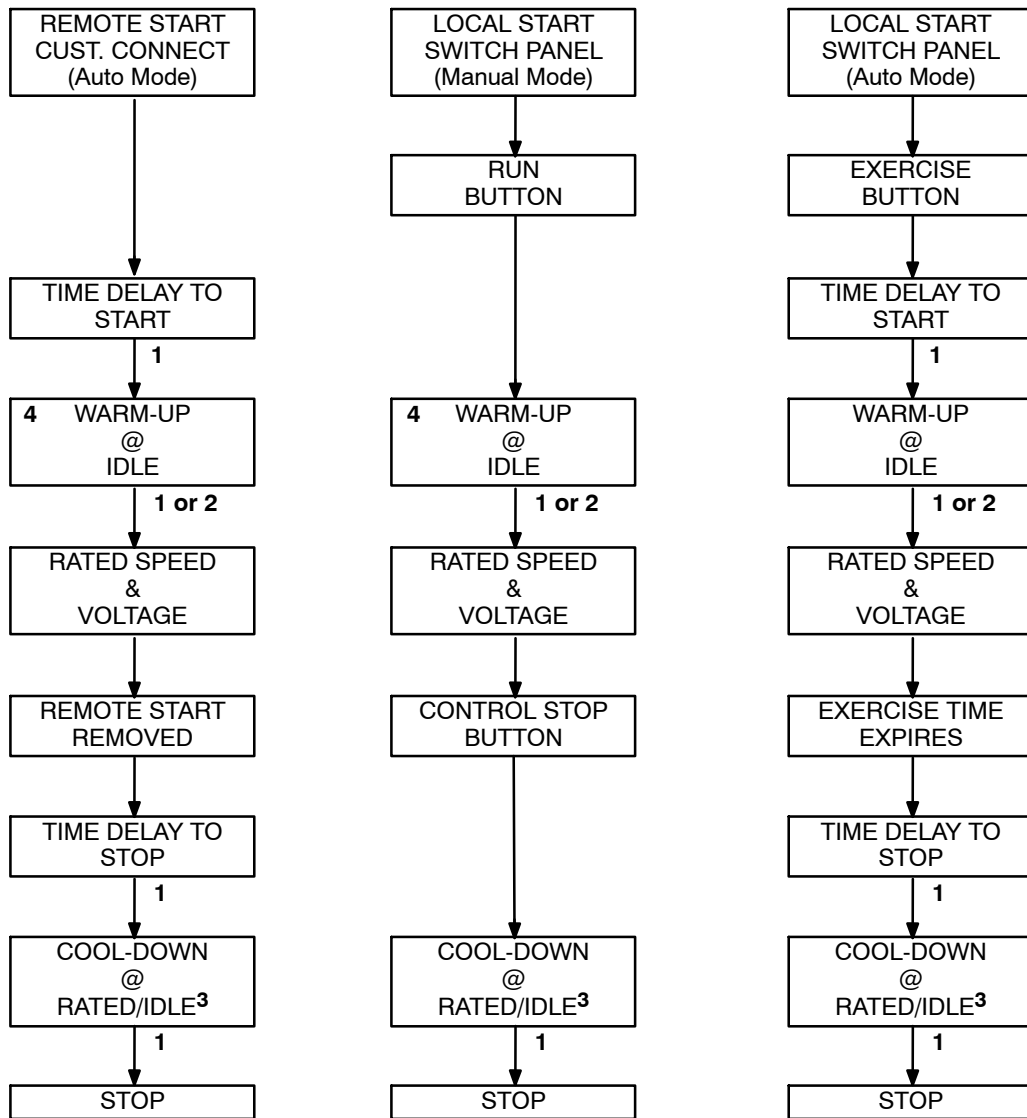
Stopping from Remote Location (Switch or Device) (Auto Mode)

If the control receives a remote stop signal or the control detects the return of utility voltage through the PTC, the set will complete its normal shutdown sequence. (The remote stop signal is actually the removal of the remote start signal to the control.)

The set will stop after completing the following cool-down sequence:

- Time Delay To Stop (0 to 300 seconds)
- Cool-down At Idle (0 to 10 minutes) or longer, if necessary, to obtain normal operating temperature before shutdown.

Refer to Adjust submenu in this section to change the Time Delay To Stop setting. The InPower service tool is required to modify the Cool-down At Idle. Contact an authorized service center for assistance.



NOTES:

1. Timer expires.
2. Coolant temperature reaches operating level.
3. Cool-down can be at rated speed and/or idle with different time-outs for each.
4. Only when non-emergency feature enabled (TB8-3 closed).

FIGURE 3-2. NORMAL START/RUN/STOP SEQUENCES

OPTIONAL POWER TRANSFER CONTROL (PTC) OPERATION

The following describes the function and operation of the PCC with the optional PTC feature installed. With the PTC feature installed, the PCC performs

two functions: genset operation and transfer of load between utility and genset.

Table 3-1 describes how the genset/PTC operates when the PCC control switch is in the Off, Manual and Auto position.

TABLE 3-1. GENSET/PTC OPERATION – OFF/MANUAL/AUTO

CONTROL SWITCH POSITION	RESULT
OFF	<ul style="list-style-type: none"> • PCC/PTC Not In Auto (1222) warning fault active. • Genset will not start. • Loads will not transfer/retransfer.
MANUAL (Sequence of Operation, Table 3-4)	<ul style="list-style-type: none"> • PCC/PTC Not In Auto (1222) warning fault active. • Genset can only be started manually via control panel Manual Run/Stop button. • Load must be transferred manually (see Figure 3-17). • Synchronizing and load ramping will occur automatically. • Enforcement of maximum parallel time will occur automatically
AUTO (Sequence of Operation, Table 3-2)	<ul style="list-style-type: none"> • PCC/PTC in automatic mode. • Genset will start automatically as required. • Loads will transfer/retransfer automatically as required.

PCC/PTC – Normal Operation Sequences

The following tables show the normal operating sequence of events for each of the four possible running modes (utility power failure, exercise, test, or manual run). The sequences are further defined by what the Genset Application Type is (i.e., Open Transition, Closed Transition–Momentary, or Closed Transition–Soft Loading).

The previous Start, Exercise and Stop information also applies/remains the same, other than the addition of the PTC transfer and retransfer of load after the genset or utility voltage/frequency stabilize.

The PCC/PTC Exercise With Load is shown in Table 3-3. The PCC/PTC Exercise Without Load is identical to the standard PCC Exercise sequence shown in Figure 3-2.

TEST Switch – With the PTC feature installed, the Remote Start input (TB8-4/5) will function as a Test mode switch for the PTC. The PTC Test sequence is identical to the Exercise sequence (with or without load), except that the genset will continue to run until the TEST switch is deactivated. The *Installation* manual describes how to enable test “with load” or “without load”.

TABLE 3-2. UTILITY POWER FAIL

	OPEN TRANSITION	CLOSED TRANSITION – MOMENTARY	CLOSED TRANSITION – SOFT LOADING
1	Utility Failure	Utility Failure	Utility Failure
2	Time Delay to Start	Time Delay to Start	Time Delay to Start
3	Genset Starts	Genset Starts	Genset Starts
4	Genset Available	Genset Available	Genset Available
5	Time Delay to Transfer	Time Delay to Transfer	Time Delay to Transfer
6	Utility Circuit Breaker Opens	Utility Circuit Breaker Opens	Utility Circuit Breaker Opens
7	Time Delay Programmed Transition	Time Delay Programmed Transition	Time Delay Programmed Transition
8	Genset Circuit Breaker Closes	Genset Circuit Breaker Closes	Genset Circuit Breaker Closes
9	GENSET SUPPLYING LOAD	GENSET SUPPLYING LOAD	GENSET SUPPLYING LOAD
10	Utility Available	Utility Available	Utility Available
11	Time Delay Retransfer	Time Delay Retransfer	Time Delay Retransfer
12		Synchronizes to Utility	Synchronizes to Utility
13		Utility Circuit Breaker Closes	Utility Circuit Breaker Closes
14		<100msec Overlap	Genset Ramp Unloads
15			Genset Unloaded
16	Genset Circuit Breaker Opens	Genset Circuit Breaker Opens	Genset Circuit Breaker Opens
17	Time Delay Programmed Transition		
18	Utility Circuit Breaker Closes		
19	UTILITY SUPPLYING LOAD	UTILITY SUPPLYING LOAD	UTILITY SUPPLYING LOAD
20	Time Delay to Stop/Cool-Down	Time Delay to Stop/Cool-Down	Time Delay to Stop/Cool-Down
21	Genset Stopped	Genset Stopped	Genset Stopped

TABLE 3-3. EXERCISE WITH LOAD (SWITCH PANEL)

	OPEN TRANSITION	CLOSED TRANSITION - MOMENTARY	CLOSED TRANSITION - SOFT LOADING
1	Exercise Start Activated	Exercise Start Activated	Exercise Start Activated
2	Time Delay to Start	Time Delay to Start	Time Delay to Start
3	Genset Starts	Genset Starts	Genset Starts
4	Warm-Up @ Idle	Warm-Up @ Idle	Warm-Up @ Idle
5	Genset Available	Genset Available	Genset Available
6	Time Delay to Transfer	Time Delay to Transfer	Time Delay to Transfer
7	Utility Circuit Breaker Opens	Synchronizes to Utility	Synchronizes to Utility
8	Time Delay Programmed Transition		
9	Genset Circuit Breaker Closes	Genset Circuit Breaker Closes	Genset Circuit Breaker Closes
10		<100msec Overlap	Genset Ramp Loads
11			Utility Unloaded
12		Utility Circuit Breaker Opens	Utility Circuit Breaker Opens
13	GENSET SUPPLYING LOAD	GENSET SUPPLYING LOAD	GENSET SUPPLYING LOAD
14	Exercise Timer Expires	Exercise Timer Expires	Exercise Timer Expires
15	Time Delay Retransfer	Time Delay Retransfer	Time Delay Retransfer
16	Genset Circuit Breaker Opens	Synchronizes to Utility	Synchronizes to Utility
17	Time Delay Programmed Transition		
18	Utility Circuit Breaker Closes	Utility Circuit Breaker Closes	Utility Circuit Breaker Closes
19		<100msec Overlap	Genset Ramp Unloads
20			Genset Unloaded
21		Genset Circuit Breaker Opens	Genset Circuit Breaker Opens
22	UTILITY SUPPLYING LOAD	UTILITY SUPPLYING LOAD	UTILITY SUPPLYING LOAD
23	Time Delay to Stop/Cool-Down	Time Delay to Stop/Cool-Down	Time Delay to Stop/Cool-Down
24	Genset Stopped	Genset Stopped	Genset Stopped

TABLE 3-4. MANUAL RUN (SWITCH PANEL)

	OPEN TRANSITION	CLOSED TRANSITION - MOMENTARY	CLOSED TRANSITION - SOFT LOADING
1	Manual Run Switch Activated	Manual Run Switch Activated	Manual Run Switch Activated
2	Genset Starts	Genset Starts	Genset Starts
3	Warm-up @ Idle	Warm-up @ Idle	Warm-up @ Idle
4	Genset Available	Genset Available	Genset Available
5		Synchronizes to Utility	Synchronizes to Utility
6	Open Utility CB (Operator)		
7	Time Delay Programmed Transition		
8	Close Genset CB (Operator)	Close Genset CB (Operator)	Close Genset CB (Operator)
9		<100msec Overlap	Genset Ramp Loads
10			Utility Unloaded
11		Utility CB Opens (Auto by Control)	Open Utility CB (* Operator)
12	GENSET SUPPLYING LOAD	GENSET SUPPLYING LOAD	GENSET SUPPLYING LOAD
13	Open Genset CB (Operator)		
14	Time Delay Programmed Transition	Synchronizes to Utility	Synchronizes to Utility
15	Close Utility CB (Operator)	Close Utility CB (Operator)	Close Utility CB (Operator)
16		<100msec Overlap	Genset Ramp Unloads
17			Genset Unloaded
18		Genset CB Opens (By Control)	Open Genset CB (* Operator)
19	UTILITY SUPPLYING LOAD	UTILITY SUPPLYING LOAD	UTILITY SUPPLYING LOAD
20	Manual Run Switch Deactivated	Manual Run Switch Deactivated	Manual Run Switch Deactivated
21	Cool-Down	Cool-Down	Cool-Down
22	Genset Stopped	Genset Stopped	Genset Stopped

* Maximum Parallel Time is enforced in Manual mode. Breaker operation will be automatic if maximum parallel time is exceeded.

MENU DISPLAY AND SWITCHES

Figure 3-3 shows the graphical display and the menu selection buttons.

Graphical Display: The graphical display is capable of displaying up to 9-lines of data with approximately 27 characters per line. The 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 the following system information:

- *Status Line* – modes of operation, such as Stopped, Time Delay To Start, Warm Up At Idle, etc. and paralleling operations, such as Standby, Dead BUS Close, Synchronize, etc.
- *Action Line* – system actions, such as Warning, Derate, Shutdown Cool-down and Shutdown, and fault codes.
- *Description Line* – Fault code/status messages.

Menu Buttons: Six momentary buttons—three on each side of the graphical display window—are used to navigate through the system control menus and to adjust generator set parameters. The button is active when the message or symbol adjacent to the switch is highlighted (displayed in inverse video). The displayed message or symbol indicates the function of the button.

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

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

In the graphical display, the “▲” symbol indicates that selecting the adjacent button causes the operating program to go back to Main Menu A (Figure 3-5).

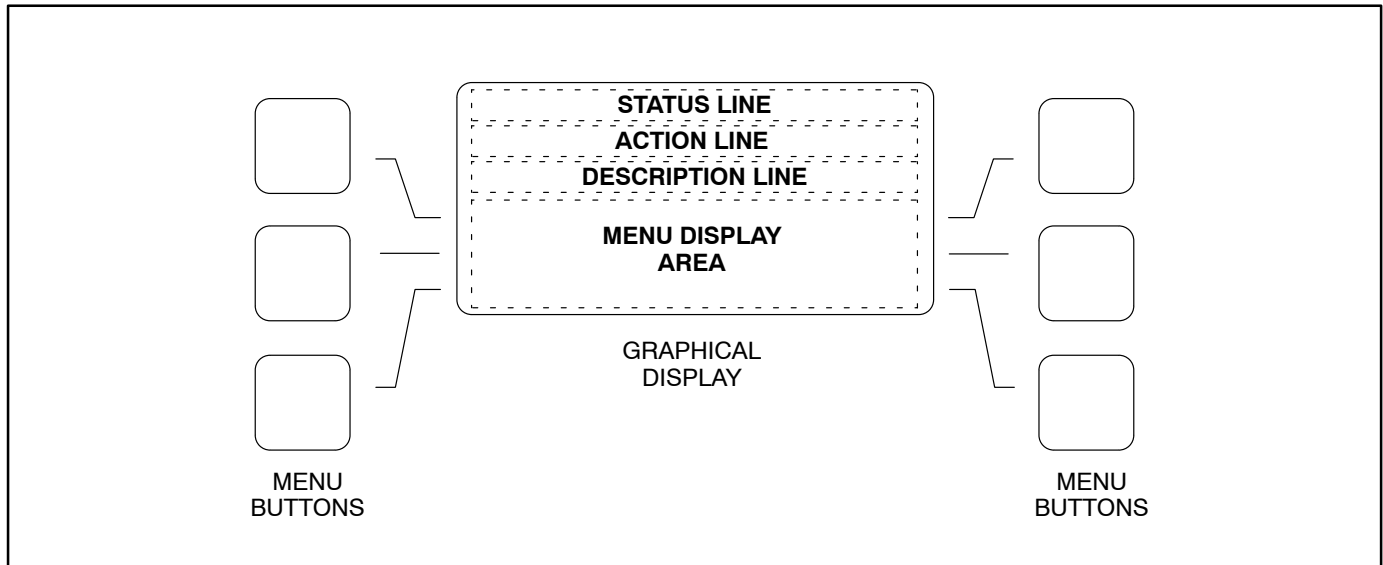


FIGURE 3-3. GRAPHICAL DISPLAY AND MENU SELECTION BUTTONS

LANGUAGE/UNITS SELECTION MENU

During any control panel operation, you can select one of three languages and change how units are displayed by pressing the two lower menu buttons (one on each side of display). When pressing these two buttons simultaneously, the language/units menu will appear (Figure 3-4). After making desired selections, press the **ENTER** button in this menu to change and save the selections.

Use the + button to select the desired option for each field. Use the arrow (→) button to move to the next field. Selected field is highlighted.

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

Local/Remote Field: This selection must be set to **Local** when the graphical display is mounted on the generator set front control panel or **Remote** when mounted remotely of the generator set.

The Local/Remote selection determines which buttons in the Control submenu (page 3-21) are active (displayed).

Temp: Used to select °F or °C for temperature readings.

Pressure Fluid: Used to select PSI, KPA, BAR or IN for pressure readings.

Pressure Gas: Used to select INHG or MMHG for pressure readings.

Flow Air: Used to select CFM or CMM for air flow readings.

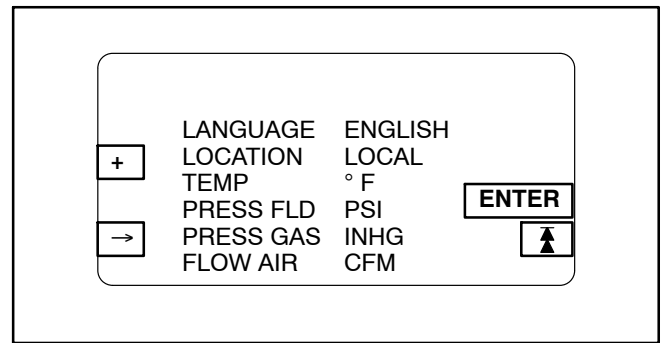


FIGURE 3-4. LANGUAGE/UNITS MENU

MAIN MENU

Figure 3-5 shows the main menus (Menu A and Menu B) of the system control. The two main menus are used to divide the system submenus into major categories, such as, Engine Data, Alternator Data, Control, etc.

To view system data, simply press the appropriate menu button to select the category. After pressing the desired menu button, refer to the page number shown in Figure 3-5 for detailed information related to the selected category.

In the following figures, the boxed/highlighted field indicates that the adjacent menu button is active. Also, the submenus are shown in the order in which they are displayed when scrolling up ▲ or down ▼.

Adjust Button

The Adjust submenu is intended for qualified site personnel only. Note that a password may be assigned to allow only authorized operators to modify this data. (Password is not required if not assigned.)

Setup Button

The “generator set” Setup submenu is described in the *Service* manual and is intended for qualified service personnel only. For this reason, a password must be entered before this data can be modified.

The “PTC” Setup submenu is described in the *Installation* manual and is intended for qualified service and site personnel only. Password is provided,

but can be changed after installation to prevent unauthorized modifications.

The “Adjust” and “Setup” submenus can be viewed, but not modified without entering the correct passwords.

/ Button (Paralleling Applications Only)

When displayed, indicates that the feature for generator set paralleling applications is installed. This button is used to open and close the generator set circuit breaker (CB). The symbol indicates if the CB is opened or closed. Opened **_/_**, push to close. Closed **_/_**, push to open.

With the control panel **0/Manual/Auto** switch in the **Auto** position, the opening and closing of the CB is controlled by the control system software. The CB symbol will indicate an open or closed CB, but the button will be inactive when the control is in Auto.

In the **Manual** position, the CB can only be closed by using this button. When manually closed and the CB opens, it must be closed again by using this button. To close the CB, press and hold the button until the symbol indicates a closed CB. (CB close will occur only when setup conditions allow – dead bus or generator synchronized with bus.)

Power Trans Button (Power Transfer Control Applications Only)

When displayed, indicates that the Power Transfer Control (PTC) feature is installed. Refer to page 3-27 for submenu description.

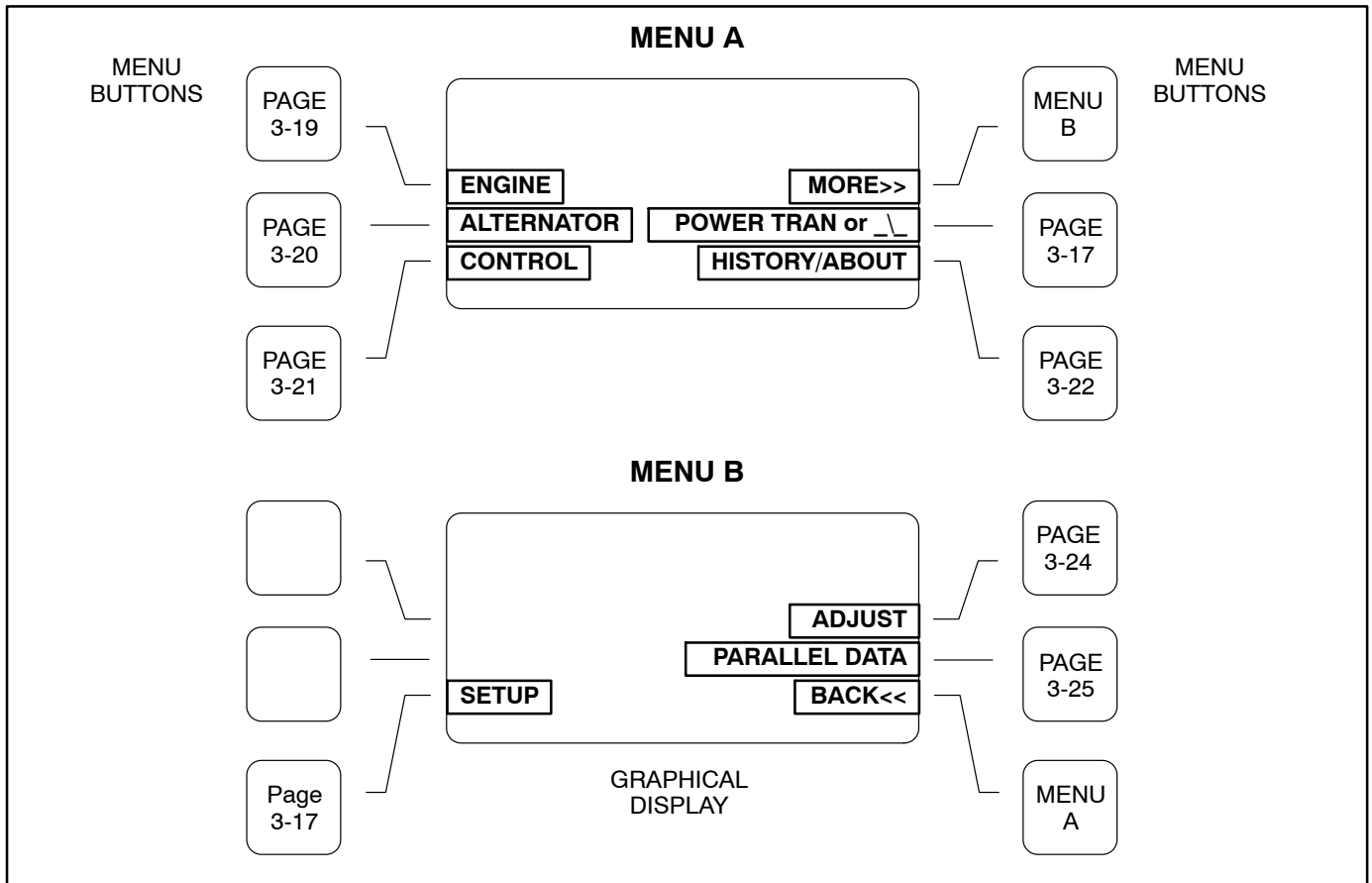


FIGURE 3-5. SYSTEM CONTROL MAIN MENUS A AND B

ENGINE DATA SUBMENUS

If you press the “ENGINE DATA” button in Menu A, the Engine Data submenus will appear (Figure 3-6).

The first submenu displays general information that applies to all gensets (coolant temp, oil pressure, etc.) The data in the remaining submenu(s) will vary according to the type and number of sensors provided with the engine.

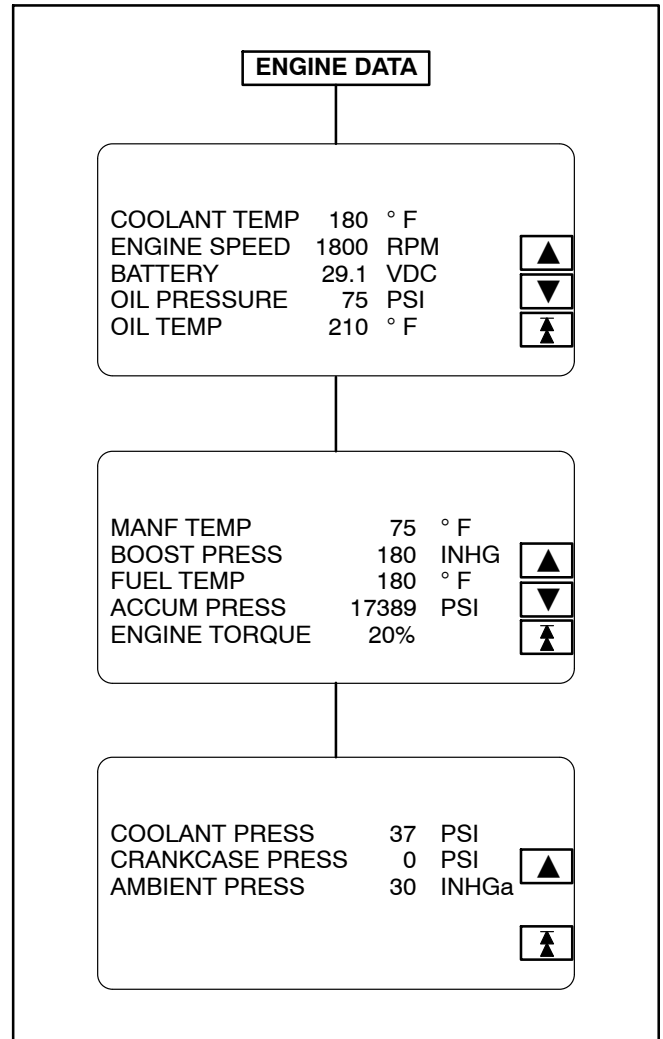


FIGURE 3-6. ENGINE SUBMENUS

ALTERNATOR DATA SUBMENUS

If you press the “ALTERNATOR DATA” button in Menu A, the Alternator Data submenus will appear (Figure 3-7).

Voltage L-L and L-N: Indicates voltage Line-to-Line and Line-to-Neutral. Note that the Line-to-Neutral column will not be displayed for a 3 phase/3 wire system. Accuracy 1%.

The voltage Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively.

Amps: All phases. Accuracy 1%.

Frequency: Generator set output frequency.

AVR DUTY CYCLE: Displays voltage regulator (drive) level in percentage of maximum.

kW, kVA and PF: Displays generator set kW and kVA output (average and individual phase, and direction of flow) and power factor with leading/lagging indication. Accuracy 5%.

The PF reading will contain an asterisk if the power factor is leading (for example, *.30).

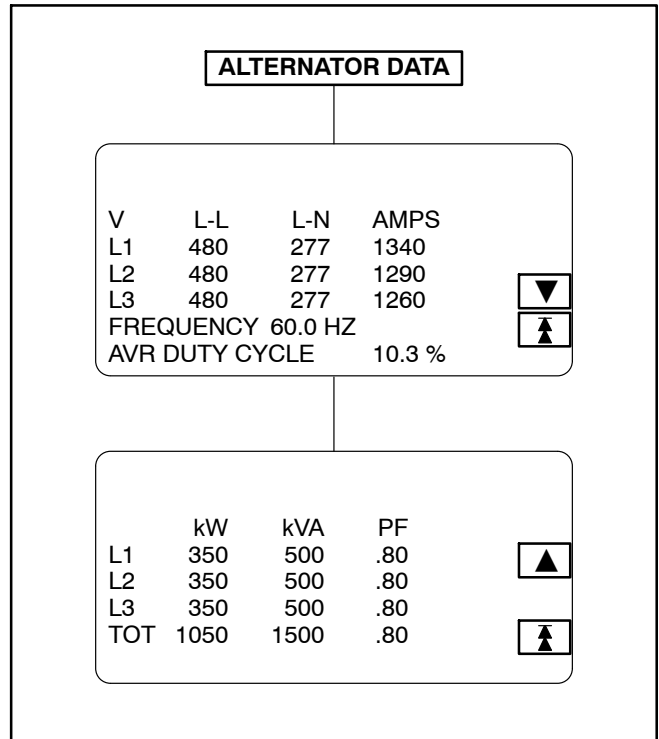


FIGURE 3-7. ALTERNATOR DATA SUBMENUS

CONTROL SUBMENU

If you press the “CONTROL” button in Menu A, the Control submenu will appear (Figure 3-8).

Local CONTROL Submenu Function

When the operator panel is mounted on the control panel assembly, the Run Mode Idle/Rated button is active (displayed). Note in Figure 3-8 that this button is not displayed in remote applications.

The shaded area in Figure 3-8 displays the selected/active mode of operation, either IDLE or RATED.

Run Mode Idle/Run At Rated Button: Refer to Page 3-8 for a complete description of the Run At Idle mode.

Remote CONTROL Submenu Functions

When the operator panel (Figure 3-1) is mounted remotely of the control panel assembly, the menu buttons in the Control submenu are used to perform the following remote operations. (To activate these menu buttons for remote/local use, refer to page 3-16.)

The 0/Manual/Auto switch must be in the Auto position to activate the Remote Menu Buttons of the Control submenu.

Remote START or STOP Button: This button is used to start and stop the generator set when the operator panel is mounted in a remote location. For additional information refer to Starting at Remote Operator Panel (page 3-6) and Stopping at Remote Operator Panel (page 3-9).

When the generator set is operating, **Stop** will be displayed for this button and **Start** will be displayed when not operating.

Fault Acknowledge Button: Used to reset inactive Warning messages, not Shutdown messages.

Local/Remote CONTROL Submenu Functions

Bargraph Test: The function of this button remains the same and is not dependent on operator panel location. This button sequentially lights the LEDs to test the bar graph display.

Enable Sync: Displayed in paralleling applications only. Intended for service personnel to turn off the synchronizer for troubleshooting/testing purposes.

Keyswitch: Intended for service personnel to turn power on/off to the engine control module (ECM).

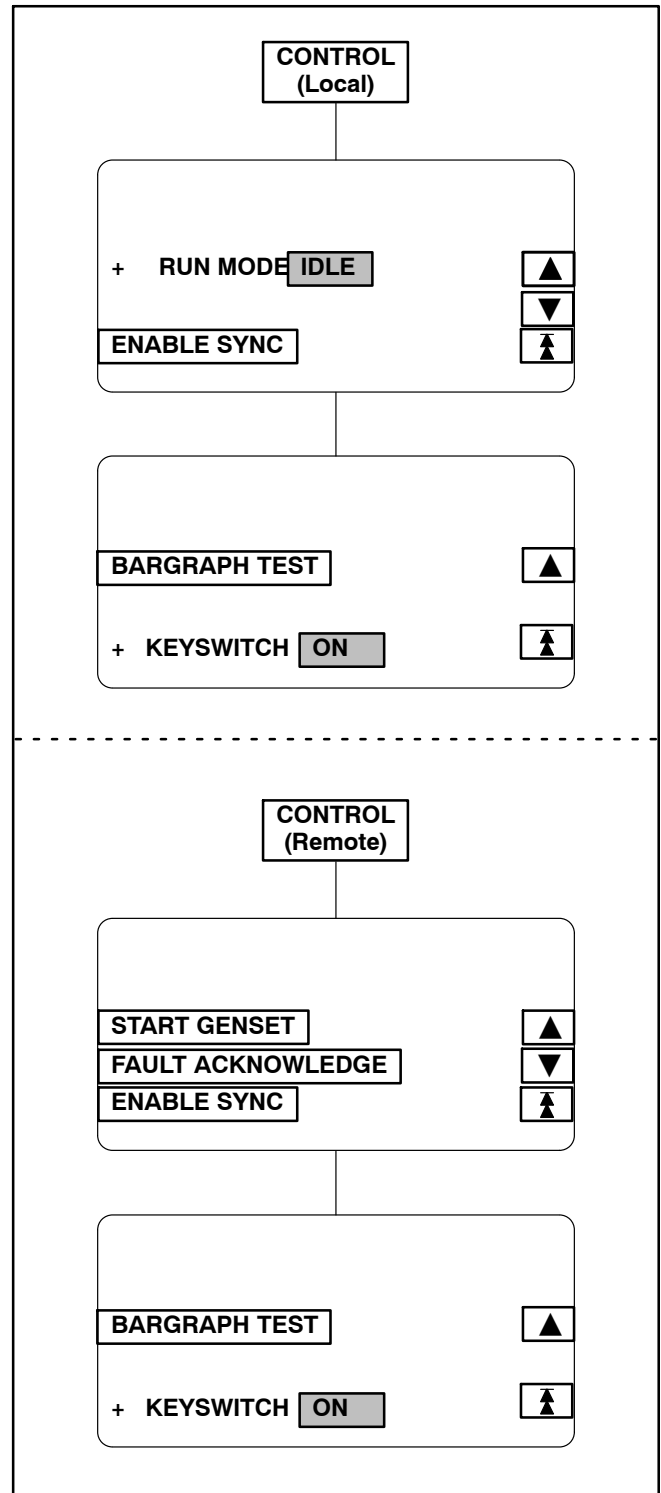


FIGURE 3-8. CONTROL SUBMENU

HISTORY/ABOUT SUBMENUS

If you press the “HISTORY/ABOUT” button in Menu A, the History/About submenus will appear (Figure 3-9).

HISTORY: The control maintains a data log of the number of engine starts and number of operating hours for the engine and control, and the megawatt and maximum torque hours of the generator set. This information is stored in non-volatile memory and will not be deleted due to loss of battery power.

ABOUT: The About submenus provide the following generator set information.

- Genset model and wattage (kW/MW)
- Output voltage and WYE, DELTA or SINGLE
- Frequency 50 or 60 Hz
- Rating: Standby, Prime or Base
- Version level of the controller and panel operating software.

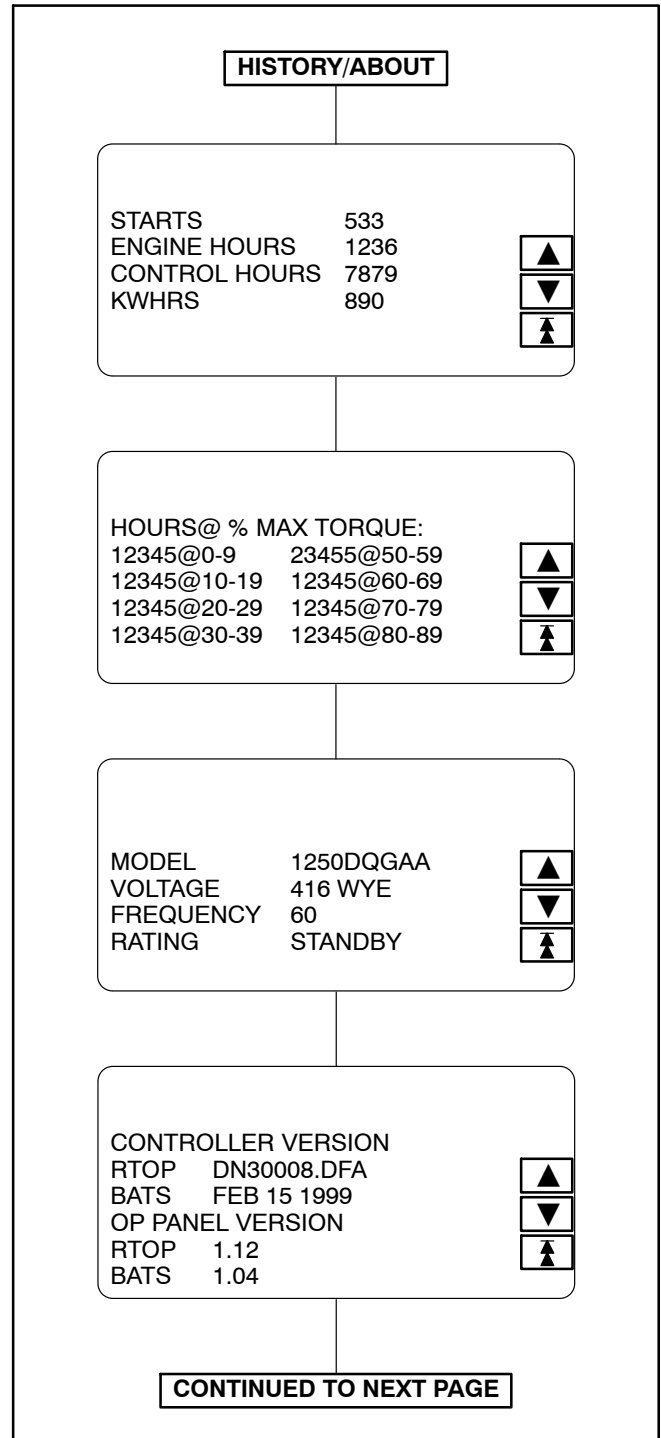


FIGURE 3-9. HISTORY/ABOUT SUBMENUS

HISTORY/ABOUT SUBMENU (CONT.)

FAULT HISTORY: The control maintains a data log of all fault conditions as they occur, and time stamps them with the control and engine operating hours.

Unacknowledged Fault Code display line: Up to 32 (unacknowledged) fault codes can be stored in control panel memory. After the fault is acknowledged and corrected, the recorded fault will be deleted from this display location, but will remain in a data log that maintains a fault code history.

Fault History display line: 1 of 24 indicates that 24 faults are recorded and that the most recent fault (1) detected by the controller is displayed.

Occurrences display line: In this example, 5 indicates that this is the fifth occurrence of this fault. (The InPower service tool is required to review the last four faults of this code.)

The Occurrences number is incremented for each new occurrence of the same fault. The controller must detect that the original sensed fault is corrected before it will increment the occurrence number for that fault.

For example, when a Low Oil Pressure fault is detected, the controller will increment the Occurrences number by 1. This fault will remain active until the controller detects that the fault is corrected. An active fault will prevent the controller from incrementing the Occurrences number each time the engine is started. When the controller detects that the oil pressure is normal the fault will become inactive, allowing the occurrences number to be incremented for the next detected Low Oil Pressure fault.

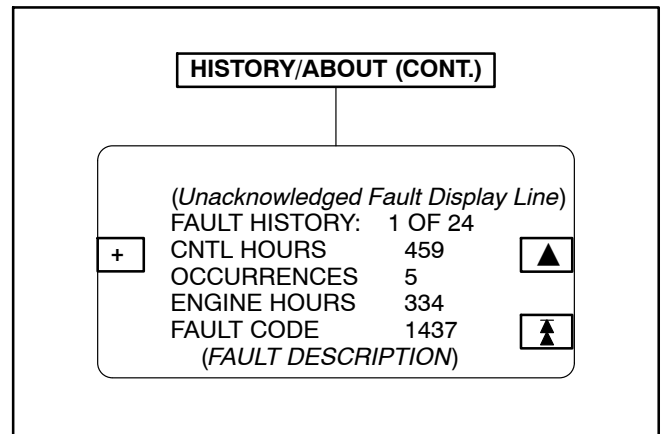


FIGURE 3-10. HISTORY/ABOUT SUBMENU (CONT.)

ADJUST SUBMENUS

If you press the “ADJUST” button in Menu B, the Adjust submenus will appear (Figure 3-11).

The Adjust submenus are intended for qualified service personnel and site personnel only and may require a **USER** password. If a password is required, the **USER** password menu will appear when you try to modify the Adjust submenus. (Refer to *PASSWORD Menu* in this section to enter password.)

Changes are automatically saved when you exit this menu.

Use the + and – buttons to increase or decrease the values in the following fields. Use the arrow (→) button to move the cursor within a field or to the next field. Selected field is highlighted.

START DELAY: This delay applies only to remote starting in the Auto mode. The Start Delay adjustment range is 0 to 300 seconds.

STOP DELAY: This delay applies only to remote stopping in the Auto mode. The Stop Delay adjustment range is 0 to 600 seconds.

VOLTAGE: Used to adjust the output voltage $\pm 5\%$.

FREQUENCY: Used to adjust the frequency ± 3 Hz.

VOLTAGE/SPEED DROOP: These two submenus apply to a genset that has the paralleling option and is configured to operate in droop mode. These adjustments must be performed by technically qualified personnel only.

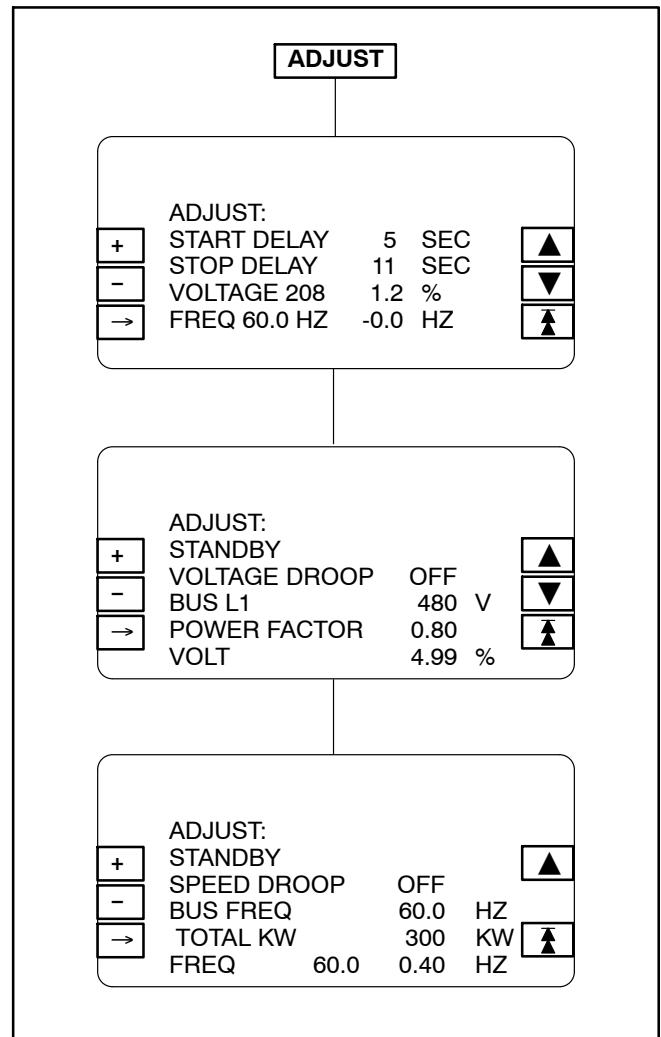


FIGURE 3-11. ADJUST SUBMENUS

PARALLEL DATA SUBMENU

If you press the “PARALLEL DATA” button in Menu B, the Parallel Data submenu will appear (Figure 3-12). This menu is displayed in paralleling applications only.

PARALLEL DATA STATUS LINE: The top line of the graphical display is used to indicate the following PARALLEL DATA status:



- STANDBY: Indicates no paralleling activity is occurring at present.
- DEAD BUS CLOSE: Indicates first genset in system to close to bus.
- SYNCHRONIZE: Genset is synchronizing to bus.
- LOAD SHARE: Genset has closed to bus and is sharing load with other gensets in system.
- LOAD GOVERN: Genset closed to bus in parallel with utility (mains).

BUS Voltage L-L: The BUS voltage Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively.

BUS/GEN HZ: BUS/GEN hertz.

BUS/GEN SYNC STATUS: The bottom line of the graphical display is used to indicate the following BUS/GEN Sync status:

- NOT SYNCHRONIZING: Genset is in service mode that does not allow auto sync feature.
- SYNCHRONIZING: Genset is synchronizing to bus.
- READY TO CLOSE: In manual mode, push circuit breaker close button to close breaker.

Button: (Paralleling applications only). Used to open and close the generator set circuit breaker (CB). The symbol indicates if the CB is opened or closed. Opened , push to close. Closed , push to open.

With the control panel **0/Manual/Auto** switch in the **Auto** position, the opening and closing of the CB is controlled by the control system software. The CB symbol will indicate an open or closed CB, but the button will be inactive when the control is in **Auto**.

In the **Manual** position, the CB must be closed by this button. When manually closed and the CB opens, it must be closed again by using this button. To close the CB, press and hold the button until the symbol indicates a closed CB. (CB close will occur only when setup conditions allow – dead bus or generator synchronized with bus.)

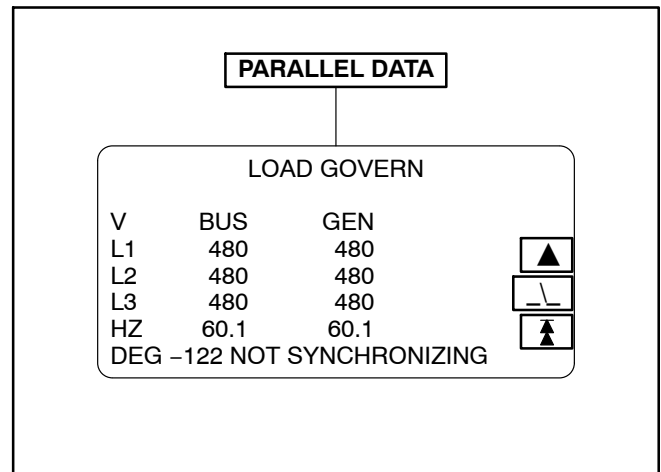


FIGURE 3-12. BUS DATA SUBMENU

PASSWORD Menu

When viewing the Adjust submenu, pressing either the + or – button will display the Password menu (Figure 3-13) if a **User** password is assigned to this field. After entering the correct password, the system will allow you to modify the submenu. To prevent unauthorized adjustment, the entered password is valid for only 10 minutes after the last button is pressed.

Application Password is intended only for qualified service personnel to allow adjustment of Setup submenu parameters.

To enter the password:

1. Display Adjust submenu.
2. Press either the + or – button within the displayed submenu. The Password menu appears. (Adjustment is allowed if Password menu does not appear.)
3. Press the + and – button to select the first character of the **User** password (A–Z or 0–9).
4. Press the → button to select the next character field. Selected character field is highlighted.
5. Repeat steps 3 and 4 to enter remaining password characters.
6. Press the **Enter** button after entering the password. The Adjust submenu will reappear.
7. Exit Adjust submenu to save changes.

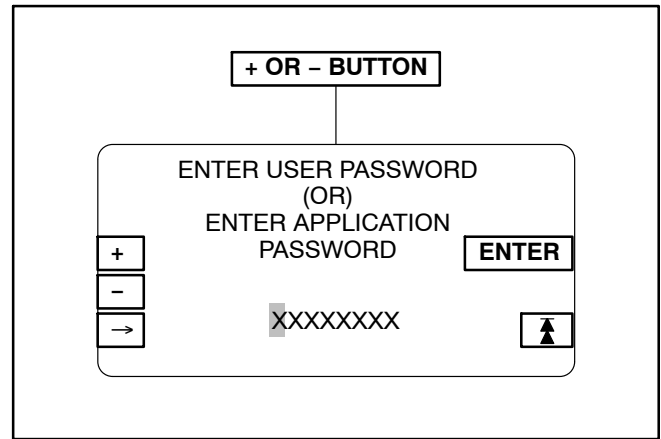



FIGURE 3-13. PASSWORD MENU

POWER TRANSFER MAIN/SUBMENUS

If you press the “POWER TRANS” button in Menu A, the Power Transfer main menu will appear (Figure 3-14). The Power Transfer Control (PTC) feature must be installed to display this menu.

The PTC feature enables the PCC to monitor the utility voltage (mains) and frequency for failure and control the opening and closing of the contacts (circuit breakers) for the utility (S1) and the genset (S2).

If utility fails, the control will initiate the starting sequence (Figure 3-2), open S1 and close S2 to the load. When utility returns, the load is retransferred to the utility (S1 closes/S2 opens) and the control initiates the genset shutdown sequence.

The  symbol displayed in the middle of the Power Transfer main menu indicates which breaker (utility or genset) is closed/opened to the load. The symbol presently shown indicates that the utility breaker is closed and supplying power to the load.

The Power Transfer main menu also indicates if the utility and the generator set are available to accept load. When the control detects that either source is ready to accept load, UTILITY and/or GENSET will be displayed in inverse video.

The Power Transfer main menu has four submenu groups. Refer to the page numbers shown in Figure 3-14 for the Power Transfer submenu descriptions.

PTC Status Line

The top line of the graphical display is used to indicate the following PTC status:

- **NOT ENABLED:** PTC is not enabled. Control panel switch in O (Off) position.
- **MANUAL:** Control panel switch is in Manual position. All PTC actions or genset start/stop actions are manually controlled.
- **NORMAL UTIL:** Load is connected to the utility.
- **RETRAN:** Retransfer of load to utility.
- **RETRAN OVRD:** Immediate retransfer of load to utility due to genset fault (e.g., warning, derate, or shutdown w/cooldown fault). The retransfer timer is ignored as is the retransfer inhibit.
- **EMERG TEST:** Emergency Test sequence initiated through Remote Start switch with emergency start sequence enabled (TB8-3 terminal opened). Emergency test mode means that the genset will continue to run even if a genset warning or derate fault occurs. This test can be performed with or without load (refer to TEST/EXERCISE submenu – *Installation* manual). See Table 3-3 for sequence of operation.
- **TEST:** Test sequence initiated through Remote Start switch with emergency start sequence disabled (TB8-3 terminal closed). Test mode is non-emergency, which means that a retransfer to utility will occur if any problems occur with the genset while testing with load. This test can be performed with or without load (refer to TEST/EXERCISE submenu – *Installation* manual). See Table 3-3 for sequence of operation.
- **EXERCISE:** Exercise sequence initiated through control panel. This test can be performed with or without load (refer to TEST/EXERCISE submenu – *Installation* manual). A retransfer to utility will occur if any problems occur with the genset during the exercise sequence. See Table 3-3 for sequence of operation.
- **UTILITY FAIL:** Utility has failed. (Initiates transfer of load to genset if O/MANUAL/AUTO switch is in AUTO.)

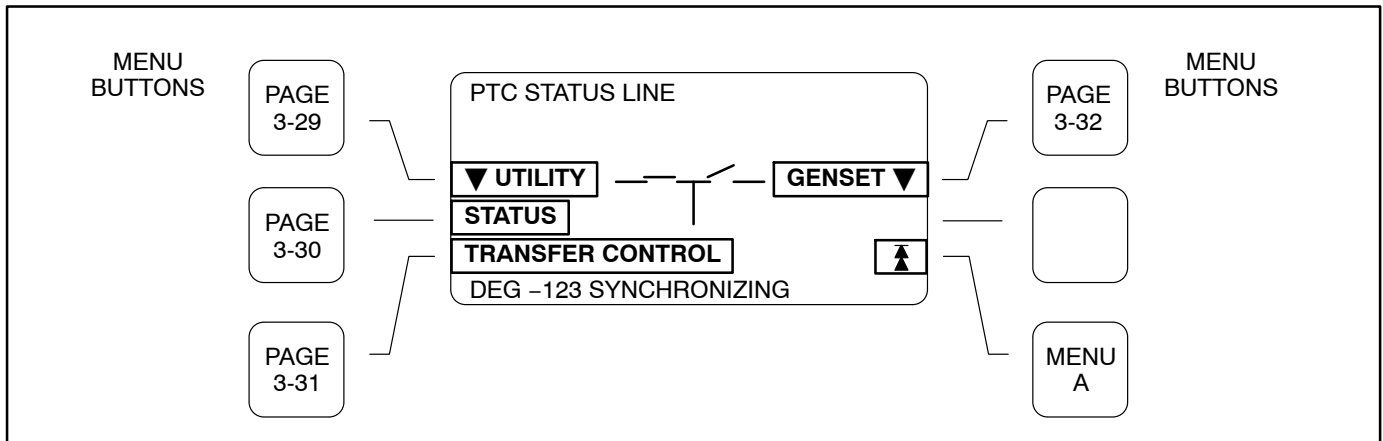


FIGURE 3-14. POWER TRANSFER MAIN MENU

UTILITY (PWR TRAN) SUBMENUS

If you press the “Utility” button in the Power Transfer Main menu, the Utility submenus will appear (Figure 3-15).

Voltage L-L and L-N: Indicates utility voltage Line-to-Line and Line-to-Neutral. Note that the Line-to-Neutral column will not be displayed for a 3 phase/3 wire system. Accuracy 1%.

The voltage Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively.

Amps: L2 only. Accuracy 1%.

Frequency: Utility frequency.

kW, kVA and PF: Displays (L2 only) utility kW and kVA output (average and direction of flow) and power factor with leading/lagging indication. Accuracy 5%.

The PF reading will contain an asterisk if the power factor is leading (for example, *.30).

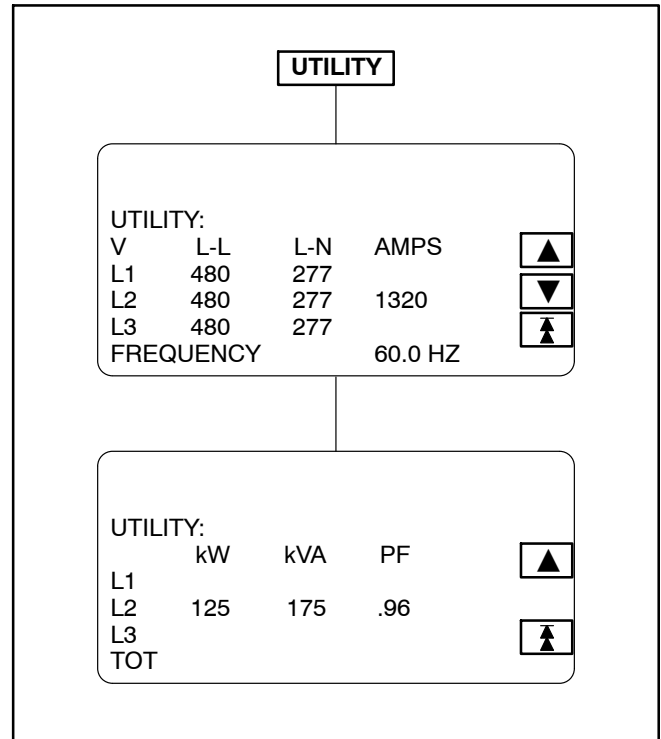


FIGURE 3-15. UTILITY SUBMENUS

STATUS (PWR TRAN) SUBMENUS

If you press the “Status” button in the Power Transfer Main menu, the Status submenus will appear (Figure 3-16).

Connected: Indicates which source(s) is connected to the load.

Available: Indicates when the corresponding sources have acceptable output voltage and frequency. Both can be available simultaneously.

Volt L12: Indicates utility and generator set Line 1 to Line 2 voltage.

HZ: Utility and generator set output frequency.

KW L2: Utility and generator set Phase B (L2) kW output.

Transfer Inhibit: This feature is used to control load transfer to the genset. When activated, load transfer to the genset will not take place if the utility fails.

Transfer inhibit is controlled by connecting a remote contact between TB3-57 and TB3-58. Closing the contact enables the feature and opening the contact disables it. When enabled, the event is displayed on the graphical display.

Retransfer Inhibit: This feature is used to prevent the PTC from automatically transferring the load back to the utility. When activated, load transfer will not take place unless the genset fails (Retransfer Inhibit is ignored if the genset fails).

Retransfer inhibit is controlled by connecting a remote contact between TB3-64 and TB3-65. Closing the contact enables the feature and opening the contact disables it. When enabled, the event is displayed on the graphical display.

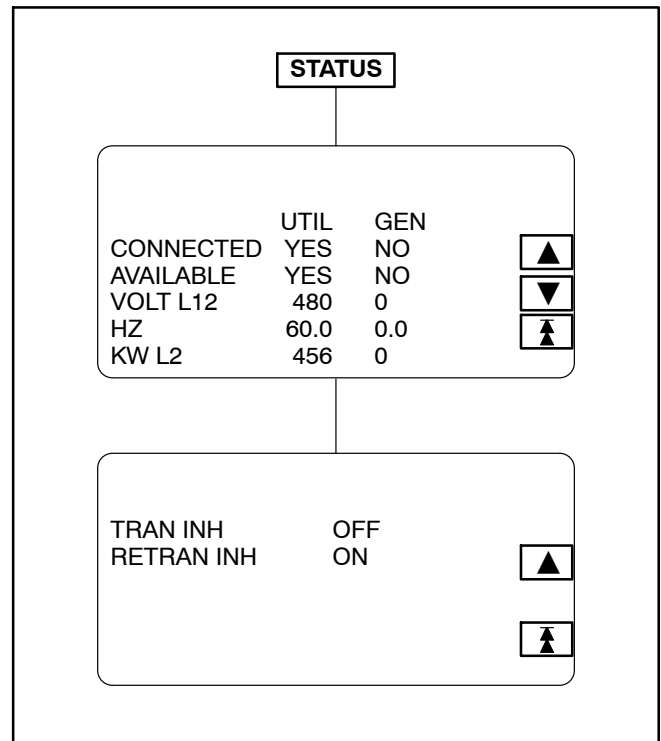



FIGURE 3-16. STATUS SUBMENUS

TRANSFER CONTROL (PWR TRAN) SUBMENU

If you press the “TRANSFER CONTROL” button in the Power Transfer Main menu, the Transfer Control submenu will appear (Figure 3-17).

The  symbol displayed in the middle of the TRANSFER CONTROL submenu indicates which breaker (utility or genset) is closed/opened to the load. The symbol presently shown indicates that the utility breaker is closed and supplying power to the load.

During genset operation in the manual mode, you can manually transfer/retransfer load between the utility and the genset. To transfer load, press the appropriate CB ENABLE button (Utility or Genset).

Example (Figure 3-17)

In the example in Figure 3-17, the CB ENABLE button for “Utility” was pressed. (If the CB ENABLE button for the “Genset” was pressed, ENABLE GEN CB would be displayed in the second submenu, allowing you to open or close the genset circuit breaker.)

After pressing the “utility” CB ENABLE button, the second submenu will be displayed allowing you to either CANCEL or ENABLE the entered selection.

Pressing the CANCEL button will return the display to the previous menu.

Pressing the ENABLE button will display the third submenu. With this submenu displayed you can return to the second submenu without opening the utility circuit breaker (press <<BACK) or you can press the OPEN UTIL button.

Pressing the OPEN UTIL button will display the fourth submenu, indicating that the utility circuit breaker is now opened.

Note that the fourth submenu displays CLOSE UTIL. Pressing this button will close the utility circuit breaker and redisplay the third submenu.

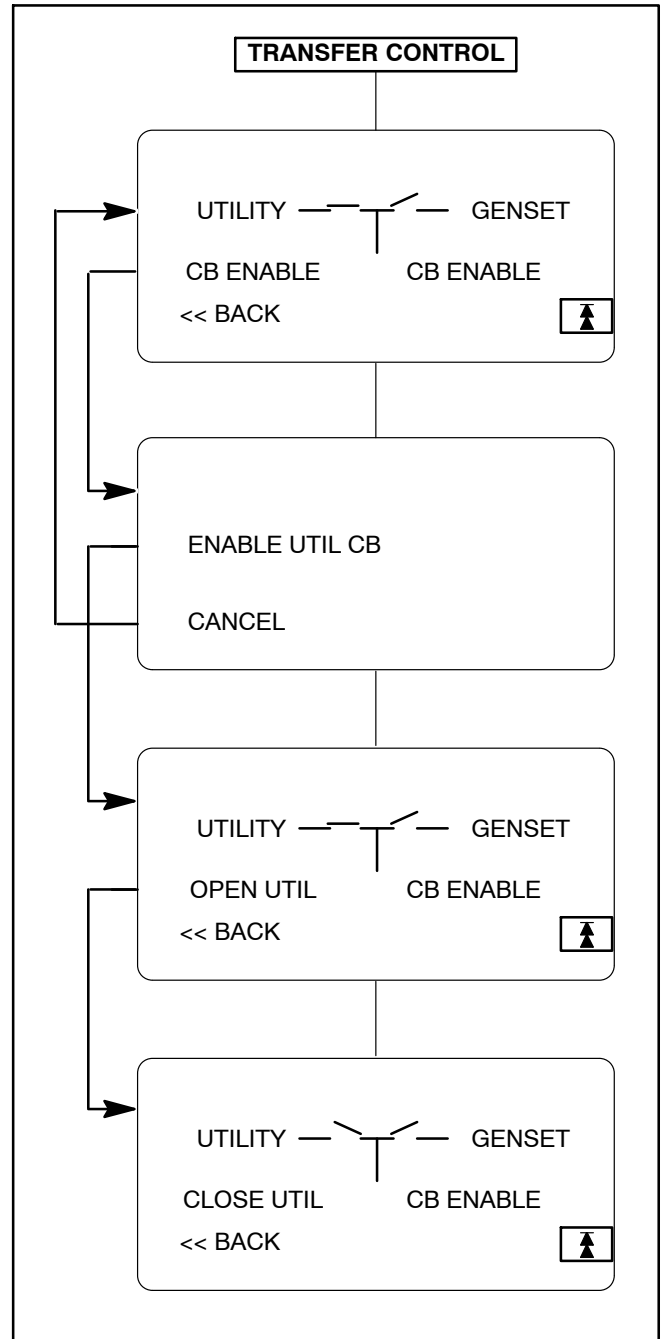


FIGURE 3-17. TRANSFER CONTROL SUBMENUS

GENSET (PWR TRAN) SUBMENU

If you press the “Genset” button in the Power Transfer Main menu, the Genset submenus will appear (Figure 3-18).

Voltage L-L and L-N: Indicates voltage Line-to-Line and Line-to-Neutral. Note that the Line-to-Neutral column will not be displayed for a 3 phase/3 wire system. Accuracy 1%.

The voltage Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively.

Amps: All phases. Accuracy 1%.

Frequency: Generator set output frequency.

kW, kVA and PF: Displays generator set kW and kVA output (average and individual phase, and direction of flow) and power factor with leading/lagging indication. Accuracy 5%.

The PF reading will contain an asterisk if the power factor is leading (for example, *.30).

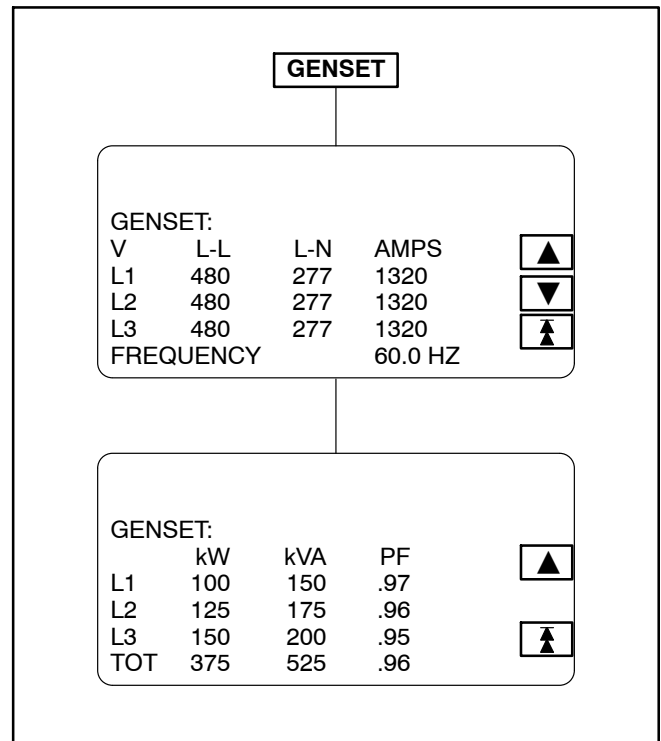


FIGURE 3-18. GENSET SUBMENU

4. Troubleshooting

GENERAL

During genset operation, the PCC control continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the control will light a yellow Warning lamp or a red Shutdown lamp and display a message on the graphical display panel.

In the event of an engine shutdown fault (red Shutdown lamp), the control will stop the engine immediately; an alternator shutdown fault, the engine will stop after the cool-down timer has timed out. If the generator set is stopped for this reason, the operator can restart the set after making adjustments or corrections. This section lists the warning and shutdown codes/messages (Table 4-1), and suggests troubleshooting procedures (Table 4-2).

Displayed error codes that are not listed in Table 4-2 will require an authorized service representative to correct the fault. Contact an authorized service center for assistance.

SAFETY CONSIDERATIONS

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

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

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

⚠ WARNING *Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.*

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

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

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

When troubleshooting a 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 (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.

STATUS INDICATORS

Not In Auto Indicator: This red lamp flashes continuously when the 0/Manual/Auto switch is not in the Auto position (Figure 4-1).

Shutdown Status Indicator: This red lamp is lit whenever the control detects a shutdown condition. After the condition is corrected, the shutdown indicator can be reset by turning the 0/Manual/Auto switch to the 0 position, and pressing the Fault Acknowledge button. The generator set can not be started when this lamp is on.

Warning Status Indicator: This yellow lamp is lit whenever the control detects a warning condition. After the condition is corrected, the warning indicator can be reset by pressing the Fault Acknowledge button. (It is **not** necessary to stop the generator set if the fault becomes inactive during genset operation.)

READING FAULT CODES

If the genset contains the optional graphical display and a fault occurs, the fault code/message will be displayed in the display Description Line (Figure 4-1). If the control does not contain the graphical display, the fault code is read from the Warning and Shutdown status indicators.

After the fault is acknowledged and corrected, the recorded fault will be deleted from the control panel memory, but will remain in a data log to maintain a fault code history. The InPower service tool is required to view this data log.

Reading Fault Codes Using Graphical Display (Optional): The top three lines of the graphical display contain the following control information in the order described:

- *State Line* – modes of operation, such as Stopped, Time Delay To Start, Warm Up At Idle, etc. (see Figure 3-2), and paralleling operations, such as Standby, Dead BUS Close, Synchronize, etc.
- *Action Line* – system actions, such as Warning, Derate, Shutdown Cool-down and Shutdown, and fault codes.
- *Description Line* – Fault code messages.

Refer to *History/About Submenus* in *Section 3*, which describes how to view fault codes using graphical display.

Reading Fault Codes Using Warning/Shutdown Indicators: If the Warning or Shutdown status indi-

cator is lit, press and hold the Fault Acknowledge button and release after ten seconds or more. After ten seconds, the Shutdown lamp will begin to blink the active fault code(s) as follows.

The Warning lamp is used to indicate the start of a new code. The Warning lamp will remain on for 2 seconds, followed by the Shutdown lamp blinking the fault code. This sequence occurs three times for each code. The fourth flash of the Warning lamp indicates the beginning of the second fault code.

There are distinct pauses between repetitions of the code blink transmissions of the Shutdown lamp.

A three digit fault code is indicated by three sets of blinks separated by a two second pause. The first set corresponds to the hundreds position, the second to the tens position and the third to the ones digit. Example for Code No. 213:

Shutdown LED:

blink-blink-pause-blink-pause-blink-blink-blink

Warning LED:

blink (2 seconds)

The light will display the fault codes (active or inactive) in succession, starting with the most recent. Up to 32 (unacknowledged) fault codes can be stored in control panel memory.

To return the control to the most recent fault code, press and release the Fault Acknowledge button (less than one second) and repeat procedure.

When the fault code is acknowledged and the fault condition is corrected, the fault code will be removed from the LED fault log.

LINE CIRCUIT BREAKER (OPTIONAL)

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

CONTROL AND DIAGNOSTICS VIA NETWORK OR PERSONAL COMPUTER (LAPTOP)

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

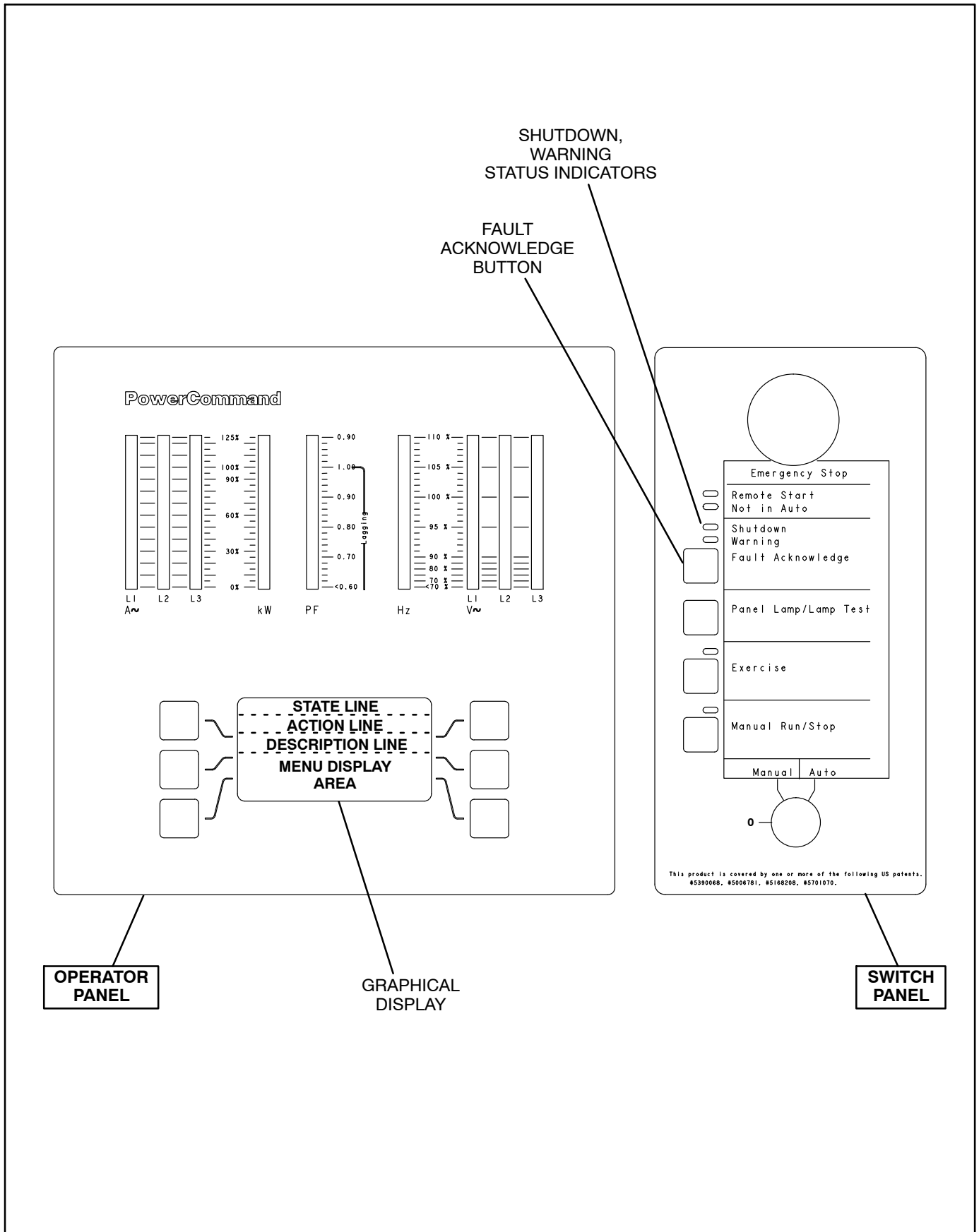


FIGURE 4-1. FRONT CONTROL PANEL (FULL-FEATURED)

FAULT CODES

The fault codes have been divided into five categories to help you determine what corrective action to take for safe operation of the generator set. Use Table 4-1 to find the category (CTG) and fault description for all codes. ***Gaps in the code numbers are for codes that do not apply to this genset model. Also, some of the codes listed are feature dependent, and will not be displayed by this genset control.***

Category A Fault Codes: Pertain to engine or alternator shutdown faults that require immediate repair by qualified service personnel (generator set non-operational). The control prevents the generator set from being restarted if the shutdown fault is not corrected.

Category B Fault Codes: Consist of faults that can affect genset performance or cause ***engine, alternator, or connected equipment damage***. Operate genset only when it is powering critical loads

and cannot be shut down. Requires repair by qualified service personnel.

Category C Fault Codes: Consist of faults that do not affect generator set performance but require qualified service personnel to repair. These code indicate a defective harness or wiring problem.

These codes can also indicate a defective engine sensor, leaving no engine protection. (Engine damage can occur without detection.) ***Continued operation may void generator set warranty if damage occurs that relates to fault condition.***

Category D Fault Codes: Consist of faults that are repairable by site personnel. Service will be required by qualified service personnel if site personnel cannot resolve the problem after taking the corrective actions suggested in Table 4-2.

Category E Fault Codes: Indicates non-critical operational status of generator set, external faults, or customer fault inputs. May require repair by qualified service personnel.

TABLE 4-1. FAULT CODES

CTG	CODE	LAMP	DISPLAYED MESSAGE
A	115	Shtdn	Speed signal lost
B	122	Wrng	Manifold air press sensor
B	123	Wrng	Manifold air press sensor
B	124	Wrng	High manifold air press
C	135	Wrng	Oil pressure sensor high
C	141	Wrng	Oil pressure sensor low
B	143	Wrng	Low oil pressure
C	144	Wrng	Coolant temp sensor high
C	145	Wrng	Coolant temp sensor low
D	146	Wrng	High coolant temp
D	151	Shtdn	High coolant temp
C	153	Wrng	Manifold air temp sens high
C	154	Wrng	Manifold air temp sens low
A	155	Shtdn	Manifold air temp alarm
C	187	Wrng	Sensor supply 2 OOR low
C	195	Wrng	Coolant level sens high
C	196	Wrng	Coolant level sens low
D	197	Wrng	Low coolant level
C	212	Wrng	Oil temp sensor high
C	213	Wrng	Oil temp sensor low
C	221	Wrng	Air pres sensor high
C	222	Wrng	Air pres sensor low
C	223	Wrng	Centinel driver low
C	224	Wrng	Centinel driver high
C	227	Wrng	Sensor supply 2 OOR high
A	228	Shtdn	Low coolant pressure
C	231	Wrng	Coolant pres sens high
C	232	Wrng	Coolant pres sens low
A	234	Shtdn	Overspeed
D	235	Shtdn	Low coolant level
C	238	Wrng	Sensor supply 3 OOR low
C	245	Wrng	Fan control sensor low
C	263	Wrng	Fuel temp sensor high
C	265	Wrng	Fuel temp sensor low
C	266	Wrng	High fuel temperature

CTG	CODE	LAMP	DISPLAYED MESSAGE
C	271	Wrng	Fuel pump press sens low
C	272	Wrng	Fuel pump press sens high
B	285	Wrng	J1939 PGN timeout error
B	286	Wrng	J1939 configuration error
C	322	Wrng	Injector cylinder 1 open
C	323	Wrng	Injector cylinder 5 open
C	324	Wrng	Injector cylinder 3 open
C	325	Wrng	Injector cylinder 6 open
C	331	Wrng	Injector cylinder 2 open
C	332	Wrng	Injector cylinder 4 open
A	342	Shtdn	ECM calibration error
B	343	Wrng	Internal ECM error
B	351	Wrng	Bad injector power supply
C	352	Wrng	Sensor supply 1 OOR low
C	386	Wrng	Sensor supply 1 OOR high
A	415	Shtdn	Low oil pressure
B	421	Wrng	High oil temperature
C	427	Wrng	CAN degraded
D	441	Wrng	Low battery voltage
D	442	Wrng	High battery voltage
B	449	Wrng	High fuel supply pressure
B	451	Wrng	Fuel rail pressure sensor
B	452	Wrng	Fuel rail pressure sensor
B	488	Wrng	High intake manifold temp
B	546	Wrng	Fuel press sensor high
B	547	Wrng	Fuel press sensor low
A	556	Shtdn	High blowby pressure
B	559	Wrng	Low fuel supply pressure
A	586	Shtdn	Run/Stop switch
A	587	Shtdn	Run/Stop switch
A	599	Shtdn	Auxiliary shutdown
D	611	Wrng	Engine hot
B	689	Wrng	Crank shaft sensor
C	697	Wrng	ECM temp sensor OOR high
C	698	Wrng	ECM temp sensor OOR low

TABLE 4-1. FAULT CODES (CONT.)

CTG	CODE	LAMP	DISPLAYED MESSAGE
B	731	Wrng	Cam/Crank misalignment
A	781	Shtdn	CAN datalink failed
A	783	Shtdn	Manifold temperature error
B	1121	Wrng	Failed to Disconnect
A	1135	Shtdn	J1939 datalink update error
C	1219	Wrng	Utility CB tripped
C	1222	Wrng	Power transfer not in auto
C	1223	Wrng	Utility frequency sensor
C	1224	Wrng	Gen over voltage sensor
C	1225	Wrng	Gen under voltage sensor
E	1243	Wrng	Engine derate
D	1244	Shtdn	Engine normal shutdown
D	1245	Shtdn	Engine shutdown
B	1248	Wrng	Engine warning
A	1257	Shtdn	ECM identification error
E	1311	Shtdn/ Wrng	Customer input #1
E	1312	Shtdn/ Wrng	Customer input #2
E	1313	Shtdn/ Wrng	Network fault 1
E	1314	Shtdn/ Wrng	Network fault 2
E	1315	Shtdn/ Wrng	Network fault 3
E	1316	Shtdn/ Wrng	Network fault 4
E	1317	Shtdn/ Wrng	Customer input #3
E	1318	Shtdn/ Wrng	Customer input #4
B	1319	Wrng	High alternator temp
C	1321	Wrng	Common warning driver

CTG	CODE	LAMP	DISPLAYED MESSAGE
A	1322	Shtdn	Load gov kW setpoint oor hi
A	1323	Shtdn	Load gov kW setpoint oor lo
B	1324	Wrng	Load gov kVAR oor hi
B	1325	Wrng	Load gov kVAR oor lo
B	1326	Wrng	Backup starter disconnect
A	1327	Shtdn	Load gov kW analog oor
D	1328	Wrng	Genset CB tripped
B	1329	Wrng	AVR DC power failure
A	1331	Shtdn	AVR driver shorted
A	1332	Shtdn	Manual switch oor lo
A	1333	Shtdn	Manual switch oor hi
A	1334	Shtdn	Critical scaler oor
B	1335	Wrng	Non critical scaler oor
E	1337	None	Network wink
E	1341	Shtdn	Load demand stop
A	1342	Shtdn	Slot 0 card
A	1343	Shtdn	Slot 1 card
A	1345	Shtdn	Slot 3 card
A	1346	Shtdn	Slot 4 incorrect
C	1351	Wrng	Slot 4 / network enabled
B	1357	Wrng	Low oil level
B	1362	Wrng	High oil filter pressure
B	1363	Wrng	Low manifold pressure
B	1376	Wrng	Cam/Crank data incorrect
C	1377	Wrng	Post-oil filter prs sensor
C	1378	Wrng	Post-oil filter prs sensor
C	1414	Wrng	Run relay contact
C	1415	Wrng	Run relay driver
D	1416	Wrng	Fail to shutdown
D	1417	Wrng	Power down error
C	1424	Wrng	High side driver

TABLE 4-1. FAULT CODES (CONT.)

CTG	CODE	LAMP	DISPLAYED MESSAGE
C	1427	Wrng	Overspeed relay driver
C	1428	Wrng	LOP shutdown relay driver
C	1429	Wrng	HET shutdown relay driver
C	1431	Wrng	LOP warning relay driver
C	1432	Wrng	HET warning relay driver
D	1433	Shtdn	Emergency stop – local
D	1434	Shtdn	Emergency stop – remote
D	1435	Wrng	Engine cold
A	1437	Shtdn	E-stop path fuse blown
D	1438	Wrng	Fail to crank
D	1439	Wrng	Fuel level low in day
D	1441	Wrng	Fuel level low in main
B	1444	Wrng	kW overload
A	1445	Shtdn	Alternator short circuit
A	1446	Shtdn	AC output voltage is high
A	1447	Shtdn	AC output voltage is low
A	1448	Shtdn	AC output frequency low
A	1449	Wrng	AC output frequency high
B	1451	Wrng	Gen/Bus voltage differ
A	1452	Shtdn	Gen CB failed to close
A	1453	Shtdn	Gen CB failed to open
C	1454	Wrng	Gen CB position contact
A	1455	Wrng	Util CB contact
E	1456	Wrng	Bus out of range
E	1457	Wrng	Fail to synchronize
E	1458	Wrng	Phase rotation
A	1459	Shtdn	Reverse kW
A	1461	Shtdn	Loss of field
B	1462	Wrng	High ground current
E	1463	None	Not in Auto
E	1464	None	Load dump
E	1465	None	Ready to load
C	1466	Wrng	Modem failure
C	1467	Wrng	Unable to connect modem
C	1468	Wrng	Network error

CTG	CODE	LAMP	DISPLAYED MESSAGE
B	1471	Wrng	High current
A	1472	Shtdn	Overcurrent
A	1473	Shtdn	Watchdog failure
A	1474	Shtdn	Software version mismatch
C	1475	Wrng	First start backup
C	1476	Wrng	LonWorks card
C	1477	Wrng	Crank relay contact
C	1478	Wrng	Crank relay driver
A	1481	Shtdn	AVR driver open
E	1483	None	Common alarm status
A	1485	Shtdn	EFC driver shorted
A	1486	Shtdn	EFC driver open
C	1487	Wrng	Auto acknowledge driver
C	1488	Wrng	Warning LED driver
C	1489	Wrng	Shutdown LED driver
C	1491	Wrng	Ready to load relay driver
C	1492	Wrng	Load dump relay driver
C	1493	Wrng	Display control driver
C	1494	Wrng	Modem power relay driver
C	1495	Wrng	Common shutdown2 driver
C	1496	Wrng	Auto mode relay driver
C	1497	Wrng	Manual run LED driver
C	1498	Wrng	Exercise run LED driver
C	1499	Wrng	Remote start LED driver
B	1548	Wrng	Injector cylinder 7 open
B	1549	Wrng	Injector cylinder 8 open
B	1551	Wrng	Injector cylinder 10 open
B	1552	Wrng	Injector cylinder 11 open
B	1553	Wrng	Injector cylinder 12 open
B	1554	Wrng	Injector cylinder 13 open
B	1555	Wrng	Injector cylinder 14 open
B	1556	Wrng	Injector cylinder 15 open
B	1557	Wrng	Injector cylinder 16 open
B	1558	Wrng	Injector cylinder 17 open
B	1559	Wrng	Injector cylinder 18 open

TABLE 4-1. FAULT CODES (CONT.)

CTG	CODE	LAMP	DISPLAYED MESSAGE
B	1622	Wrng	Injector cylinder 9 open
C	1843	Wrng	Blowby pressure sensor
C	1844	Wrng	Blowby pressure sensor
C	1845	Wrng	H2O in fuel sensor low
C	1846	Wrng	H2O in fuel sensor high
D	1847	Shtdn	High coolant temperature
D	1852	Wrng	High H2O in fuel
D	1891	Wrng	Change oil and filter
C	1978	Wrng	Load/speed bias sens high
A	1992	Shtdn	Overspeed
C	2111	Wrng	Aftercooler temp sensor
C	2112	Wrng	Aftercooler temp sensor
B	2113	Wrng	High aftercooler temp
A	2114	Shtdn	High aftercooler temp

CTG	CODE	LAMP	DISPLAYED MESSAGE
C	2185	Wrng	Sensor supply 4 OOR high
C	2186	Wrng	Sensor supply 4 OOR low
B	2215	Wrng	Low fuel supply pressure
B	2261	Wrng	High fuel supply pressure
B	2262	Wrng	Low fuel supply pressure
C	2265	Wrng	Fuel lift pump sensor high
C	2266	Wrng	Fuel lift pump sensor low
B	2311	Wrng	Fuel injector control error
C	2331	Wrng	Utility under volt sensor
C	2377	Wrng	Fan control sensor high
C	2358	Wrng	Utility over volt sensor
C	2396	Wrng	Utility CB failed to close
C	2397	Wrng	Utility CB failed to open
D	2545	Wrng	Keyswitch reset required

TABLE 4-2. WARNING AND SHUTDOWN CODES (CTG “D”)

<p>⚠ WARNING <i>Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and mechanical hazards should perform service procedures. Review safety precautions.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>CODE: 146 LAMP: Warning MESSAGE: HIGH COOLANT TEMP WARNING</p>	<p>Indicates engine is operating near cooling system capacity. Increase in load or higher ambient temperature may cause High Coolant Temp (151) shutdown. Review 151 correction list for other possible causes.</p>
<p>CODE: 151 LAMP: Shutdown MESSAGE: HIGH COOLANT TEMP ALARM</p>	<p>Indicates engine has overheated (coolant temperature has risen above the shutdown trip point). Allow engine to cool down completely before proceeding with the following checks:</p> <ol style="list-style-type: none"> Check coolant level and replenish if low. Look for coolant leaks and repair if necessary. Check for obstructions to cooling airflow and correct as necessary. Check fan belt and repair or tighten if necessary. Check blower fan and circulation pumps on remote radiator installations. Reset control and restart after locating and correcting problem.
<p>CODE: 197 LAMP: Warning MESSAGE: LOW COOLANT LEVEL</p>	<p>Indicates engine coolant level has fallen to an unacceptable level. If generator is powering critical loads and cannot be shut down, wait until next shutdown period, then follow 235 Coolant Level Alarm procedure. If engine can be stopped, follow 235 procedure.</p>
<p>CODE: 235 LAMP: Shutdown MESSAGE: LOW COOLANT LEVEL</p>	<p>Indicates engine coolant level has fallen below the alarm trip point. Allow engine to cool down completely before proceeding.</p> <ol style="list-style-type: none"> Check jacket water coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. Reset control and restart after locating and correcting problem.
<p>CODE: 359 LAMP: Warning MESSAGE: ENGINE FAILED TO START</p>	<p>Indicates possible fault with control or starting system. Check for the following conditions:</p> <ol style="list-style-type: none"> Poor battery cable connections. Clean the battery cable terminals and tighten all connections. Discharged or defective battery. Recharge or replace the battery.
<p>CODE: 441 LAMP: Warning MESSAGE: LOW BATTERY VOLTAGE</p>	<p>Indicates battery voltage is below 24 VDC.</p> <ol style="list-style-type: none"> Discharged or defective battery. Check the battery charger fuse. Recharge or replace the battery. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. Check engine DC alternator. Replace engine DC alternator if normal battery charging voltage (24 to 26 VDC) is not obtained. Check float level if applicable (raise float level).

TABLE 4-2. WARNING AND SHUTDOWN CODES (CTG “D”) (CONT.)

<p>⚠ WARNING <i>Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and mechanical hazards should perform service procedures. Review safety precautions.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>CODE: 442 LAMP: Warning MESSAGE: HIGH BATTERY VOLTAGE</p>	<p>Indicates battery voltage exceeds 32 VDC.</p> <p>Check float level on battery charger if applicable (lower float level).</p> <p>Check engine DC alternator. Replace engine DC alternator if normal battery charging voltage (24 to 26 VDC) is not obtained.</p>
<p>CODE: 611 LAMP: Warning MESSAGE: ENGINE HOT</p>	<p>Indicates that an engine hot shut down has occurred (cool-down timers were bypassed). This condition will occur when the operator presses the Emergency Switch or moves the 0/Manual/Auto switch to the 0 (Off) position before the genset completes the cooldown operation. (Genset should run at 10% or less load for 3 minutes before engine shutdown.) This type of shutdown should be avoided. Can cause possible loss of performance and engine damage.</p>
<p>CODE: 1248 LAMP: Warning MESSAGE:</p>	<p>Indicates that an engine warning fault has occurred in the Engine ECM. This fault code is activated by another active warning fault in the engine or ECM. Connect the engine ECM with Inpower or INSITE to determine the actual warning fault that is generating fault code 1248. Troubleshoot the warning faults as reference to the Engine Service Manual.</p>
<p>CODE: 1311 through 1318 LAMP: Shutdown/Warning MESSAGE: Customer Defined Fault</p>	<p>When any one of these customer defined inputs is detected by the control, the corresponding fault message is displayed. The nature of the fault is an optional customer selection. These fault functions can be programmed to initiate a shutdown or warning as indicated by the Warning or Shutdown lamp.</p> <p>Note: Customer fault messages are editable. The message displayed for the code shown (1311 through 1318) is determined by the customer.</p>
<p>CODE: 1416 LAMP: Warning MESSAGE: FAIL TO SHUTDOWN</p>	<p>Status – indicates that the “Fault Bypass” mode is enabled and that a critical shutdown fault has occurred. In this mode the generator set ignores the majority of system shutdown faults. The purpose of this mode is to satisfy local code requirements where necessary. The InPower service tool is required to enable/disable the Fault Bypass mode.</p>
<p>CODE: 1417 LAMP: Warning MESSAGE: POWER DOWN ERROR</p>	<p>Indicates that the control can not power down due to some unknown condition. Possible drain on battery. Contact an authorized service center for service.</p>

TABLE 4-2. WARNING AND SHUTDOWN CODES (CTG “D”) (CONT.)

<p>⚠ WARNING <i>Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and mechanical hazards should perform service procedures. Review safety precautions.</i></p>	
SYMPTOM	CORRECTIVE ACTION
<p>CODE: 1433 / 1434 LAMP: Shutdown MESSAGE: EMERGENCY STOP – LOCAL / EMERGENCY STOP – REMOTE</p>	<p>Indicates local or remote Emergency Stop. Emergency Stop shutdown status can be reset only at the local control panel. To reset the local/remote Emergency Stop button: Pull the button out. Move the O/Manual/Auto switch to O (Off). Press the front panel Fault Acknowledge button, and hold until the fault is cleared. Return O/Manual/Auto switch to desired position.</p>
<p>CODE: 1435 LAMP: Warning MESSAGE: ENGINE COLD</p>	<p>Indicates engine coolant heater is not operating or is not circulating coolant. Set is in standby mode but is not operating. Warning occurs when engine jacket water coolant temperature is 70° F (21° C) or lower.</p> <p>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.</p> <p>Check for the following conditions:</p> <ol style="list-style-type: none"> Make sure both ball valves in heater coolant lines are open. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required. Check for low jacket water coolant level and replenish if required. Look for possible coolant leaks and repair as required.
<p>CODE: 1438 LAMP: Warning MESSAGE: FAIL TO CRANK</p>	<p>Indicates possible fault with control or starting system. Check for the following conditions:</p> <ol style="list-style-type: none"> Poor battery cable connections. Clean the battery cable terminals and tighten all connections. Discharged or defective battery. Recharge or replace the battery.
<p>CODE: 1439 LAMP: Warning MESSAGE: FUEL LEVEL LOW IN DAY</p>	<p>Indicates fuel supply is running low. Check fuel supply and replenish as required.</p>
<p>CODE: 1441 LAMP: Warning MESSAGE: FUEL LEVEL LOW IN MAIN</p>	<p>Indicates fuel supply is running low. Check fuel supply and replenish as required.</p>

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5. Maintenance

GENERAL

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

- Use for continuous duty (prime or base load power)
- Extremes in ambient temperature
- Lack of weather protective enclosure
- Exposure to extended storage periods
- Exposure to salt water

- Exposure to dust, sand or other airborne contaminants

Consult with your local Cummins Power Generation distributor if the generator set will be subjected to any extreme operating conditions and determine a suitable schedule of maintenance. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated or after the number of operating hours indicated, whichever comes first. Use Table 5-1 to determine the maintenance required and then refer to the sections that follow for the correct service procedures.

LONG TERM STORAGE

Contact your authorized distributor if long term storage of the generator set is required. Long term storage procedures must be repeated every 12 months for MCRS fuel equipped engines.

TABLE 5-1. MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	SERVICE TIME							
	See Engine Schedl.	Daily or after 8 Hours	1 Week or after 50 Hours	1 Month or after 100 Hours	6 Months or after 250 Hours	Yearly or after 500 Hours	2 Years or after 1500 Hours	4000 – 4500 Hours
General Genset Inspection	X ¹	X ²						
Check Coolant Heater		X						
Check Oil Level		X						
Check Coolant Level of Radiators		X						
Check Fuel Level		X						
Check Air Cleaner			X ³					
Check Battery Charging System			X					
Drain Water and Sediment from Fuel Tank			X ⁴					
Drain Exhaust Condensate Trap				X				
Check Starting Batteries				X				
Check Fan Belt				X ⁵				
Check Radiator Hoses for Wear & Cracks					X			
Change Air Cleaner Element						X ³		
Perform Polarization Index Test						X ⁷		
Cooling System Maintenance						X		
Change Fan Belt							X	
Lubricate Fan Bearings (two)					X ⁸		X	
Check Generator Output Lug Torques							X	
Grease Generator Bearing (P7 / MV7)								X
Drain Fuel Filter(s)	X ¹							
Check Anti-freeze and DCA Concentration	X ¹							
Change Engine Oil and Filter	X ^{1, 6}							
Change Coolant Filter	X ¹							
Clean Crankcase Breather	X ¹							
Change Fuel Filters – Tall Single						X		
Change Fuel Filters – Tall Duplex						X		
Change Fuel Filters – Double					X			
Change Fuel Filters – Triplex					X			
Clean Cooling System	X ¹							

Inspect all sealed alternator bearings every 4000 to 4500 hours.
Replace all alternator bearings (sealed or regreasable) every 30000 hrs/5 years (or if necessary after 10000 hrs /2 years.
Regrease all alternator bearings every 4000 to 4500 hours /6 month.

- X¹ Refer to Cummins engine Owners Manual for maintenance interval and/or procedure.
- X² Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with set running and repair any leaks immediately.
- X³ Perform more often in dusty conditions.
- X⁴ Drain 1 cup or more of fuel to remove water and sediment.
- X⁵ Visually check belt for evidence of wear or slippage. Replace if hard, brittle, cracked or edges are frayed.
- X⁶ If genset is used for standby applications, change oil every 12 months or 250 hours, whichever comes first.
- X⁷ This procedure should be followed periodically throughout the life of the generator set, or if the generator has set idle for a period of time with no generator heaters used. Contact your authorized service center.
- X⁸ Please check and follow the greasing interval specified on the radiator decal.

GENERATOR SET INSPECTION

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

Exhaust System

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

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

Fuel System

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

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

AC Electric System

Check the following while the genset is operating.

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

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

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

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

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

DC Electrical System

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

Engine

Monitor fluid levels and oil pressure and coolant temperatures frequently. Most engine problems give an early warning. Look and listen for changes in engine performance, sound, or appearance that can indicate service or repair is needed. Some engine changes to look for are as follows:

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

GENERATOR SET MAINTENANCE (Battery Disconnected)

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

WARNING Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

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

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

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

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

1. Move the O/Manual/Auto switch on the control panel to the O (off) position.

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

Mechanical Inspection

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

FUEL SYSTEM

Refer to the Cummins engine *Owners Manual* for fuel system maintenance.

Fuel Handling Precautions

WARNING Ignition of fuel can cause serious personal injury or death by fire or explosion. Do not permit any flame, cigarette, arc, spark, pilot light, or other igniter near the fuel system.

To avoid condensation problems, keep fuel supply tanks as full as possible by filling up each time the engine is used. In cold weather, warm fuel returning from the injectors heats the fuel in the supply tank. If the fuel level is low, the upper portion of the tank tends to form condensation. In warm weather, both the fuel and the tank will be warm during the daytime. At night, cool air tends to lower the temperature of the tank more rapidly than the temperature of the fuel. If the fuel level is low, the upper portion of the tank will cool more rapidly and tend to form condensation.

Condensation (water) can cause clogging of fuel filters with the sulphur in the fuel forms acid which can corrode and damage engine parts.

LUBRICATION SYSTEM

Gensets are shipped filled with the correct type and quantity of oil. Be sure to check oil level before initial start.

Oil API Classification

Refer to the Cummins engine *Owners Manual* for lubricating oil classification.

Oil Viscosity

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

Engine Oil Level

Check the engine oil level during engine shutdown periods at the intervals specified in Table 5-1. The dipstick is stamped with high and low marks to indicate the level of oil in the crankcase. For accurate readings, shut off the engine and wait approximately 15 minutes before checking the oil level. This allows oil in the upper portion of the engine to drain back into the crankcase.

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

Keep the oil level as near as possible to the high mark on the dipstick. Remove the oil fill cap (see Figure 5-1) and add oil of the same API viscosity and brand when necessary. Install the oil fill cap after adding oil.

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

Oil and Filter Change

Refer to the Cummins engine *Owners Manual* for maintenance interval and procedure.

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

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

COOLING SYSTEM

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

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

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

Coolant Level

Check the coolant level during shutdown periods at the intervals specified in the Maintenance Table. A sight glass is provided on both radiators (Figure 5-1).

The coolant level should be approximately in the middle of the sight glass, with the coolant temperature at 120° F (50° C) or lower. Refer to the Cummins engine *Owners Manual* for coolant recommendations/specifications.

WARNING *Contact with hot coolant can result in serious burns. Allow cooling system to cool before releasing pressure and removing jacket water radiator cap or LTA expansion tank cap.*

Cooling System Maintenance

Refer to the Cummins engine *Owners Manual* for all cooling system maintenance, such as, coolant requirements, filling of the engine jacket water and LTA cooling systems, coolant filter replacement and flushing and cleaning. Refer to Figure 5-2 for the

coolant drain locations of the aftercooler and water jacket systems.

In addition to the cooling system maintenance procedures in the Engine Owners Manual, also refer to Fill Cooling System in this section, which contains additional information that must be followed to properly bleed the air from the cooling system during coolant refill.

If engine coolant heater(s) is installed in the jacket water cooling system, disconnect heater(s) from power source before performing cooling system maintenance.

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

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

Radiator

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

CAUTION *To prevent damage to fins and resultant loss of cooling, do not exceed recommended pressure and always maintain the stream of air or water at right angles to the core face.*

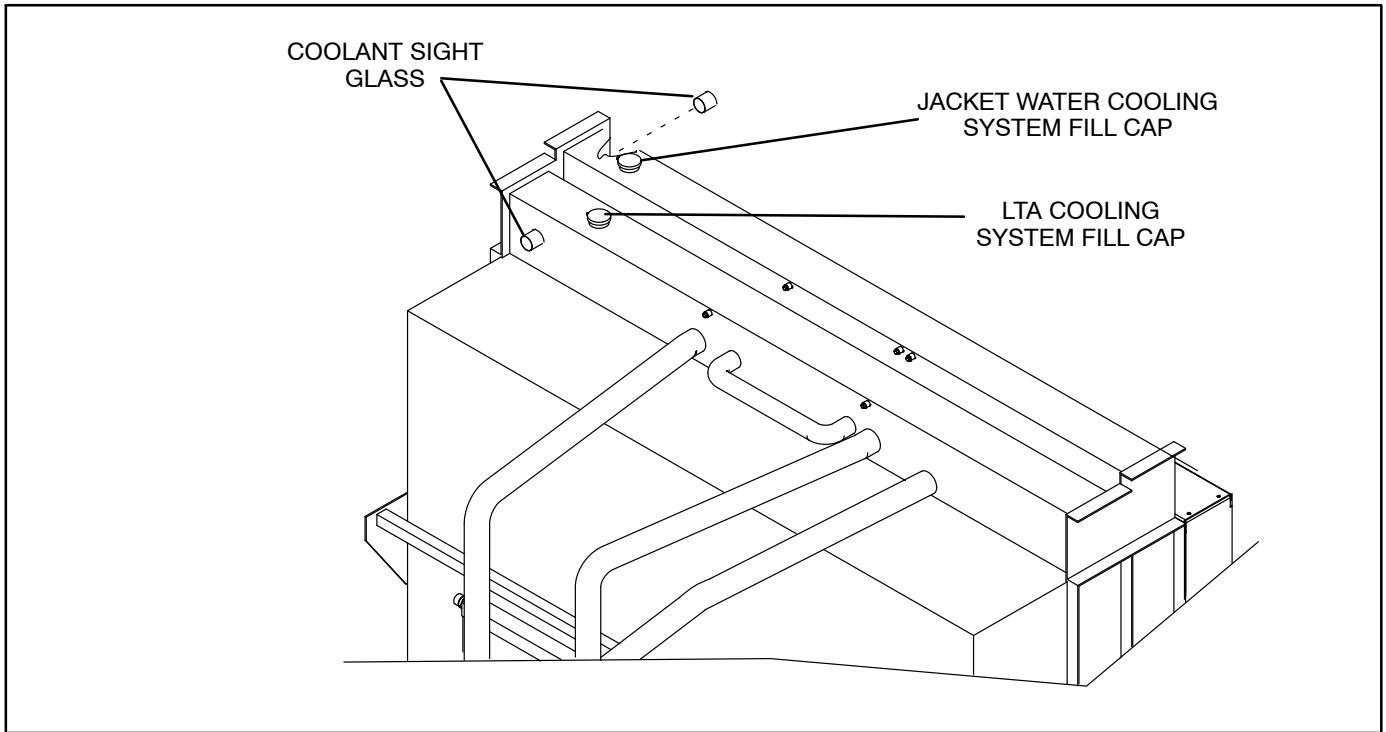


FIGURE 5-1. COOLING SYSTEM SIGHT GLASSES/FILL LOCATIONS

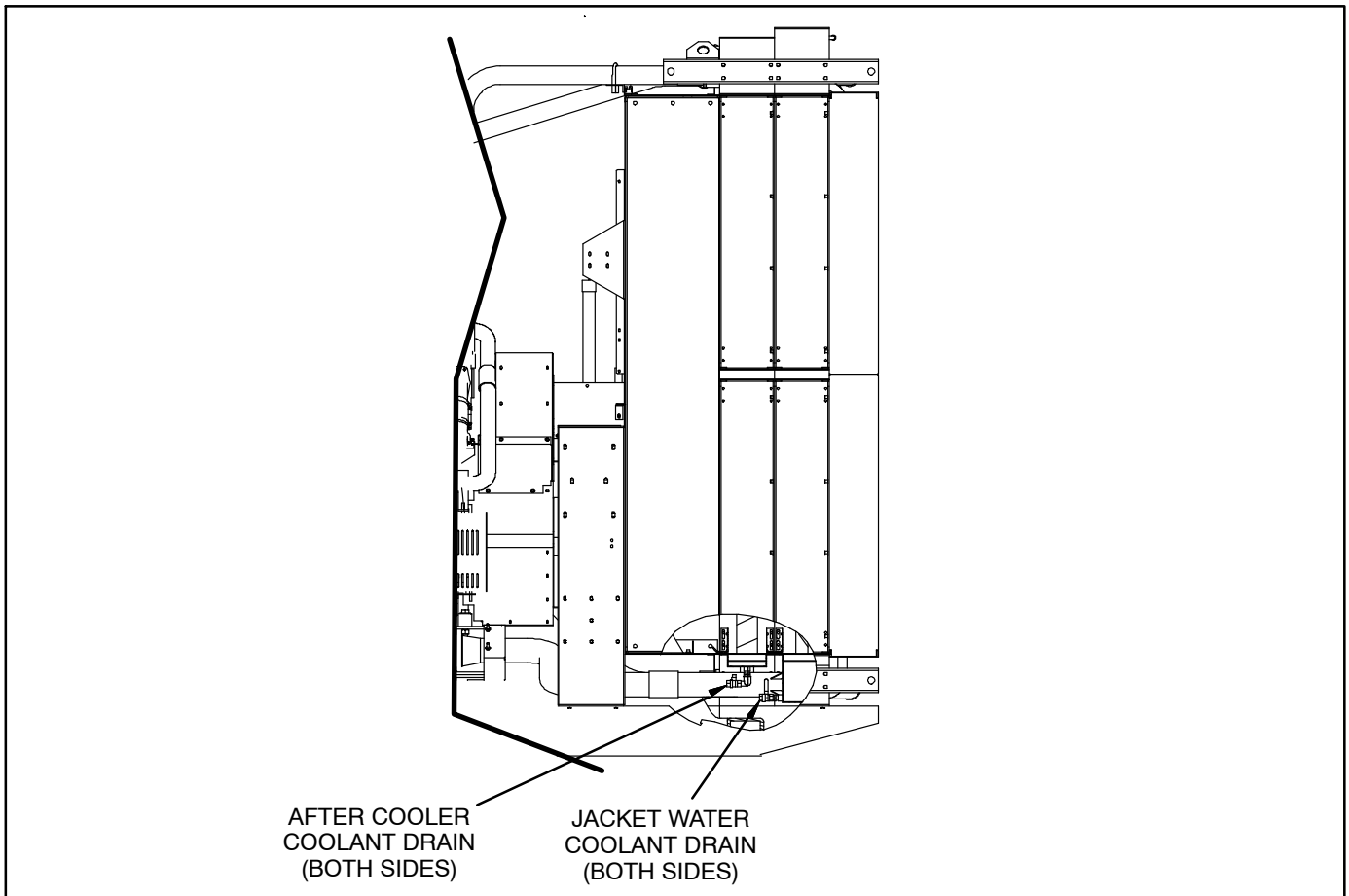


FIGURE 5-2. AFTER COOLER/JACKET WATER COOLANT DRAIN LOCATIONS

Fill Cooling System

The engine cooling system for these models consists of two separate liquid cooling system circuits. This two-circuit system is commonly referred to as a “two pump two loop” (2P2L) cooling system. One system is dedicated to the engine jacket water (JW) circuit. The other is for the engine low-temperature aftercooling (LTA) circuit.

Both circuits require a blend of 50% ethylene or propylene glycol and 50% water. The quality requirements are defined by PGA drawing 0880-0152. Each radiator-cooled genset is shipped with Fleetguard supplemental coolant additive (SCA), trade name DCA4. If the radiators are not filled using Fleetguard “Compleat” brand antifreeze or equivalent antifreeze, the DCA4 needs to be added to the cooling systems.

One coolant pump is used for both radiators, which ties the two radiators together. When filling, coolant will slowly flow to the other radiator. After filling the second radiator, make sure the first radiator that was filled is full.

CAUTION *Failure to use the correct type of coolant, maintain the correct level and bleed the systems of air can result in severe engine damage.*

1. Water-cooled turbochargers:

Open the petcock at the top of each of the four turbochargers.

Non-water-cooled turbochargers:

Loosen the vent line at the engine jacket water (JW) vent outlet located on top of the engine thermostat housing (Figure 5-3).

2. Remove the radiator cap on the jacket water cooling (front) radiator. Begin filling the radiator with antifreeze, water, and SCA.

3. Water-cooled turbochargers:

When coolant begins to flow from a petcock,

close the petcock and continue filling the radiator.

Non-water-cooled turbochargers:

Tighten vent line when coolant begins to flow from the vent outlet.

4. Observe the coolant level through the sight glass at the top of the J/W radiator. Coolant level should be approximately in the middle of the sight glass with a cool engine.

5. When the radiator is full, replace the radiator cap securely. Push down and twist clockwise until the cap lip hits the tank stop flange.

WARNING *Failure to properly replace coolant caps can result in hot pressurized coolant escaping from the radiator fill necks, causing severe personal injury and engine damage. Always make sure the radiator caps are properly secured before operating the genset.*

7. Remove the radiator cap on the low-temperature aftercooling (rear) radiator. Begin filling the radiator with antifreeze, water, and SCA.

8. Observe the coolant level in the radiator through the sight glass at the top of the LTA radiator. Coolant level should be approximately in the middle of the sight glass with a cool engine.

9. When the radiator is full, replace the radiator cap securely. Push down and twist clockwise until the cap lip hits the tank stop flange.

WARNING *Failure to properly replace coolant caps can result in hot pressurized coolant escaping from the radiator fill necks, causing severe personal injury and engine damage. Always make sure the radiator caps are properly secured before operating the genset.*

Coolant Heater

Check the operation of the coolant heater (Figure 5-4) by verifying that hot coolant is being discharged from the outlet hose. **Do not touch outlet hose** – if heater is operational, radiant heat should be felt with hand held close to outlet hose.

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

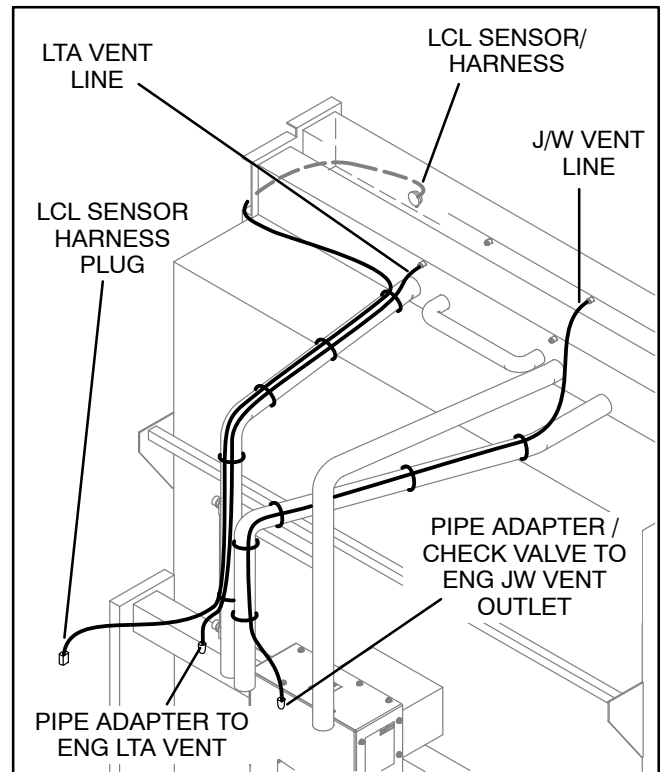


FIGURE 5-3. VENT PIPES/LOW COOLANT LEVEL SENSOR

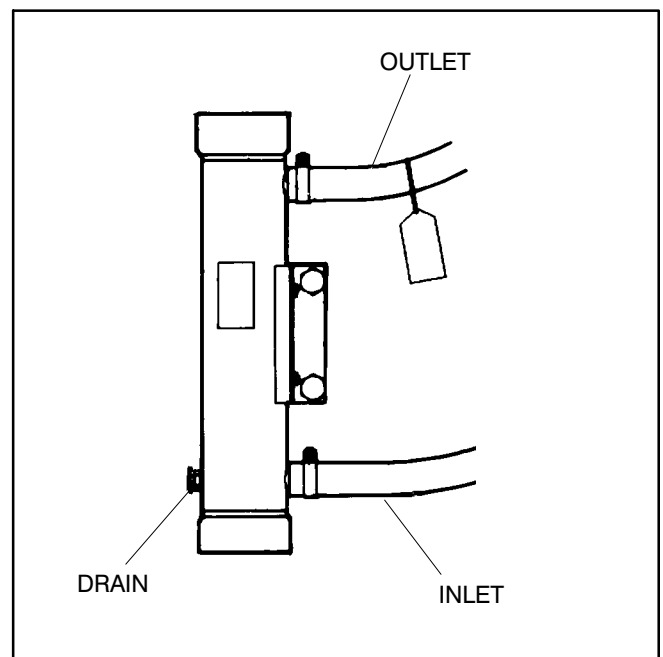


FIGURE 5-4. COOLANT HEATER

FAN BEARING RE-LUBRICATION

⚠WARNING *Lithium and Polyurea greases are not compatible and must not be mixed.*

Please follow the grease decals that are located on the radiator. The grease decals clearly indicate the grease type, amount and intervals that should be followed. The decal is located on the fan pedestal close to the grease fittings.

NOTE: If the grease decal cannot be located on the radiator please contact your local Cummins Distributor for more information.

Grease quantity and greasing intervals have been designed to coincide with engine service intervals. This will prevent over greasing (It is possible to hydraulically lock a bearing by over greasing a stationary bearing).

A grease fitting is provided for each of the two bearings (Fan and Pulley) to allow the use of a grease gun to re-lubricate the bearings. The grease fittings can be located on side of the fan housing pedestal structures such as the example in Figure 5-5.

NOTE: The older model belt fan drive system bearings are filled with Lithium-based grease. All belt drive radiators fitted with new fan drive system will be filled with Polyuria grease as clearly shown on

the decal. For exact grease type and quantities please consult the decal.

NOTE: All current direct belt drive fan hubs are fitted with sealed for life bearings.

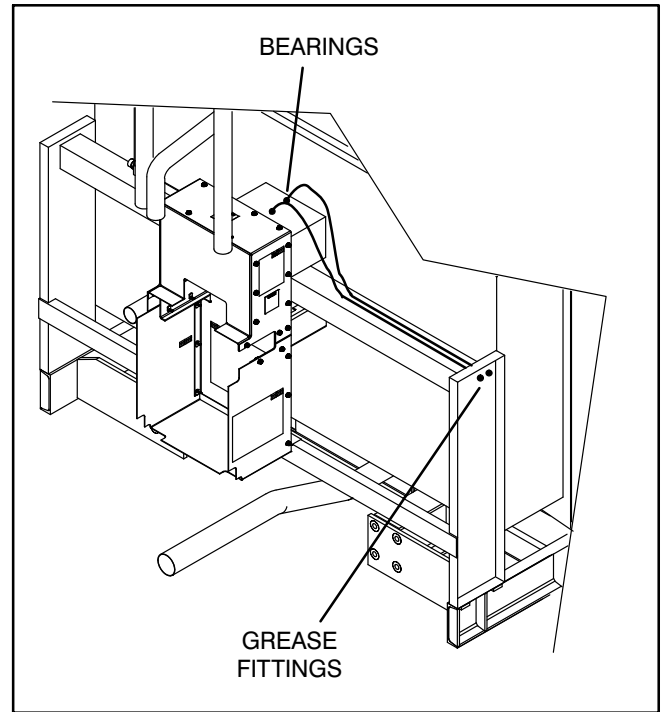


FIGURE 5-5. FAN BEARING GREASE FITTINGS

FAN BELT REPLACEMENT

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

WARNING Arcing at battery terminals, arcing in light switch or other equipment, flame, pilot lights and sparks can ignite battery gas causing severe personal injury.

Ventilate battery area before working on or near battery—Wear safety glasses—Do not smoke—Switch trouble light ON or OFF away from battery—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 while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

Belt Removal

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 fan belt guard (between engine and radiator) to gain access to fan belt.
6. Use an 8-point socket and breaker bar or a large wrench to hold the idler in position against the spring tension. Slowly turn the wrench until the spring tension is relieved (Figure 5-6). Remove the fan belt.

WARNING The fan belt idler is under tension. Do not allow your hands to get between the idler and the belt or the fan hub. Personal injury will result.

Belt Replacement

1. Slip new fan belt onto the crankshaft and fan hub pulley.

⚠WARNING *The fan belt idler is under tension. Do not allow your hands to get between the idler and the belt or the fan hub. Personal injury will result.*

2. Use an 8-point socket and breaker bar or a large wrench to hold the idler in position against the spring tension. Slowly turn the wrench until

the spring tension is relieved sufficiently to position the belt in front of the idler pulley. Align the grooves of the belt on the ribs of the pulley and shaft and then slowly release spring tension onto belt.

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

3. Install fan belt guards.
4. Reconnect starting batteries (negative cable last).

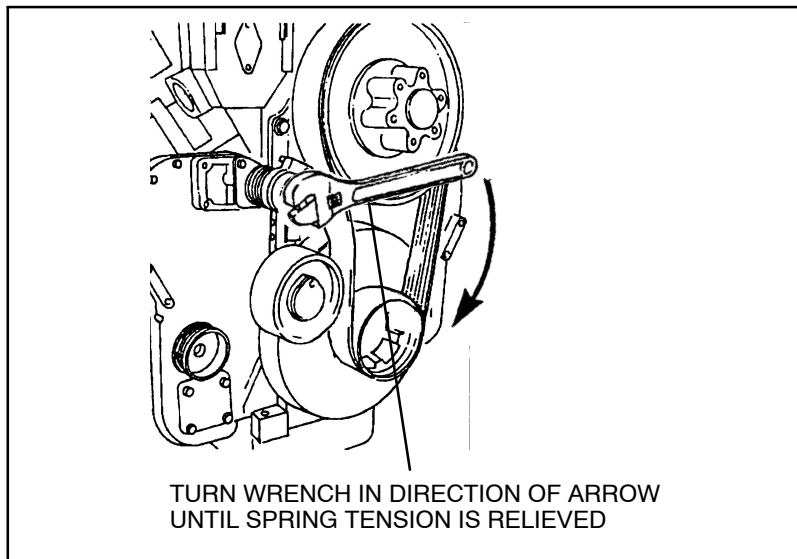


FIGURE 5-6. FAN BELT REPLACEMENT

AIR CLEANER

The filter element (standard or heavy duty) should be replaced yearly or sooner if the service indicator button pops up indicating air restriction.

Cleaning of paper type air cleaner elements is not recommended. Elements that have been cleaned will clog and air flow to the engine will be restricted.

⚠ CAUTION *Holes, loose end seals, dented sealing surfaces and other forms of damage render the cleaner inoperative and require immediate element replacement.*

Inspect all components of the air filtering system including all ducts and hoses. Verify that all connections and clamps are tight and inspect each component for cracks, dents, or other damage. Repair or service as required.

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

The following procedure should be followed when replacing the element.

1. Loosen fastener(s) and remove air cleaner housing end cap.
2. Slowly remove the air filter from air cleaner housing to reduce the amount of dust dislodged.
3. Wipe out the interior of the air cleaner housing and cover with a clean, damp cloth. Make sure that **ALL** dust is removed from **ALL** interior surfaces of the air cleaner housing.
4. **CLEAN:** Tap air filter on a flat surface to remove dirt. Place a light source inside filter and inspect for air passage. If necessary, apply a low pressure air source (30 psi) to the inside of filter to remove as much dirt as possible.
NEW: Inspect new air filter for shipping damage. Do not install damaged filter.
5. Install air filter.
6. Install the air cleaner cover and secure with retaining clip.

BATTERIES

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

⚠ WARNING Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

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

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

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

Cleaning Batteries

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

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

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

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

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

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

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

Checking Specific Gravity

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

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

Checking Electrolyte Level

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

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

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

Battery Replacement

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

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

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

NiCad Batteries

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

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

GENERATOR BEARING RE-LUBRICATION

Re-lubricate the generator bearing at the interval specified in the Maintenance Table. A grease fitting is provided to allow the use of a grease gun to re-lubricate the bearing.

The bearing must be filled with the same type of grease used when the generator was manufactured. This grease was chosen to provide the bearing with optimum lubricating characteristics, and **MUST NOT** be mixed with any other type.

The grease that must be used is Kluber, type ASONIC GHY72.

To locate the nearest Kluber grease distributor, see Kluber Web site at:

www.klueber.com

Lubrication

It is important that the correct quantity of grease is used for periodic re-lubrication with a grease gun during planned maintenance. Refer to label located at bearing end of generator (if provided) or Table 5-2, which specifies the grease fill quantity.

To determine how much grease is supplied with each pump (stroke) of the device, weigh the quantity required (e.g., 75 grams or 2.7 ounces \div $1/4 = 19$ grams or 0.68 ounces), against the number of pump strokes taken to inject that amount onto a small weighing scale. Also, note in practice:

- If the pump hits an airlock, (i.e., no pressure when pumping) these strokes can not be counted.
- For greater accuracy, the grease fitting can be unscrewed, and a flexible grease-pipe screwed directly to the fitting adapter. This will make sure that no grease is expelled outside of the fitting.
- If too much grease is applied, any excess will be exhausted out of the bearing cartridge via the grease escape. (Any exhausted grease should be cleaned out of the PMG cover.
- Always extend the grease gun pump arm out to its full extent with each pump, failure to do this could mean little or no grease is going into the bearing.

Re-Lubrication Procedure

1. Make sure grease gun nozzle and re-lubricating fitting are free from contaminants or abrasive material.
2. With the generator running, apply the specified re-lubrication grease fill quantity through the grease fitting.
3. Run the generator for at a minimum of 10 minutes to allow excess grease to exhaust.
4. Check inside the PMG cover for expelled grease. Clean out as necessary.

TABLE 5-2. MAINTENANCE CHART FOR RE-GREASE

FRAME	GREASE QTY		RE-LUBRICATION PERIOD
	CM	GRAMS	
P7 / MV7	85	75	4000 – 4500

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6. Operating Recommendations

NO-LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a load bank of at least 30 percent of nameplate rating.

EXERCISE PERIOD

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

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

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

LOW OPERATING TEMPERATURE

Use a coolant heater if a separate source of power is available. The optional heater will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

HIGH OPERATING TEMPERATURE

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

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